

Surgeon Royal

THE
PHILOSOPHY OF MEDICINE:

OR,

MEDICAL EXTRACTS

ON THE

NATURE OF HEALTH AND DISEASE,

INCLUDING THE

LAWS OF THE ANIMAL ŒCONOMY,

AND THE

DOCTRINES OF PNEUMATIC MEDICINE.

BY

A FRIEND TO IMPROVEMENTS.

There are three things which almost every person gives himself credit for understanding, whether he has taken any pains to make himself master of them or not.— These are: 1. *The art of mending a dull fire*; 2. *Politics*; and, 3. *PHYSIC*.

DR. BEDDOES.

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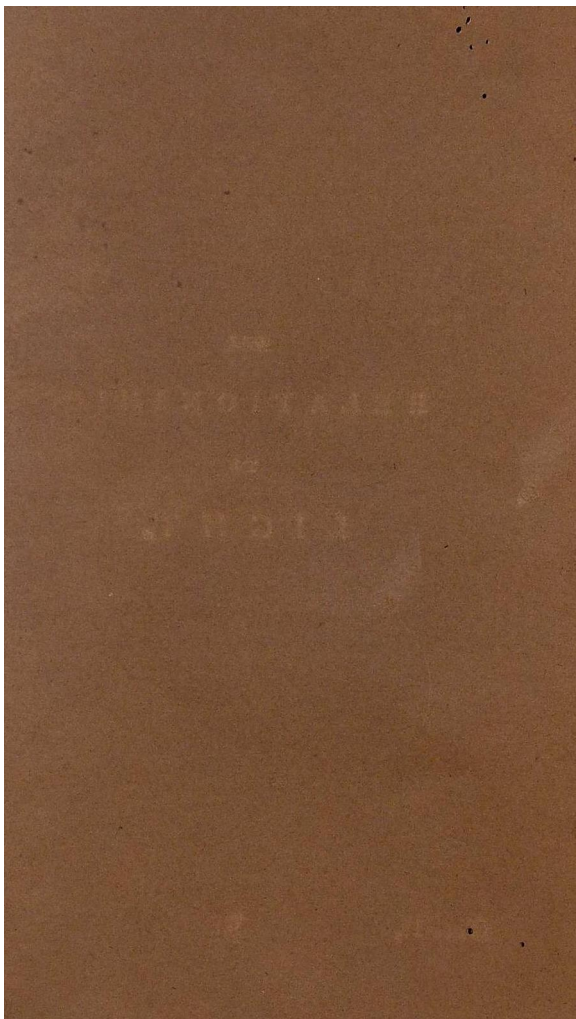
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OUR
RELATIONSHIP
TO
LIGHT.

VOL. II.

B



SECTION I.

ON LIGHT.

LIGHT, like air and water, is known to be not a simple, but a *compound* body. The all-penetrating genius of Sir Isaac Newton* has demonstrated, by undeniable experiments, that *a single ray of light*, which former philosophers imagined so infinitely fine, is in reality a collection of *seven parts*, which are perfectly distinct, and composed of as many different colours, and subject to different reflections and refractions.

Some

* It appears to me, says Lord *Bolingbroke*, that THE AUTHOR OF NATURE has thought fit to mingle, from time to time, among the societies of men, a few, and but a few of those, on whom he is graciously pleased to bestow a larger proportion of the *ethereal spirit* than is given in the ordinary course of his providence to the sons of men. Look about you from the palace to the cottage; you will find that the bulk of mankind is made to breathe the air of this atmosphere, to roam about this globe, and to consume, like the courtiers of ALCINOUS, the fruits of the earth. *Nos numerus sumus & fruges consumere nati*. When they have trod this insipid round a certain number of years, and begot others to do the same after them, they have lived: and if they have performed, in some tolerable degree, the ordinary moral duties of life, they have done all they were born to do. Look about you again, nay look, perhaps, into your own breast, and you will find that there are *superior spirits*, men who shew, even from their early youth, though it be not

Some modern philosophers have considered *heat* and *light* as one and the same substance. Although, it must be confessed, they are frequently found existing together, yet, on the other hand, must it be allowed, that there is often *much dazzling splendour* where there is *little or no heat*. The Honourable Mr. Boyle draws a minute comparison between the light of combustible bodies, and that of shining wood, &c. Among other things he observes, that extreme cold *extinguished* the light of shining wood, as appeared when a piece of it was put into a glass tube, and held in a freezing mixture. He also found that rotten wood did not *waste* itself by shining, and upon the application of a thermometer he could not discover the smallest degree of *heat*.

That these are distinct substances, may be also proved from their distinct operations on the *living fibre*.

The muscular fibres of the retina are excited into instantaneous action by the smallest variation in *light*: but are insensible to the greatest changes in the circumambient *heat*. Most of the discous flowers, obe-

always perceived by others, perhaps not always felt by themselves, that they were called into this world for something more and better. These are they, who engross almost the whole reason of the species, who are born to *instruct*, who are designed to be the *tutors* and *guardians* of human kind. When they prove such, they exhibit to us examples worthy of the highest praise, and they deserve to have their names recorded, instead of a crowd of warriors, with whose feats the page of history is crowned and disgraced.

dient .

dient to the impulse of *light*, follow the sun in his course. They attend him in his evening retreat, and meet his rising lustre in the morning. If a plant be shut up in a dark room, and a small hole be made in the shutter, through which the *light* may penetrate, you would see the different plants confined there, turn towards that hole, and even alter their shape to creep through it, so that though these were *straight* before, they would in a short time become *crooked*, to obtain the full enjoyment of *light*. Thus if a GERANIUM be placed in any window for a certain time, the interior surface of every leaf would be turned to meet the *light*; and if you remove it to an opposite window, you would soon see a sad contortion and confusion among the leaves, until they had obtained a right position with regard to *light*. To prove that it is not *heat*, but *light*, which plants covet, if this GERANIUM be placed near a fire, which gives a stronger heat than the sun, you would soon observe it turn away its leaves and flowers from the *fire* to the *sun*.

To illustrate this curious circumstance, Dr. Hill placed a plant of *abrus* in a room, where it had moderate day-light, without the sun shining upon it. The lobes of the leaves were then fallen perpendicularly from the middle rib, and closed together by their under sides. Thus they continued all night. *Half an hour* after day-break, they began to separate, and *a quarter of an hour* after sun-rise, were perfectly expanded. *Long before* sun-set they began

to droop again, and towards evening were closed as at first.

Next day the plant was placed where there was *less* light. The lobes were raised in the morning, but *not so much*: and they drooped *earlier* at evening.

The third day it was set in a south window, open to the *full sun*.—*Early* in the morning the leaves had attained their horizontal situation: by *nine* o'clock they were raised above it, and continued so till *late* in the evening; then they fell to the horizontal situation, and thence gradually to the usual state of rest.

These experiments prove that the whole change is occasioned by *light* only. To put this beyond dispute, in the evening of the sixth day, the plant was set in a book-case, on which the morning sun shone, the doors standing open. The day was bright. The lobes, which had closed in the evening, began to open *early* in the morning, and by *nine* o'clock they were raised in the usual manner. I then, says he, *shut* the doors of the book-case: on opening them an hour after, *the lobes were all closed* as at midnight. On opening the door they expanded again, and in twenty minutes they were fully expanded. This has since been many times repeated, and always with the same success. We can therefore, by admitting or excluding the light, make the plant put on all its changes. Hence we are certain, that what is called *the sleep of plants*, is caused by the absence of *light* alone, and that their various intermediate states are owing to its different degrees.

Some experiments on plants give us reason to believe, that *light* combines with certain parts of vegetables, and that the green of their leaves, and the various colours of their flowers, is chiefly owing to this combination. This much is certain, that plants which grow in darkness are perfectly white, languid, and unhealthy, and that to make them recover vigour, and to acquire their natural colour, the direct influence of *light* is absolutely necessary.

It would be difficult, in the present state of chemical knowledge, to shew the combination of light with *our* bodies. But it cannot but be allowed, that *light* is a stimulus, awaking us to muscular action, and opening an inlet to the stimulus of the various passions.

A thick and impenetrable cloud of *darkness* on a sudden enveloped the Grecian army, and *suspended* the battle. AJAX, perplexed what course to take, prays thus,

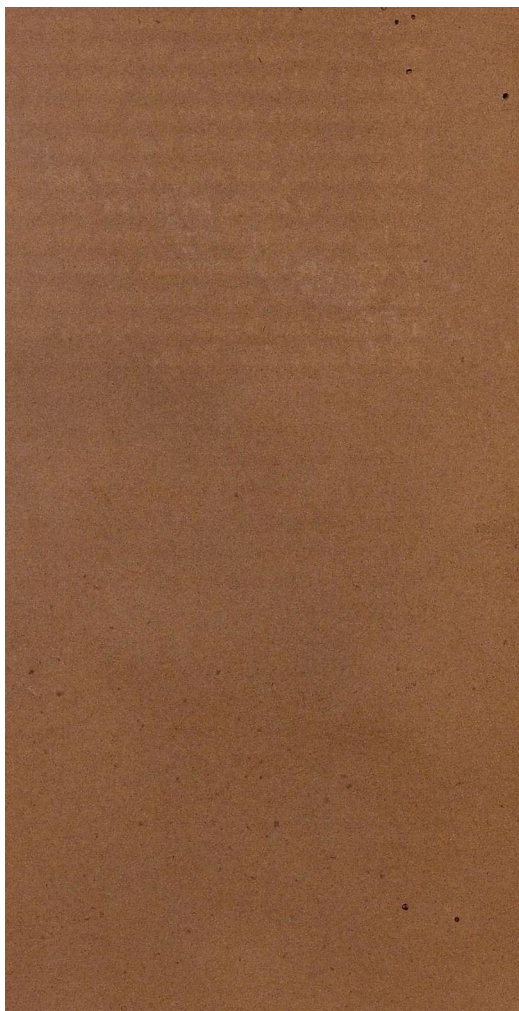
Accept a warrior's pray'r, eternal Jove;
This cloud of darkness from the Greeks remove;
Give us but *light*, and let us see our foes,
We'll bravely fall, tho' *Jove himself* oppose.

The sentiments of AJAX are here pathetically expressed: it is AJAX himself. He begs not for life: a request like that would be beneath a hero. But because in *that darkness* he could display his valour in no illustrious exploit, and his great heart was unable to brook a sluggish inactivity in the field of

action, he only prays for *light*, not doubting¹ to crown his fall with some notable performanté, though *Jove himself* should oppose his efforts.

The boy, who was couched for blindness by Mr. Cheselden, had no great expectation of pleasure from a *new sense*; he was only excited by the hopes of being able to read and write; he said, for instance, that he could have no greater pleasure in walking in the garden with his sight, than he had without it, for he walked there at his ease, and was acquainted with every turn. He remarked also, with great justice, that his former blindness gave him one advantage over the rest of mankind, which was that of being able to walk in the night, with confidence and security. But, when he began to make use of this new sense, he seemed transported beyond measure. The brightness of the day, the azure vault of heaven, the verdure of the earth, the crystal of the waters, all employed him at once, and animated and filled him with inexpressible delight. He turned his eyes towards the sun. Its splendour dazzled and overpowered him: he shut them once more; and, to his great concern, he supposed that, during this short interval of *darkness*, he was returning to nothing. New ideas now began to arise; new passions, as yet unperceived, with fears, and pleasures, all took possession of his mind, and prompted his curiosity: love served to complete his happiness; and every sense was gratified in all its variety.

I had not, perhaps, been thus diffuse on the article of *light*, unless I had observed, that all animals, when afflicted with illness, fly instinctively to some *silent* and *dark* retreat, where, unaided by art, they quickly recover; and that man, left to the guidance of reason only, often falls short in this respect of the brute creation, and frequently his powers, already weakened by disease, get still the more *exhausted* by an imprudent admission of *company* and *light*. Every one, who has experienced a nervous fever, says the benevolent Mr. Townsend, must have felt the distress that is occasioned by both *these stimuli* at the first onset of this disease.



OUR
RELATIONSHIP
TO
HEAT.



SECTION II.

ON ANIMAL HEAT AS DEPENDANT UPON VITAL
AIR.

IT was shewn in the first volume, that when the heart did not receive blood impregnated with *oxygen air* it ceased to beat; besides *the circulation of the blood*, we are indebted also for our *vital heat*, to the *oxygen air contained within the blood*.

The ingenious Dr. Crawford appears to have been the first who attempted to ascertain by direct experiments the cause of ANIMAL HEAT as dependant upon the air. In an elaborate work he maintains, that the blood, which is returned to the lungs, is highly charged with *phlogiston*,—that the air having a greater affinity for *phlogiston* than the blood, attracts to itself *that principle*, and having in consequence a less *capacity* for heat than before, it parts with a portion of its heat,—and as the *capacity** of the blood for heat

* The meaning of this word may be easily understood, if we contemplate the CAPACITY of a *sponge* for containing water, and that of any other body; it must appear that bulk for bulk, its CAPACITY with regard to that fluid, is greater than the CAPACITY of any other known substance. Or, to give another illustration, *hot water* will dissolve a greater quantity of *salt* than *cold*, and *hot air* will suspend a greater quantity of *moisture* than *cold air*. Hence when these are changed into each other, that is, the *hot water* containing salts is converted into *cold water*, and the

heat is at the same time increased by the separation of the *phlogiston*, the *heat*, detached from the air, is fixed in a quiescent or latent state in the blood:— and that the blood in the course of the circulations absorbing *phlogiston*, and thereby having its *capacity* for *heat* diminished, part of it (in proportion to the quantity of *phlogiston* absorbed) breaks out in the form of sensible or moving heat, and hence the cause of ANIMAL HEAT.

It required a strong philosophic conviction in Dr. Thornton to depart from a proposition at that time so generally received. But having made many ex-

the *hot air* of the day into the *cold air* of the evening: in the first instance, the *superabundant salt* before held in solution will be deposited at the bottom; and in the second, the moisture, or the *dew* of evening, will descend on the ground. In the same manner the *CAPACITY* for *heat* being found greater in *arterial* than *venous blood*; hence when the *arterial* becomes *venous blood* (just as the *hot air* converted into *cold air* deposited its *moisture*, and *hot water* converted into *cold* deposited its *salts*), so must *arterial* blood converted into *venous* deposit its *superabundant heat*.

Dr. Crawford's opinion therefore, to state it in a few words, is, that, in *respiration*, the blood is *discharging PHLOGISTON* and *absorbing HEAT*; and that in the *course of the circulation*, it is continually *imbibing PHLOGISTON* and *emitting HEAT*. This excellent philosopher became, however, a convert to the *new* or *antiphlogistic chemistry*, and being a patient to Dr. Thornton for the inhalation of air in a pulmonary complaint, he declared to that physician he was satisfied at the justness of his arguments adduced at Cambridge respecting the cause of *animal heat* as depending upon the decomposition in the body of VITAL AIR.

periments,

periments, when enquiring into this subject, he was confident, that the OXYGEN AIR which WAS ABSORBED BY THE BLOOD (as is proved in Sect. VI.), was the true source of ANIMAL HEAT. Struck with the important discovery, he proposed it as the subject of his *thesis* at Cambridge. The professor of physic at first refused it, as being an opinion perfectly *novel*. He, however, at length very politely consented to his disputation on this question, and Dr. Thornton maintained at Cambridge, previous to his receiving his degree in physic in that university, in opposition to the opinion of Dr. Crawford, “ that the *venal* blood “ in the lungs absorbs from the air not *fire*, but *oxy-* “ *gen*, in combination with *the matter of heat* (OXY- “ GEN AIR), and that in the circuit of the blood “ through the body, the *oxygen*, meeting with some “ superior attraction, is divorced from its *caloric**, “ which becoming disengaged (*just as an acid dis-* “ *covers its sensible properties, its alkaline basis being* “ *withdrawn from it*), so did it assume its well known “ *active* character; and as *uncombined fire* ever tends “ to form an equilibrium, or equal temperature “ with the substances around, by pervading the bo- “ dy, it became the source of VITAL OR ANIMAL “ HEAT.”

Animal heat, therefore, appears to be a gentle combustion:—and an animal in many respects may be compared to a burning lamp; the HEAT produced in both cases arising from the same cause.

* The matter of heat.

If AN ANIMAL be placed in *an exhausted receiver* of an air-pump it quickly expires; in similar circumstances A BURNING LAMP goes out. If AN ANIMAL be not supplied with *fresh air* it dies, and its *heat* is extinguished; so it is with the LAMP. The air breathed by ANIMALS is *diminished in quantity*; so it is by the burning of THE LAMP. A *certain quantity* of air supports AN ANIMAL for a *certain time*, but no longer; so it will keep up the FLAME OF THE LAMP, for a *certain time* only. The air in which a LAMP has burnt out *destroys* ANIMAL *life*; so the air that THE ANIMAL hath breathed, *puts out* THE LAMP. Fixed, azotic, and inflammable airs, *destroy* ANIMALS; so likewise do they *extinguish* THE LAMP.

A LIVING ANIMAL and a BURNING LAMP, therefore, exactly agree in requiring the *same kind of air* to support them, and in producing *the same effects* upon the air, to which they are exposed.

But they do not resemble each other only in *producing* HEAT, and requiring the *same kind of air*: for if AN ANIMAL hath not *fresh supplies* of FOOD, as well as AIR, after a *certain time* it dies, and becomes cold; just in the same manner as THE LAMP dies out, if not *duly supplied* with OIL.

Since then *that part* of the air destroyed by RESPIRATION is the *same* as *that* destroyed by COMBUSTION; and since the *ultimate effect* is the *same* in both operations, that is, THE PRODUCTION OF HEAT, is it not reasonable to think, that the FOOD affords to the ANIMAL *principles alike attractive of* OXYGEN, and *disengaging* HEAT, as the OIL affords to

THE

THE LAMP? For since *the effects* are the same, *the cause* must be so too. OIL, therefore, affords the principle attractive of OXYGEN TO THE LAMP: and, consequently, THE FOOD of animals supports the generation of heat, by supplying to the animal body those principles which are attractive of OXYGEN, the base of vital air.

The *chemical analysis* of such substances as are to support animal life confirms this opinion; for no substance affords proper nourishment, which contains not principles that readily combine with OXYGEN; and the instantaneous support, and refreshment, perceived by those, who are much exhausted, upon taking into the stomach certain inflammable substances, as diluted spirits, &c. depend upon the same principle. *Very different matters*, therefore, will support ANIMAL LIFE, if they contain principles, separable by the animal process, that have an affinity with oxygen.

To prove that *animal heat* arises from the *decomposition* of VITAL AIR by those substances which attract oxygen, we have the following very striking facts.

Mr. Windy having been previously indisposed with stomach affection, had the extremities remarkably cold. He became at length insane. He was placed in a mad-house at Chelsea; where for the first five months he raved, and after that, for four months, he scarcely ever uttered a single word. When he was removed from this place to be under

Dr. Thornton, he was gloomy, sullen, and silent, or muttered only expressions, which evinced what were the terrors of his disturbed imagination. He had no recollection of his wife or children, and the only notice he took of his attendants, was to manifest suspicion, that they meant to injure him. Dr. Thornton gave him for some days *oxygen air* mixed with atmospheric daily, but his hands continued still as cold as clay. *Ether*, *brandy*, and *wine*, were tried, but without the least effect in warming him when employed alone: but the *primæ viæ* being cleared, and *ether* and *brandy* being given, *before the inhalation* and *after*, a general glow was immediately produced, which extended even to his fingers ends. Nor was this a transitory effect, for the benefit after a while became permanent*.

Dr. Beddoes, the justly celebrated professor of chemistry at Oxford, respired at times for seven weeks air of a much higher than the ordinary standard, and commonly such as contained almost equal parts of oxygen and azotic airs. He relates, in his letter to Dr. Darwin, "that he felt that agreeable glow, and lightness of the chest, which has been described by Dr. Priestley and others. "In no long time," he says, "I observed in myself

* For the sequel of this case see Dr. Beddoes's *Considerations*, Part III. p. 109. It is thus with the culinary fire, sometimes it will be sufficient to *blow* it; added to this we must sometimes employ *sticks* also, and the fire being once well kindled, it will afterwards maintain itself.

"a remark-.

“ a remarkable power of sustaining *cold*. Except one
 “ or two evenings I never once experienced the sen-
 “ sation of *chilliness*, though cold easterly winds pre-
 “ vailed, during great part of the time I inspired
 “ the *super-oxygenated air*. I was not only able,”
 he adds, “ to reduce my bed-clothes to a single
 “ blanket and coverlid, but slept without incon-
 “ venience in a large bed-chamber, looking to the
 “ north-east, with the window open all night, and
 “ with the door and windows of an adjacent sitting
 “ room also open.—My appetite was keen, and I
 “ eat *one third or one fourth more than before*, without
 “ feeling the stomach loaded.”

Animal heat, therefore, proceeds from the chemical union of certain parts of our food and oxygen, modified, and combined, by the proper exercise of the natural animal functions, disengaging caloric.

When we come to treat on digestion, it will be shewn how the *gastric juice* has a solvent power over *certain substances*. Our aliment is therefore broken down in the stomach into its constituent principles, and these comminuted parts then enter and pass along the capillaries of the intestines, which are incapable of admitting any substance, unless in an highly attenuated or *aerial* form.

The anatomical lecturer at Pisa, in the year 1597, happening to hold a lighted candle near the subject he was dissecting, on a sudden the vapours that issued from the stomach and intestines were set on fire. In the same year Dr. Ruisch was dissect-

ing a woman, and had no sooner opened the stomach, than there issued out a yellow greenish flame, supposed to have arisen from the vapours, which were kindled by a student's holding a lighted candle near him. Dr. Vulpare, the anatomical professor at Bologna, affirms that any one may see, issuing from the stomach of an animal, a vapour that *burns like spirits of wine*, if the upper and lower orifices are bound fast with a tight thread. The stomach thus tied up, must be cut immediately under the upper ligature, the contents of the stomach being first pressed with both hands, so as to pass to one side. A candle being held about half an inch from the aperture, a flame will be observed immediately to issue from the stomach. Bartholine relates the case of a person, who having drank much brandy for a wager, died, after an eruption of a flame of fire had first issued from his mouth. *The inflammable woman of Coventry*, as described by Mr. Wilmer, appears also to have reduced herself by dram-drinking to such a state as to be capable of being set on fire, and burn like any very combustible matter ; *so eager*, says the learned Dr. Beddoes, *were the principles of which she was composed to combine with oxygen*. In like manner the countess *Cornelia Bandi*, near Cesena in Romagna, in 1731, in the sixty-second year of her age, was found in the middle of her bed-chamber reduced to ashes. These ashes were light, and left in the hand a greasy and sticking moisture. The floor

• was.

was smeared with a gross unpleasant moisture, and the walls and furniture were covered with a moist foot.

An instance of the same kind occurred at Christ-Church in Hampshire, June 26, 1613; one John Hitchell, a carpenter of that parish, a great drunkard, having ended his day's work, came home and went to bed. His wife found him dead before morning at her side. He felt so extremely hot, that it was impossible to touch him. *He lay burning for three days*; nor was there any appearance of flame outwardly, but only a smoke or mist ascending from his carcase till it was consumed.

These curious instances of *quick combustion* carried on in the body, if I may be allowed to continue the expression, are adduced only as exceptions to Dr. Thornton's general rule, "that within the body
"there is always carried on a *gentle combustion*, productive of *the vital flame*."

SECT. III.

HOW LIFE DEPENDS UPON A DUE QUANTITY
OF ANIMAL HEAT.

IN the last Section it was proved, that *vital heat arose from the decomposition of oxygen air in the blood*. In this it will appear, *how life depends on a certain degree of heat in the body*.

In the chick contained within an egg there are no powers capable of generating heat. Therefore until the chick receives heat from the mother it remains in a torpid and inactive state. The principles of life are then called into action. A gradual extension of the parts commence. During the time of incubation, the living principle every day increases in quantity and power with the perfection of the animal, and the capacity of its organs for performing its functions, and *generating heat*, which last does not happen till the time of its exclusion from the shell: after which, the chick does not depend *entirely* on the mother for the production of that heat, which must always accompany and support the functions of life. When, by respiration, the first action after birth, *oxygen air* is absorbed by the blood, the motion of the heart, the circulation, and other operations, are carried on
with .

with greater vigour than formerly, and the food being separated into principles attractive of *oxygen*, the chick is capable, in a great measure, of generating a degree of heat equal to that of the parent. At first the mother, by a wonderful instinct, as if conscious of the tender state of her offspring, and of the impossibility of their being kept sufficiently warm by their own powers, gathers them under her wings to cherish that vital warmth, which she appears to judge them incapable of creating, and *without which* they would necessarily perish. In the same way, if, during incubation, the hen leaves her nest so long as to cool the eggs a few degrees, from that period the powers of life are proportionably diminished, and a stop is put to the growth of the chick; both of which, if the eggs have not been cooled too far, are recoverable on the return of the hen, or of that genial heat they receive from her body. The mother is so solicitous to preserve *this heat*, that she seldom leaves her nest above five or six minutes in the day, to take a slender repast; and when she discovers the motion of the chickens in the eggs, she then sits so close, that even the sight of food, though ever so much pressed by hunger, can scarcely prevail with her to stir from the eggs for three or four days, or until they are completely hatched. But if she abandons her nest altogether, or is killed by accident, then, as the eggs cool, the powers of life gradually decline, till they are at last totally abolished by the death of the chickens.

Though *the functions of life*, in this instance, are soon destroyed or suspended for want of a due quantity of animal heat, yet in some creatures, under these circumstances, the *vital principle* still remains intire. Thus flies, when the cold comes in, appear as if deprived of sense, and in proportion to the degree of cold, the *moving mechanism* is retarded. But if the weather be *intensely cold*, they then "*sleep the sleep of death.*" Hence the reason why we see toads burrowing, frogs living under large stones, snails seeking shelter in the hollows of trees, and fishes having recourse to deep waters; the heat of all these places being generally *above* the freezing point, even in our frosts, which are however sometimes so severe, as to kill many whose habitations are not well chosen.

Some years ago I cut out, says Dr. Gardinor, the heart and part of the large vessels of a turtle, with a view to examine the structure of these parts and the circulation of the blood in that animal. Having wiped off the blood and other moisture, the heart was wrapped up in a handkerchief; but engagements in the way of my profession obliged me to postpone my curiosity till about six or seven hours after it was cut out. When I examined it, there appeared not the *least signs* of life. It was much shrivelled and dried. But, by putting it into water, nearly *milk warm*, it plumped up, and some of its parts acquired a tremulous motion. Laying it on the table, and pricking it with a large
needle,

needle, it palpitated several times. The palpitations were renewed, as often as the needle was pushed into its substance, until it became *cold*, when it seemed to be insensible to every stimulus. But, after *warming* it again in the water, it recovered its *irritability*, and repeated its palpitations on the application of the needle. Though no movement could be excited in it by any stimulus when *cold*, yet it moved several times after being macerated in *warm water*. This evidently shows the necessity of HEAT for maintaining the full powers of the *contractile living principle*.

The effects of temperature is, in a most satisfactory manner, illustrated by the learned and ingenious Dr. Robertson, in his history of *America*; when taking a view of the effects of climate on the human body, he says, In every part of the earth where man exists, the power of climate operates with *decisive influence* upon his condition and character. In those countries which approach near to the *extremes of heat or cold*, this influence is so conspicuous as to strike every eye. Whether we consider man merely as an animal, or as a being endowed with rational powers, which fit him for activity and speculation, we shall find that he has uniformly attained the greatest perfection, of which his nature is capable, in the *temperate regions* of the globe. There his constitution is most vigorous, his organs most acute, and his form most beautiful. There, too, he possesses a superior extent of capacity, greater fertility

tility of imagination, more enterprising courage, and a sensibility of heart, which gives birth to passions not only *ardent* but *persevering*. In this favourite situation he has displayed the utmost effects of his genius, in literature, in policy, in commerce, war, and in all the arts which improve and embellish life.

He accordingly divides the natives of America into *two distinct classes*; the *one* inhabits the *temperate*, the *other* the *torrid zones*, on both side of *the line*. He says, that the human species in the *former* appears manifestly more perfect: that the natives are more robust, more intelligent, more active, and more courageous. They possess, in the most eminent degree, that force of mind, and love of independence, which are regarded as the chief virtues of man in his savage state. These natives accordingly, though surrounded for several centuries past by polished and hostile nations, have hitherto maintained, in a great degree, their freedom and independence: but the *other* class, from the debility of their mind and body, their inactivity, want of active courage, and of that independence which characterises those living in the more *temperate climates*, have become so dependent as to be nearly in a state of slavery to those nations, who, for the sake of mines or commerce, have taken possession of their territories.

S E C T. IV.

HOW NATURE INCREASES OR RIDS HERSELF OF
THE ANIMAL HEAT.

IN the last Section *the close connexion between life and heat* was shewn; we shall slightly consider here *the method Nature takes to increase or rid herself of this subtile and penetrating fluid.*

ANIMAL HEAT USUALLY EXCEEDS THE SUR-
ROUNDING AIR*.

As the heat of the living body generally *exceeds* that of the surrounding atmosphere, it is obvious, so far from any heat being derived from it, on the contrary, the body must *communicate* heat to the external air; and if we consider the great difference subsisting between the temperature of the human body, and that of the atmosphere in our climate, it is clear that a very large portion of heat must be ever *escaping* from the body, and of course there must be *constant generation* of animal heat carried on in the body to balance this consumption.

Every one who has paid attention to the temperature of the atmosphere by means of the thermo-

* A thermometer being put under the tongue of man in all countries rises to 97. HUNTER on the Animal Economy.

meter, must have observed how frequently our feelings, respecting heat and cold, *disagree* with the indications of them, as expressed by that instrument; since it often happens, that when experiencing a very considerable degree of cold, we are surprised to find the mercury at a moderate temperature; and this may be observed usually to happen in *windy weather*, or when the air is particularly loaded with *wet particles*.

This can be accounted for on no other principle than that of *the constant production of heat within the animal, and of its tendency to pass off by the surface*: for the thermometer very soon acquiring the temperature of the air, becomes at once stationary, varying only with the real changes which take place in the atmosphere; whereas the constant succession of heat, which there is in the living animal, prevents it acquiring the temperature of the air, and it cannot, therefore, like the mercury, descend to its temperature, and then become stationary; and as the sense of cold felt by us, must consequently be owing to the constant *escape* of heat which is thus promoted, the degree of cold felt must obviously be in proportion to the celerity with which the air is enabled to *carry off* the warm atmosphere surrounding us.

The effects produced by *fanning*, when persons are very hot, may be understood from the principles of the foregoing doctrine: when the surface is loaded with heat, and the air, which is in immediate

ate contact with it, has already taken up so much, that it is either unable to carry off any more, or performs this office so slowly, as to be unequal to the removal of the quantity which is constantly arriving at the surface, the driving away such air by the fan, and permitting other colder air to approach, which not being so loaded, is able to carry off the heat more quickly, the skin must in consequence feel cooled.

Moist air is, likewise, a better conductor of heat than when dry, because *water*, though of the same temperature with air, is well known to carry it off more quickly than air will do.

If, therefore, *these two causes unite*, as is the case in *moist* and *windy* weather, we may easily understand why the heat from animals should be carried off more quickly, and the animals should experience a greater sense of cold, than when the air is *still* and *dry*, though the thermometer should, in both cases, stand at the same point.

Even in torpid animals the temperature of heat is constantly *higher* than the surrounding medium.

In the *winter*, the atmosphere at forty-four degrees, the heat of the torpid hedge-hog at the diaphragm was found, by Mr. Jenner, to be $48^{\circ}\frac{1}{2}$.

When the atmosphere was at twenty-six degrees, the heat of a torpid hedge-hog was reduced so low as 30° .

In *summer*, the atmosphere at seventy-eight degrees,

grees, the heat of the hedge-hog at the diaphragm was found to be 97° .

The atmosphere being at thirty, that ingenious and most accurate experimental philosopher, Dr. Haighton, the present Lecturer on Physiology at Guy's Hospital, found the animal heat of a torpid bat at 33° ; and when the atmosphere was at sixty, he found it so high as 63° ; that is, during life the *vital heat* was always found, even in dormant animals, *to exceed the surrounding medium*.

OF THE RETENTION OF ANIMAL HEAT.

It may be remarked, that all animals, when the heat is passing off them in an *inconvenient degree*, endeavour to CHECK IT by lessening the surface of their bodies, which is exposed to the surrounding air; thus we see why dogs, cats, &c. when lying on the ground, and not in a warm situation, draw their limbs close to them, and endeavour to acquire such a posture of the whole body, as shall bring all the parts as much into contact as possible; and when in a contrary situation, as exposed to the warm rays of the sun, or near the fire, they stretch out their limbs, and extend their whole surface as much as possible: and we all know, that we ourselves, when naked, or when entering a cold bed, do exactly the same thing; and in bed we continue such a posture until such a quantity of heat has been accumulated, and confined by the bed-clothes, as

to

to remove all sensation of cold, when, like the before-mentioned animals, we stretch forth our limbs, and acquire our accustomed posture.

The universal custom of the inhabitants of all countries in which the temperature of the atmosphere is below the standard of the heat of the human body, making use of apparel, and this being thicker or thinner in proportion to the respective differences of seasons or climates, is founded on the same principle, *to prevent such an escape of heat from the body as would be unpleasant or injurious.*

The same thing may be observed of the natural clothing of different animals; in *warm climates* their coats are short, smooth, and lie close to the skin; but in the *northern regions* their covering consists of a rarer substance, as fur, wool, &c.

It may likewise be observed, that even in the *same animals* a difference, respecting the heat-conducting powers of their covering, takes place under different exposures; that in *summer* it is less calculated to retain their heat than in *winter*; and when protected by the external cold, by living *within doors*, than when exposed to it when living in the *open air*. The horse may be considered as a very familiar instance of the truth of this remark, for every one knows how long and rough the coats of those are which winter in the *straw-yard*, and how short and smooth are the coats of those which are kept in warm *stables*; and that it is a common practice with such as have the care of horses, to cover them
with

with woollen cloths, to render their coats fine and smooth.

In *birds* this provident care of nature is peculiarly striking; as they pass freely through the air, and are often exposed in the higher regions to a very cold medium, their natural heat would pass off much too quickly, if they were not covered with a substance which conducts heat very slowly, which feathers are well known to do: and in those birds that *live in water*, which withdraws heat much quicker than air, their covering is much more rare and compact than common feathers; the down upon the breast and under the bellies of those birds, which in cold climates live principally in the water, being perhaps the slowest conductors of heat in nature; modern luxury having, on this principle, set a great value on the down of the *eider duck*, and its use in retaining heat, to which it is applied, being well known in fits of the gout; to which cases, on account of its extraordinary lightness, it is particularly well adapted, as the parts affected are usually so exquisitely tender, as to suffer pain from the contact of whatever has weight, or occasions pressure. The slow conducting power of this down being evidently owing to its rare texture, it is obvious, that to retain this quality it should remain perfectly dry, as the plumage, when *wet**, will
very

* Mr. HUNTER, having put a *dormouse* in a freezing mixture, could not freeze the whole animal, but only the feet,
the

very soon collapse together, and form a body capable of carrying heat off, perhaps, too quickly. To guard against this circumstance, nature has kindly furnished *these aquatic birds* with a peculiar kind of oil, and has given them the power of occasionally opening the receptacle where it is deposited, and of spreading a sufficient quantity of it over their outermost feathers, by which the contact of water is effectually prevented.

Lastly, we may observe, that the *sensible perspiration* is much less in cold than in hot weather, which circumstance in the next paragraph will be more particularly considered.

the hair being so bad a conductor of heat, that the *heat* withdrawn from the animal was not more than its powers were capable of generating. Taught by the failure of this experiment, I took care, says this great physiologist, that the hair should not a second time be an obstruction to our success. Having, therefore, first made the animal *wet all over*, that its heat might be more expeditiously carried off, it was put into a leaden vessel, and the whole placed in the cold mixture as before. The animal soon gave signs of feeling the cold, by *coiling* itself into a round form, and repeatedly attempting to make its escape; and the breath and water evaporating from its body being soon frozen, appeared like a hoar frost on the sides of the vessel, and on its whiskers; but as long as the vigour of life lasted, it seemed to defy the cold. However, from the air being *wet*, and thereby rendered a good conductor, there was a much greater consumption of heat than in the first experiment; which hastened on a diminution of the power of producing it. The animal soon became stiff; and upon being thawed, was found quite dead. HUNTER *on the Animal Economy*.

THE ESCAPE OF ANIMAL HEAT.

When the air is of that particular temperature which, with the assistance of other operations in the œconomy, is just sufficient to carry off such a quantity of the heat generated in the body, that the remainder shall exactly support the animal body, we say such an air is mild, or it is temperate; because we are not sensible of any troublesome degree of heat or cold. This precise temperature varies in different people, according to the climate, age, and constitution of the individual; but at whatever point of the thermometer this temperature may be, if it rises or falls a few degrees only, we then complain of heat or of cold, and employ various ways of obviating their effects. When we are surrounded with a *warm air*, a *free perspiration* succeeds; and if a further accumulation of heat takes place in the body, a *sweat* is brought on proportioned to the stimulus, from the excess of heat. Nature is now employed in COUNTERACTING the effects of an accumulation of heat by the refrigerating process of *sweating*, and the consequent expenditure of heat in the formation of vapour. How soon will the mercury and the thermometer cool by the ball being wet with æther, or volatile alkali! The degree of cold that may be produced in this way, has been sufficiently proved by the celebrated Dr. Cullen. Wit-
ness.

ness the ice found in the morning on linen hung out to dry during the night, when the temperature of the air is even much above the freezing point: the practice of cooling wine in warm countries, by hanging up their bottles in wet cloths to the sun*, to expedite the evaporation; the cooling of the wine going on in proportion to the quickness with which its heat is abstracted by the vapour. I should not have insisted so much on the effects of *evaporation*, says Dr. Gardiner, President of the Royal College of Physicians at Edinburgh, had I not considered it as a material circumstance in examining the effects of hot air on the human body, which sooner or later, according to the degree of heat it possesses, produces, in the manner above mentioned, a *sweat*, and consequently *evaporation* from every part of the body. Not that the whole of the matter perspired is turned into vapour; it is only such a portion of it as can readily absorb the necessary quantity of heat from the body and external air, which will be in proportion to the degree of heat

* The Arabians have this remarkable method of cooling their wines when conducting caravans over the deserts, which exhibits, in the most forcible manner, the truth of the above account. They dig a hole, and having filled it with straw, they place the bottle of wine they mean to cool into the midst of it, having previously surrounded it with *wet* straw or clay. They then set fire to the straw, and the bottle of wine is brought out (from the evaporation of the wet clay or straw surrounding it) *quite cool*. Vide Philos. Transf. Vol. LXV. p. 252.

they possess; the rest running in drops off the body, or it is absorbed by the cloths, and is afterwards evaporated from them.

The matter of heat, or caloric, finds, moreover, other outlets to escape by, besides the surface of the body; as a considerable quantity must, evidently, pass off from the *lungs* in breathing. Indeed the quantity which is carried off by the air, as also by the lungs, is found, by experience, to be much greater than one would at first imagine, "*for we know that the heat contained in one breath of air, will, if properly managed, raise Fahrenheit's thermometer ten degrees* *." And provident nature seems to take advantage of this circumstance, when an extraordinary quantity of heat is suddenly excited in those animals, which are but little able to carry off a superabundance: thus *dogs*, which do not sweat, and *sheep*, whose clothing is so particularly unfavourable to the carrying off an unusual quantity of heat, always open their mouths very wide, that the whole surface of the fauces may be exposed, and move the tongue remarkably quick, to agitate the air in contact with it.

When heat is accumulated in the system, either by fever, by strong exercise, or by the scorching heat of the sun, nature constantly cries aloud for *ACIDS*, and a *cooling diet*; and to those who have turned their mind to chemistry, the reason for this

* Vide Critical Review for January 1782, page 6.

strong desire is obvious. They know that *animal heat* originates in the decomposition of OXYGEN AIR, after it is received into the blood by the lungs; and they observe, that the quantity of air which is decomposed or vitiated, bears direct proportion (as will be explained when mentioning the experience of the celebrated diver Mr. Spalding) to the quantity of combustible matter, whether animal or vegetable, whether sugar, oil, or spirits, received into the stomach. They observe, likewise, that *acids* taken into the stomach always check, and restrain the generation of heat; or, in other words, that when the system is saturated with OXYGEN only, less OXYGEN AIR (oxygen and *caloric*) is imbibed by the blood in the lungs, and consequently less *heat* will be evolved in the body. It is upon these principles, says the Rev. Mr. Townsend, that the reapers in the south of Spain covet their *guzpacho*, composed of bread, oil, and *vinegar*: the two first articles for nutriment, and the latter to moderate their vital heat. On the same principles, obedient to the voice of nature, during the sultry heats of summer, we equally desire our lettuce, oil, and *vinegar*, and we may remark, that in *warm climates*, and in summer in the *more temperate regions* of the globe, the *acescent* and watery fruits abound, but in the autumn we have chiefly those which produce *oil* and *sugar*, while dried *fish*, *meat*, and *train oil*, form the principal support of the hardy inhabitants of the *north*.

PRACTICAL OBSERVATIONS:

SECT. V.

I. OF THE CLOTHING OF INFANTS.

MIDWIFERY was first practised by women. Hence the dressing of children became an art which few could attain unto. Each midwife strove to outdo all others in this pretended knowledge. These attempts were seconded by the vanity of parents, who, too often desirous of making a show of the infant as soon as it was born, were ambitious to have as much *finery* heaped upon it as possible. Thus it came to be thought as necessary for a midwife to excel in bracing and dressing an infant, as for a surgeon to be expert in applying bandages to a broken limb; and the poor child, as soon as it came into the world, had as many rollers and wrappers applied to the throat* and body, as if every bone had been fractured in the birth; while these were often so tight, as not only to gall and wound its tender frame, but even to obstruct the motion of the organs necessary for life.

* As the *long stay* to hinder the child from bending back the head and breaking its neck!

NATURE knows no other use of clothes but to keep the body *warm*. All that is necessary for this purpose, is, when the child is born, to excite the external circulation by rubbing it with brandy and water with the warm hand, and having affixed the *belly-band* made of *fleecy hosiery**, to wrap it in a loose covering of the same soft material; and then to lay it by the side of the fond mother to partake of *her* vital warmth†. Were parents left to the dictates of nature alone, they would certainly follow this method. If we consider the body of an infant as a bundle of soft pipes, replenished with fluids in continual motion, the danger of *pressure*‡ will appear in the strongest light. NATURE, in order to make way for the growth of children, has formed their bodies soft and flexible; and lest they should receive any injury from pressure in the womb, has surrounded the foetus every where with yielding fluids. This shews the care which NATURE takes to prevent all unequal pressure on the bodies of infants, and to defend them against every thing that might in the least cramp or confine their motions.

Not only the analogy of other animals, but the

* More will be said hereafter of this happy discovery. At the same time that it is *warm* and *unirritating*, it is perfectly *elastic*.

† Vide Section III. *How life depends on a certain degree of heat in the body*.

‡ Some allowance ought certainly to be made for the swelling of the muscles during sleep.

very feelings of infants, inform us, they ought to be kept easy and free from pressure. They cannot indeed tell us their complaint; but they can shew signs of pain; and this they never fail to do, by crying when pinched by their clothes. No sooner are they freed from their bracings, than they seem pleased and happy; yet, strange infatuation! the moment they hold their peace, they are again committed to their chains. I have known, says the benevolent Dr. Buchan, numerous children seized with *convulsion-fits* soon after the midwife had done swaddling them, who, upon taking off the rollers and bandages, were immediately relieved, and never had that disease recur afterwards.

II. OF THE CLOTHING OF ADULTS.

We have before contemplated the benevolent care of PROVIDENCE to the lower order of creatures in providing them with *clothing suited to the climate and the season of the year* *. The horse, the deer, and birds, *double* their covering in the beginning of the cold season, and *shed* it in the spring when a warm garment is no longer serviceable.—The beaver removed to the higher latitudes exchanges its fur, and the sheep its wool, for a coarse hair, to al-

* When treating, Sect. II. *On Animal Heat*; also Sect. III. *How Life depends on a certain Degree of Heat in the Body*; and in Sect. IV. *On the Method Nature takes to increase or rid herself of this subtle and penetrating Fluid*.

low of the escape of heat. The coarse and black shag of the bear, on the contrary, is converted in the arctic regions into the finest and whitest fur *to retain the vital flame.*—In short, the softness and density of hair in animals seems always in proportion to the coldness of the country. The Canadian and Russian furs are therefore better than the furs of climates farther removed from the north. It is well known that the fur of the ermine is the most valuable of any hitherto discovered: and it is in winter only that this little animal has it of the proper colour and consistence. NATURE has provided some animals with another resource; when the season becomes too cold for their constitutions, they sleep, or emigrate into warmer climates.

Pliny, one of the most celebrated naturalists of antiquity, pathetically laments, “that whilst NATURE has given various clothing to the brute creation, and even fenced plants and trees with bark, against the injuries of the cold and heat, she should have cast man into this world naked, unprovided against the inclemency of different climates and seasons.” But instead of agreeing with that philosopher, that NATURE has, in this particular, acted more like a cruel step-mother, than a kind and indulgent parent to man, we cannot sufficiently extol her providence and wisdom. It was no more than consistent with equity to provide the irrational part of her works with clothing suitable to their circumstances; but man, whom

whom she endued with the transcending faculty of reason, she hath very wisely left to accomodate himself to the difference of seasons and of climate, and to clothe himself accordingly with the plumes, the fleeces, the skins of animals, and the products of various plants and trees. This would invariably be found to be the case, were not man, alas ! fervilely imitative, and in the highest degree capricious in the ornaments of his person. Hence it is, that the nations beyond the *Indus*, as well as the *Tartars*, are at great pains to compress their eyes at the corners, and to stretch their ears by heavy weights appended to them, and pulling them frequently with the fingers, so that they may hang down to their shoulders, which *they* consider as the highest mark of beauty. On the same principle, they extirpate the hair from their bodies ; and, on the face, they leave only a few tufts here and there. The *Tartars* frequently extirpate the whole hair of the head, except a knot on the crown, which they braid and adorn in different manners. Some, and among others the *Turks*, cut the hair off their heads, and let their beards grow. The *Europeans*, on the contrary, shave their beards, and wear their hair. Every nation seems to have entertained prejudices, at different times, in favour of one part or another of the beard. Kingson assures us, that a considerable part of the religion of the *Tartars* consists in the management of their whiskers ; and that they waged a long and bloody war with the *Persians*, declaring them infidels,

merely because they would not give their whiskers the *orthodox* cut. Peter the Great had nearly occasioned a revolution in his kingdom, by wishing to have his subjects shaved. In our country we daily see men, who encourage the growth of the hair on the cheek, below the ear, to look fierce, while others again wish to have the size of their understanding measured by the size of their heads. The largeness of the doctor's wig* arises evidently from the same cause as the smallness of the beau's queue. In *Arabia* and *Greece* large eyes are esteemed beautiful; and in these countries they take extraordinary pains to stretch the lids, and extend their aperture. Among some *Indian tribes* in *America* they flatten the forehead in infancy by the application of broad plates of lead, and file to a point all the teeth to imitate the canine. In *Africa* they flatten the nose, to accomplish *their* idea of beauty. The skin in

* The tye-wig was disused in England through the humour of Dr. Somerville. Some of the faculty having taken offence, that he came not unfrequently to *George's* unarrayed with the sword, and in coloured clothes, and being on that account one day openly insulted by his indignant brethren, he came the next day to the coffee-house, having on the jehu of his coachman, who, on the contrary, had on the doctor's tye. "Here, gentlemen, he said, is an argument to the purpose, that knowledge does not consist in exteriors. There are none of you, who would trust me to drive you, and the world shall soon see, also, as I pass through the streets of London, that the wig does not constitute the physician." Having made for several days this curious exhibition, the tye-wig was quickly converted into a subject of ridicule, and Dr. Somerville gained the day.

many

many nations is darkened by art; and all savages esteem certain kinds of deformity to be perfections; and strive to heighten the admiration of their persons, by augmenting the terror of their features. In *China*, the reigning fashion is still more contemptible; to appear *ever idle*, they suffer their finger nails to grow to an enormous length, and *pinch their feet* into the smallest size imaginable. The latter custom has unfortunately reached these kingdoms. Instead of having the size and figure of the shoe adapted to the shape of the foot, the toes must be cramped, and deprived of all separation, which the perspiration of that part seems to demand*, and nine tenths of mankind are troubled with corns, a complaint that is seldom or never occasioned but by narrow and pointed shoes. The ladies, who ever improve on the fashions of the time, to gain a little in height, lengthen out the heel, and constantly walk on *tiptoe*. The consequence of which is, acting contrary to the intentions of NATURE, they never seem to walk well; and as the fibres of the muscles of the calf are not drawn into their due tension, they become subject to frequent and incurable *cramps*, which, as disturbing sleep, is again the remote cause of other dreadful disorders.

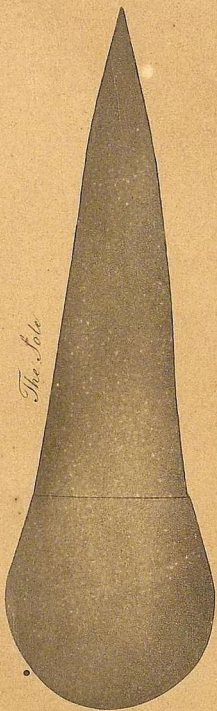
The shape God has given is too often attempted

* Dr. Vaughan, of Rochester, recommends stockings to be made with the separation like gloves.

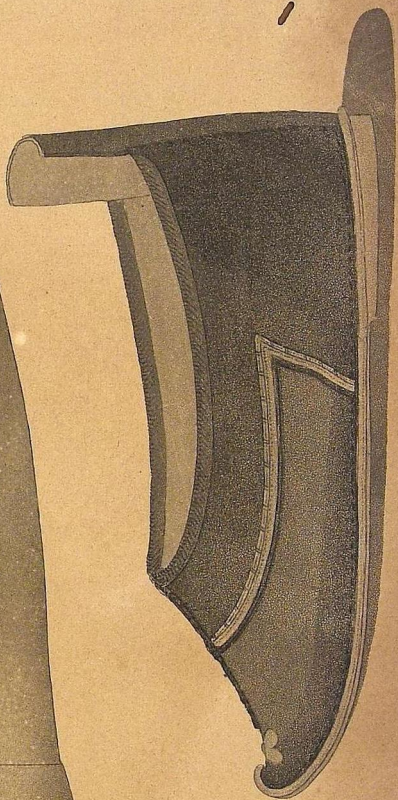
The Chinese Foot.

From a Model in the Possession of Mr. Cruikshanks.





The Sole



A Chinese Shoe.

to be *mended* by dress, and those who know no better, believe that mankind would be frights without its assistance. The bones of growing persons are so cartilaginous, that they readily yield to the slightest pressure, and easily assume the shape of the mould in which they are confined. Hence it is that so many girls in proportion to boys are *mishapen**. Deformity of body may indeed proceed from weakness or disease; but in general, says Dr. Buchan, it is the effect of improper clothing. The pressure of the abdomen by stays impedes the action of the stomach and bowels, and the motion necessary for respiration, and consequently the just circulation of the blood. Hence a train of dreadful disorders ensue. The pliancy of the body, and the natural grace of the female form, is prevented by this rigid coat of mail. The imprudent zeal of the mother for a fine shape performs another most unkindly office to the child. She frequently becomes either incapacitated for marriage, or dies in child-birth. The madness in favour of stays seems,

* A Lady in the city, who had no girls, though her family was numerous, but were *mishapen*, consulted the celebrated anatomist Mr. Cline, on the prevention. "*To have no stays—and to let the next girl run about like the boys,*" was the excellent advice of this gentleman, which being complied with, neither she nor any of the future children were afterwards *marred* by the ill-placed attention of the ignorant mother. This story Mr. Cline is very careful to deliver in his public lectures at St. Thomas's Hospital twice a year.

however,

however, to be somewhat abated; and it is hoped the world will, in time, become wise enough to know, that the human shape does not solely depend upon whalebone and bend-leather.

In *England* we seldom enjoy any continuance of settled weather, except towards the close of summer, and the beginning of autumn, and even then we are frequently balked in our expectations. The sudden changes that take place during three fourths of our year may be regarded as no less prejudicial to the health, than disagreeable to our feelings; and our terrors of *catching cold*, which have frequently appeared ridiculous to foreigners, are really better founded than we ourselves are apt, most of us, to apprehend; *colds* in their *consequences* proving fatal to thousands every year. Though we cannot hope entirely to escape the unpleasant sensations, or altogether to ward off the fatal effects occasioned by this caprice of our climate; yet considering properly *the nature of clothing*, we may avoid much of the danger. If *ladies* are subject to *catch cold* more frequently than men, it is not *alone* their delicacy of constitution, or their being more confined within doors; but the frequent changes they make in the quality or quantity of their garments, and sometimes, however fearful of a partial current of air, because they expose even those parts of the body, that a little before had been warmly covered. If a greater proportion of females fall victims to *consumption*, is it not because, losing sight more than men of its primary

mary purpose, says Dr. Beddoes, they regulate their dress solely by fantastic ideas of elegance? If happily our regret should recall the age of chivalry,—to break the spell of *fashion* would be an achievement worthy the most gallant of our future knights. Common sense has always failed in the adventure; and our ladies, alas! are still compelled, whenever the enchantress waves her wand, to expose themselves, half undressed, to the fogs and frosts of our island.

It is, I believe, adds the celebrated Dr. Beddoes, unfortunate for the inhabitants of this country, that we are not subject to such a continued severity of cold, as should oblige us regularly to fortify ourselves by *warm clothing*. By linen worn exclusively, we lose more in health than we gain in comfort; which comfort is, perhaps, after all, merely imaginary; for from the representation of Dr. Thornton, he appears to have supported the remarkable heats of a very hot summer, better than most other persons, by having on, instead of linen next his skin, a *fleece woollen waistcoat* *.

It is a mistaken notion, says Sir Benjamin Thompson, that flannel is too warm a clothing for summer. I have worn it, says he, in the hottest climates, and in all seasons of the year, and never

* Vide his Letters as published by Dr. Beddoes, in which he adds, "*and since my first using this under garb, I am not subject to catch cold as formerly from the vicissitudes of the weather.*"

found the least inconvenience from it. Sir Benjamin moreover adds, I shall be happy if what I have said or done respecting *flannel** should induce others to make a trial of what I have so long experienced with the greatest advantage, and which I am confident they will find to contribute greatly to health, and consequently to all the other comforts and enjoyments of life. As being the most effectual method to escape the influence of sudden changes of atmospherical temperature, and because flannel is so much less unpleasant, when moist, than linen. *Fleecy hosiery*, or *flannel*, should be worn during every season in Great Britain; and those who feel it necessary may add above the linen in winter a cotton under waistcoat, which he may put off during the warm weather, and resume again in the autumn. The philanthropic Jonas Hanway was a very great advocate for *warm clothing*. Being in a decline, he was ordered by his physicians to the south of France: but some very urgent business calling him to visit Holland, in the moist air of that country he recovered, and remarks that the Dutch are less subject to this dreadful calamity, which he attributes

* Had Sir Benjamin Thompson known the *fleecy hosiery*, he would most probably have recommended it in preference to *flannel*. It *equally* attracts and imbibes the moisture of the skin: but the former as being *elastic* embraces the body, as being from an animal substance is *warmer* and *lighter* for wear than flannel, and as being of a *softer texture* does not unpleasantly and injuriously *irritate* the skin.

partly to the air *, and partly to their warm method of ~~clothing~~. He adds, if a number of persons meet in a room, where there is no fire, and they feel cold, no pleasant conversation takes place, and *warm clothing* ought therefore to be used, if for no other reason than for the preservation of *good humour*. Boerhaave's favourite receipt for health was, "to leave off our winter clothing on Midsummer day, and to resume it the day following."

To keep an animal in health, beside the retaining of a due degree of animal heat †, there must be a continued generation of new juices, and a perpetual discharge of the old. Without the due quantity of PERSPIRATION, which with us depends very much on our clothing, neither the vegetable nor animal can continue in health; a plant whose *perspiration* is stopt becomes sickly and dies; and an egg whose shell has been covered with a varnish, and the *perspiration* stopt by this means, will produce no living

* Those consumptive patients, whom *we* hurry off to the clear air in the south of France, the *French physicians*, on the contrary, order to the foggy air of Lyons. As they cannot *both* be right, and as the HOT WELLS favours the sentiments of the latter, being near a great town, where innumerable works are carrying on, and situated on the borders of marshy ground, and a river the most choaked up with mud of any in the world, there is some probable grounds for doubting of the justness of *our* prevailing practice. Vide the Section on *Phthisis Pulmonalis*.

† Vide Sect. III. on the Necessity of a due Quantity of Animal Heat to support the Vital Functions, p. 22.

animal either by the application of common heat, or that of incubation from the hen. The celebrated Sanctorius affirms, that the insensible perspiration alone discharges more than all the sensible evacuations together; and that the proportion of this to all the other evacuations, is as 5 to 3: though this proportion varies in different ages, climates, and constitutions, yet is it of such importance in all, that where it is in any considerable degree deficient, a diseased state of the body must ensue. The matter of *insensible perspiration*, or, in other words, the subtle vapour that is continually exhaling from the surface of the body, is not secreted by any particular glands, but seems to be derived wholly from the extremities of minute arteries, that do not terminate in veins, and are every where dispersed on the surface. These *exhaling vessels* are easily demonstrated in the dead subject, by forcing water into the arteries; for then small drops exude from all parts of the skin, and raise up the cuticle, the pores of which are closed by death; and in the living subject a looking-glass placed against the skin, is soon obscured by the vapour. When the perspiration is by any means increased, and several drops, that were insensible when separate, are united together, they form upon the skin those visible drops called *sweat*. This particularly happens after much exercise, or whatever occasions an increased determination of fluids to the surface of the body; a greater quantity of perspirable matter being in such cases carried

carried through the passages that are destined to convey it off*.

Now, the reason of the propriety of *fleecy hosiery* in *summer* is, that though it promotes the perspiration, it equally favours its *evaporation*: and we know that *evaporation* produces *positive cold*, the *aqueous discharge* being the means designed by nature for carrying off the superabundant heat †, whether arising from climate, exercise, or fever.

IN CHILDREN, where the food is continually combining with oxygen, and the fibres are irritable, it is of the utmost consequence to keep the body temperate, but never to suffer it to get *chilled*. Thus, without being enervated, they may escape the bad consequences arising from the sudden changes in this inconstant climate; for it is not true, that cold hardens *children* as it hardens *steel*. If delicate children are subject to diseases and danger in England, to which they would not be subject in the warmer climate of Italy, is it not evident that *the difference* between the climate of England and Italy is the cause of these diseases and dangers? I firmly believe, says Dr. Beddoes, that the greatest mortality is among those children who are hardily

* We shall treat more at large on *Perspiration*, Sect. VI. page 54.

† Vide Sect. IV. p. 27. "on the Means NATURE employs to rid herself of too much internal Heat." When dogs are exercised, who do not perspire, they carry off the superabundant heat by the *kidneys*, as well as by the *tongue*.

brought up. Nearly one third of the poor, born in this island, sink into the tomb, as soon almost as they have caught a few glimpses of the light of heaven. And even when they have weathered out the early inclemencies of their station, unless they afterwards wear warm and comfortable clothing*, they enjoy no such advantage of freedom from *pulmonic complaints* as we are taught to imagine. Among the peasantry of *Warwickshire* and *Staffordshire*, I am creditably told, says Dr. Beddoes, that *consumptions* are not less frequent, than among the better order of people who are more delicately bred up.

FAT PEOPLE need a less warm raiment than those that are lean; for oil, as being a bad conductor of heat, acts as a fleecy hosiery waistcoat, reflecting back the vital warmth. Here we cannot but admire the benevolent care of PROVIDENCE to the lower order of animals, by giving the whale, the bear, and other animals who inhabit the colder climates, a deep covering of fat.

OLD PEOPLE, as requiring *abundant excitement*, ought more especially to be warm clad, and rather to exceed, than to be deficient in the quantity of their clothing, and to wear that which affords them the greatest warmth with the least possible weight. They will not then be liable to be injured by sitting all day in the chimney corner, breathing an un-

* No people are better clothed than the *farmers* in this island, who usually enjoy *ruic health*.

wholesome air, and in a current of wind. A person sufficiently clothed with the *fleecy bosomy* next his skin may wear any slight substance for ornament above it, and will, I am certain, feel more comfortable even at some distance from the fire, than when he was scorching on one side, and felt half frozen on the other.

SECT. VI.

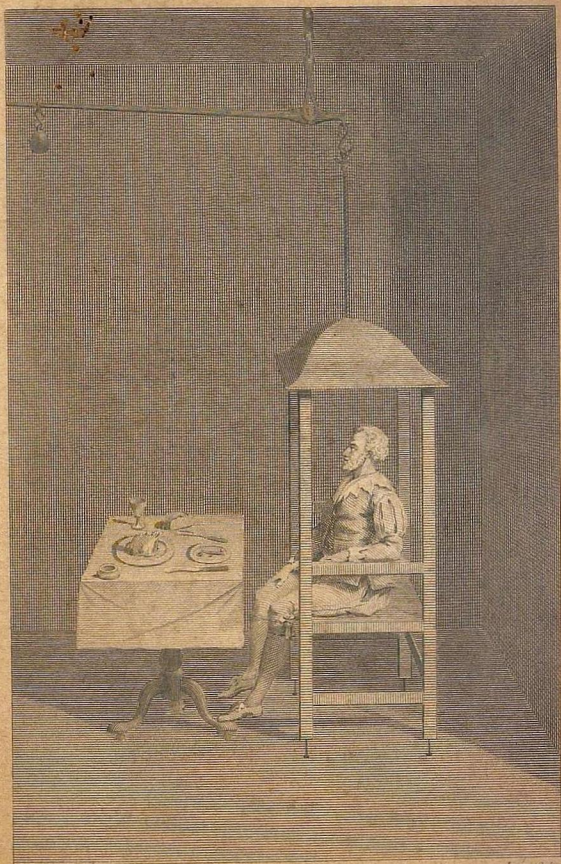
ON PERSPIRATION.

Now all over the surface of the body, both where there is true cutis under the cuticula, and where there is not, there is a perpetual exhalation, and a waste or dispendium of the liquids in the body, flying off in a subtile vapour.

This exhalation, or perspiration, is called *Sanctorian*, from Sanctorius, a celebrated Italian physician, who flourished in the beginning of the last century; not that he was the full discoverer thereof, but because he was the first who applied himself to the thorough examination of its quantity by statical experiments; and its proportion to the sensible evacuations; and to find out what causes either promote or obstruct it; and what are the consequences, good or bad, of its increase or diminution.

Common sense could not but teach the bulk of mankind that the body perspired. The fouling of clothes without sweat; the fudding of any polished piece of metal or glass by the touch, must have been early demonstrations of it.

That there is a perpetual insensible exhalation from the surface of the body, appears evidently from a variety of phænomena. Hold a polished, dry, clean, rubbed piece of metal, close (without touching)



Lowry, sculp.

Sanctories in his balance.

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ing) to any bare part of the body, though not sweating, in warm weather, and it will be quickly fullied. Wipe it clean and dry, and hold it again to the part, and the same effect will be constantly renewed.

Fill a clear drinking glass full of cold water (if sal armoniac is dissolved in it, the experiment will be the more conspicuous, and satisfactory, because it makes the water colder), and hold it near the bare skin, without touching it, and its outer surface will be dimmed, by the vapour exhaling from the skin being condensed by the coldness of the exterior surface of the glass. If you put your naked arm into a wide-mouthed chemical glass vessel, very dry, you will soon see the internal surface of the glass dimmed with the exhalation from the limb. And if it be kept long enough within the glass, there will be seen streaks of moisture trickling down its sides.

And to mention only another experiment, if a person weighs himself when going to bed, and again when he rises next morning, he will often find himself considerably lighter, though he has made no sensible evacuation in that time, either by urine, stool, or sweat.

From all which it is plain, that the body perspires insensibly.

Let us now inquire whence this matter of perspiration comes; and how the evacuation is made.

The cutis vera, as we have said, is supplied with blood vessels, both arteries and veins. Warm water

injected into an artery, suppose the axillary artery, reaches to the external surface of the skin; and being stopped by the epidermis, whose pores are shut after death, raises it into little vesicles.

This experiment, compared with the circulation in living bodies, shews that the matter of perspiration is brought by minute arterial tubes to the surface of the skin; and flies off by pores in the epidermis; though these pores are so extremely small as not to be seen by the help of the greatest magnifiers.

The experiment before mentioned, of the naked arm kept in the chemical glass vessel, shews that water is its basis. But this water is more or less impregnated with animal principles, rendered volatile by the action of the animal heat—This evidently appears by hounds tracing animals and even their masters at a great distance by the scent.

Those parts of the body which have no cutis, and are exposed to the air, are always moist; and if ever so well dried, quickly become humid again; therefore their perspiration is performed by the small arteries continually pouring out their liquids upon them, which the ambient air constantly licks up, and would soon dry them quite, if there were not a perpetual supply of the same moisture.

Insensible perspiration differs in quantity and proportion to the other evacuations, according to the different circumstances of the individual, in point
of

of climate, diet, and manner of living, age, sex, and temperament.

It likewise varies in the same person in different seasons of the year, in different parts of the same day, and at different spaces of time after meals; and is different in sleep and watching.

And it is affected by exercise or rest; health or sickness; and by the passions.

In general, a warm climate, brisk exercise, if not immoderate, and beyond the strength, youth, health, and vigour, animal diet, promote and increase it.

And the contrary circumstances tend to diminish or obstruct it.

Men perspire insensibly in a general way more than women; which is owing to the greater vigour of their circulation.

And the young perspire more than the old, because the circulation in the former is brisker; the vessels are more yielding and permeable.

We perspire most after a full meal, when the digestion in the primæ viæ is nearly completed, and the blood is most turgid with new chyle, which is now attenuated enough to let its aqueous and volatile parts fly off. Immediately after eating, while the stomach is labouring in the work of concoction, we perspire less than before; but in an hour or two we begin to perspire plentifully; and continue so to do for some hours, till the vessels begin to be empty and the pulse sinks.

We

We perspire more in the warm part of the day, than in the mornings and evenings. Our pulse is raised by the increased heat of the atmosphere, and our bodies heated of course. Heat increased promotes evaporation; and by the pulse being raised, a greater quantity of perspirable matter is brought to the exhaling vessels of the skin, in a given time.

It hath been much disputed whether we perspire most sleeping or awake. Sanctorius, by his experiments, makes perspiration greatest in sleep: Keill, in his *Medicina Statica Britannica*, makes it constantly least. The truth of both the facts, as they observed them, is not to be called in question; but how are they to be reconciled?

The Italians, as well as the French, make supper their principal meal: but the English make their dinner their chief meal. Now, as we observed before, perspiration begins to be increased some little time after the stomach is filled; and continues to be plentiful till the vessels become empty: so that, with Sanctorius, the time of the greatest perspiration from eating, coincided with the middle of the time of sleep; whereas with Keill, who often mentions his going to bed supperless, and commonly sat up late, that time of the greatest perspiration arising from eating was over before his bed-time. We are likewise here to take in absorption, of which we shall say more by and by; which, *cæteris paribus*, is greatest when the air is moistest, and when the vessels are emptiest; and therefore no doubt is

greater in England than in Italy; and is greater in the night than in the day-time; and greater in one who goes to bed with an empty, than with a full stomach.

You may perhaps be curious to know in what manner Sanctorius made his static experiments. He had a chair hanging by a short beam, near the centre of motion; the beam was continued to a sufficient length, marked at certain distances, in the same manner as stilliards are, by which means a small weight, at a great distance from the center of motion, might be in *æquilibrium* with, or outweigh the chair, and himself sitting in it. He knew the weight of his chair, and of his clothes; having weighed himself immediately before, and immediately after eating, he of course found the weight of all the *assumpta*. And weighing himself immediately before he had any evacuation, he knew their weight, without the uncleanly drudgery of weighing them. By weighing himself at different times, when he had neither eat nor drank, and had been without any sensible evacuation during the intervals of weighing, he found the quantity of perspiration produced in these intervals.

Sanctorius makes insensible perspiration equal to five eight parts of the whole *assumpta*.

Keill finds it, at a medium, rather under one half of the *assumpta*.

Dodart and Gorter, the latter living in Holland, the former in or near Paris, make it somewhat larger

ger than Keill; but nearer the proportion he gives, than that of Sanctorius.

The use of insensible perspiration in the animal œconomy seems to be first to give vent to the oily and saline parts of the blood and humours; which, after having undergone the effects of repeated circulation, if retained, would in time become too acrimonious, volatile, and exalted, to be consistent with that mild balsamic nature in the juices, which is necessary to keep up health, and durable life. And secondly, as these are expelled, intimately mixed with and dissolved in an aqueous vehicle, highly attenuated, and in the form of vapour, the steam, while it passes, must of course moisten and lubricate the corpus reticulare and epidermis; and likewise the nervous papillæ, preserving the latter in a fit state for sensation.

Sweat may be reckoned and termed sensible perspiration. It arises from the same emissaries that perspiration comes from, there being no good reason to think the outlets of these two discharges to be different. Sweat is produced when the small exhaling arteries, which naturally carry off the matter of insensible perspiration, are so dilated as to let pass a sensible fluid.

While perspiration continues plentiful, and at the same time the body feels light and active, good health is prognosticated, because in this state the humours must be sufficiently attenuated, to part with so many subtle and volatile parts; and all the vessels,

sels, from the largest to those that carry off the perspirable matter, which are among the smallest of all in the animal body, must continue tight and permeable; and consequently concoction, circulation, and the various secretions must be duly carried on. But no doubt perspiration may be too great, and weaken, by an over dissipation of our finest fluids. Obstructed perspiration, by penning up the oils and salts of the blood and juices, after they are become acrid by the action of the animal machine, is very probably a frequent cause of irritation. But Keill's tables shew, that in our climate health doth not so critically depend upon the regularity of perspiration, as one, by reading Sanctorius, would be apt to believe; and that the latter may be often very much diminished, without any remarkable bad consequence. If things were otherwise, how could such a variety of business be carried on in our climate by travellers, all the hours of day and night, by land and by water, in all kinds of weather, which so much influences perspiration, and is so variable and inconstant, as not seldom to be violent in extremes within the compass of a few days, and sometimes hours? We are so made, that, while the body is in health, and vigorous, the defect of one evacuation is made up by the increase of another, and things set right. Upon the whole, I am apt to believe, that too much is imputed to obstructed perspiration, in daily practice; and that the assigning of that cause is often the refuge of ignorance.

SECT.

SECT. VII.

ON THE QUANTITY PERSPIRED.

SANCTORIUS deserves great commendation for the prodigious pains he took in so nicely and minutely observing, for so long a space of time, the different changes of the quantity of perspiration upon different occasions.

But is it not amazing, that in thirty years space, he should never once have thought on inhalation, or resorption from without? If inhalation, or resorption, is not considered, it is plain, that only the apparent, not the real quantity of perspiration can be found by statical experiments. If, for example, the body, after ten hours, is found lighter than it was by ten ounces, without any sensible discharge, it doth not follow, that just ten ounces, and no more, are exhaled during that space, because two or three ounces might have been gained in the same time by the way of resorption; in which case, the real quantity of perspiration is not ten, but twelve or thirteen ounces, so that weighing the body shews only the excess of the latter above the former, as Dr. Arbuthnot hath, and I believe the first, distinctly and explicitly taught.

A lad, at Newmarket, having been almost starved in order that he might be reduced to a proper

proper weight for riding a match, was weighed at nine o'clock in the morning, and again at ten o'clock, and he was found to have gained near 30 *ounces* in the course of an hour, though he had only drank *half a glass* of wine in the interval*. A gentleman in the city was lately weighed before dinner, and was highly offended to find from his weight, not long after dinner, that he must have eat, unless some deceit was played on him, above *two pounds* of beef-steaks, so much had he increased in weight.

In the year 1779, Dr. Ingenhoufz discovered that the animal body threw out azotic, and fixed, airs. In the very same year, Mr. Cruikshanks, the celebrated author of a work on the absorbent system, and Lecturer on Anatomy in London, published a similar discovery; and in justice to both characters, I must observe, as I heard from Dr. Ingenhoufz, that their respective works were in the press at the same time. This however is not the only instance of two persons, ignorant of each others pursuits, happening to hit upon the same thing. Nothing was more simple than the experiment of these philosophers; the hand was immersed under quicksilver and the bubbles of air collected, and it was discovered, that the discharge from the surface of the body was,

1. Two parts *fixed air*.
2. One part *azotic air*.
3. A quantity of *aqueous fluid*, which contained the different salts of the body.

* From Dr. Watson's Chemical Essays.

To these discoveries, confirmed by Mr. Abernethy, Lecturer on Anatomy at Bartholomew's Hospital, was added an important fact, that the absorbents had the power of separating the oxygen air from the azotic, that is, of decomposing our atmosphere, as also of absorbing fixed and other airs.

EXPERIMENT I.

Thermometer between 50° and 60°.

I filled and inverted, says Mr. Abernethy, a jar in quicksilver, and threw up into it one measure of atmospheric air, which could contain seven ounces of water. The quicksilver was depressed two inches and a half from the top of the jar. After moving my hand ten minutes beneath the surface of the quicksilver, to detach any common air which might adhere to it, I put it up into the air in the jar, and there retained it for the space of an hour. Before I withdrew my hand, I depressed it beneath the surface of the quicksilver, still keeping it within the glass, and agitated it in this situation, for ten minutes; this was done that I might not remove any of the air, which was the subject of the experiment. The same conduct was pursued in all the subsequent experiments. After five hours exposure of the hand to this air, the quantity in the glass was *diminished about half an ounce*. It might have been expected that the *perspiration* would have increased the

the bulk of the air, but in this experiment, the *absorption* seemed to surpass in quantity the secretion.

I now threw up into the jar lime water, by which nearly an ounce of air was rapidly absorbed, and the lime was precipitated; the remaining air being examined by the addition of nitrous gas, was found to contain nearly one-sixth less of oxygen gas, than it did before the experiment.

In another similar experiment, after the hand had continued nine hours in the air, I found more than one ounce measure of carbonic gas, or fixed air, had been produced, and the remaining air being examined by the eudiometer, contained one-fourth less of oxygen than before the experiment.

It might, perhaps, here be inquired, does the oxygenous gas of the atmosphere contribute to the formation of the carbonic gas?—Both reason and experiment reply that it does not, for if oxygenous gas combined with carbon on the surface of the skin, much heat should be produced at the time of their combination; but this production of heat is not found to take place. Experiments also shew that carbonic gas is perspired from the vessels, for into whatever air the hand be immersed, the quantity of carbonic gas given out will be nearly the same. This is a point which I have determined by careful experiment.

EXPER. II.

Having filled and inverted a jar in quicksilver, I put up into it a seven ounce measure of *azotic gas*. I pursued the plan related in the former experiment, to avoid adding to, or abstracting from, this air. After two hours exposure of the hand, on throwing up lime water a rapid and considerable diminution of air followed; so that rather more than an ounce of carbonic gas was produced, when no oxygen was present. The increase of the quantity of carbonic gas is accounted for in this experiment, by the heat of the atmosphere being greater, which disposed the skin to more copious perspiration.

I made similar experiments with the *hydrogenous* and *nitrous gases*; in these an equal quantity of carbonic gas was produced; and when the hand was surrounded by oxygen, the quantity of carbonic gas was not much greater.

EXPER. III.

Thermometer about 50°.

I next wished to discover what effect the action of the hand would produce on carbonic gas.

Into a glass jar filled with, and inverted in quicksilver, I introduced six ounces of *carbonic gas*, and exposed my hand to it, for the space of nine hours,

in .

in the manner, and with the precautions, before related. In that time the air was reduced in quantity to less than three ounces. A portion of the carbonic gas was examined, by the addition of lime water, before the experiment, when it was almost wholly absorbed; an unexaminable bubble only remained. When the remaining gas was examined by lime water, after the experiment, a considerable quantity of *azotic* gas, which doubtless exhaled from the hand, was found mixed with it.

I twice repeated this experiment, with similar events, though with rather less diminution in the quantity of carbonic gas: it was however sufficiently evident, that the absorption of this gas, by the skin, was very copious and rapid.

• EXPER. IV.

Thermometer 80°.

The absorption of carbonic gas makes it difficult to ascertain precisely the quantity perspired, since that gas which is thrown out from the body by secretion, will probably be readmitted by absorption. I therefore wished to discover the quantity of carbonic gas perspired in one hour.

The hand being retained one hour in five ounces of nitrous gas, no ascent nor depression of the quicksilver was remarked. On the introduction of lime water into the glass, *six drams* of carbonic gas were absorbed.

In a similar experiment with atmospheric air, after the expiration of an hour, the quicksilver had rather risen, and *three drams* of carbonic gas were discovered by lime water. In another experiment, in which hydrogenous gas was employed, *four drams* of carbonic gas were found at the termination of an hour.

All the last related experiments were performed in very hot weather. If two drams of carbonic gas were emitted in an hour, as the quantity usually obtained in five hours was but one ounce, it would be a sufficient demonstration of the absorption of a part of the air perspired. Neither are these experiments conclusive as to the precise quantity of air emitted, for even in an hour part of that which is exhaled will be again imbibed. When I first attempted the experiments with carbonic gas, I supposed that the absorbents would receive it reluctantly, for I thought that matter which was thrown out from the skin in such quantities, could neither be requisite, nor salutary to the body. The experiment proved that I was mistaken, and there are reasons which tend to shew the salubrity of this gas. When it is admitted into the stomach, it is generally found beneficial. When employed as a local application, its stimulus is useful, and when in combination with the blood, it probably produces equally serviceable effects.

EXPER. V.

Thermometer between 60° and 70°.

The experiments that have been related, indistinctly shew, that a small quantity of one kind of air, when mixed with a larger proportion of another, can be abstracted from it by the action of the animal body. This circumstance will be hereafter fully proved. I will now relate an experiment that was made in support of this opinion, as it was performed beneath quicksilver, and in the same manner with those which immediately precede it.

Into a jar filled with, and inverted over quicksilver, three measures of *azotic* gas and three of *carbonic* were introduced; the two airs depressed the quicksilver two inches and a half, and occupied the space of seven ounces of water. After five hours exposure of the hand, the air contained in the jar filled the space of only five ounces and a half of water; on putting up lime water to this air, it was diminished to three ounces. In this experiment one ounce and a half of carbonic gas appears to have been removed, and half an ounce of azot; but if you admit that one ounce of carbonic gas was perspired during this experiment, and one third of an ounce of azotic, the quantity of air estimated to be absorbed is increased, but the proportions remain unaltered.

EXPER. VI.

Thermometer 60°.

In the experiments with common air I have mentioned, that it contained less oxygen after it had undergone the operation of the hand, than before it became the subject of experiment. A question here occurs, does this variation proportionably arise from the addition of the one gas, or the removal of the other? That it is owing to absorption, will, I believe, be evident, from the following experiments. Although the addition made to any kind of air, cannot be accurately ascertained when water is employed, yet if the hand removes any portion of air, that removal will be ascertained by examination, neither does the experiment appear liable to deception. In the experiments next related the air was confined by water; this gave me an opportunity of using larger vessels, and exposing a greater extent of surface of the skin to the contact of the air. I forbore particularly to remark the quantity of air absorbed in the foregoing experiments, for though it corresponded to those which I shall next relate, yet the correspondence was not uniform, and the degree of absorption was less evident.

I filled and inverted a jar in water, and put up into it twenty-four ounces, by measure, of *atmospheric*
air;

air; to this the hand was exposed for twelve hours, the same precautions being used to avoid adding to, or taking from the air contained in the jar. The water had risen in the vessel, and about two ounces and a half of the air were removed; that which remained was examined by the eudiometer, when two measures of it, and one of nitrous gas, filled the space of nearly two measures, and one third of another; it therefore follows, that about one half of the usual quantity of oxygenous gas was removed from the other part of the atmosphere. That there could be no addition of nitrogenous gas capable of so greatly altering the proportions of these gases, must, I think, be too evident to need argument for its proof. Similar experiments were afterwards made with correspondent events. In the experiments made under quicksilver, the abstraction of oxygen was equally evident, and considerable; it therefore appears, that the animal body is capable of taking away the oxygen, when in intimate mixture, with a much greater quantity of azot. The avidity with which oxygen is absorbed, will be made still more conspicuously evident by the following comparative experiment.

EXPER. VII.

I filled and inverted two jars in water, into one I put twenty-four ounces by measure of *azotic* gas, into the other the like quantity of *oxygen*. The

hand was put into these airs alternately, and retained there for an hour each time : after it had been exposed to each for eight hours, the water rose one-eighth of an inch in the bottle containing the azotic gas, and nearly a whole inch in that containing the *oxygen*. On estimating the quantity removed, by weighing the water which filled the bottles to the different marks, it appeared that *one twentieth* part only of the *azotic gas* was removed, but *one-third* of the *oxygenous gas* was gone. The remaining oxygenous gas was found to contain one eighth more of azotic gas than before the experiment. I next examined the degree of celerity with which other gases would be imbibed.

EXPER. VIII.

Having filled and inverted a jar in water, and put into it thirteen ounces of *nitrous gas*, I retained my hand in this air, at different times, five hours, in which time three ounces were absorbed. My hand being retained for as many hours in a like quantity of *hydrogen gas*, not more than one ounce and a half was removed.

The removal of a quantity of *oxygen gas* from common air, is surely a curious circumstance ; if this be the effect of an action in the absorbing vessels, it must much exalt our ideas of their subtilty, and their aptitude, or disposition, to admit one species of matter, and to reject another. That the
 3 abstraction

abstraction of one air, in preference to another, depends: upon this cause, I believe will not, on reflection, be doubted; it might indeed be suspected, that oxygenous gas was separated from the atmosphere by the skin, as it is in the lungs by chemical attraction: but it has been proved that *carbonic* gas is removed with equal celerity; and experiments on animal substances shew in them a disposition rather to part with than to imbibe carbonic gas. The removal of this air is therefore not likely to be the effect of chemical affinity. The different degrees of celerity with which other gases are admitted, seem to establish the opinion, that the removal of one kind of air in preference to another is the effect of an active *selecting power* in the absorbing vessels.

The experiments which have been related satisfactorily prove the quality of the aeriform perspiration; perhaps the proportions may occasionally vary, but, as nearly as I can determine, it consists of rather more than *two parts* of *carbonic*, with the remainder of *azotic* gas. The quantity of the matter perspired is with less certainty ascertained; in one hour I obtained *four drams of carbonic gas*: but it should be remembered, that these experiments were made in very hot weather; and it also deserves notice, that the quantity of the cutaneous perspiration is subject to great variety. In every experiment *absorption* was found to be equal to *perspiration*, in many it was much more copious; especially when the air to which the skin was exposed was salutary to the constitution.

stitution. The *oxygenous* and *carbonic* gases are very readily imbibed; whilst the *nitrous*, *hydrogenous*, and *azotic* gases, tardily gain admittance into the absorbing vessels. In Experiment V. from about half of the surface of the hand two ounces and a half of carbonic gas were absorbed in five hours; in other Experiments, from the hand and wrist there was imbibed,

In eight hours	8 ounces of oxygenous gas.
In five hours	3 do. - nitrous gas
In five hours	$1\frac{1}{2}$ do. - hydrogenous gas.
In eight hours	1 do. - azotic gas.

EXPER. IX.

Thermometer 65°.

I next endeavoured to ascertain the quantity and quality of aqueous perspiration.

I introduced my hand and fore-arm into a glass jar, covered with bladder; an aperture was left in the bladder, to admit my arm, round which the bladder was tied; so that the ascent of any vapour was prevented. In six hours I procured nearly *three drams* of limpid tasteless water. The quantity collected corresponds with the result of Mr. Cruikshank's experiments, who obtained the water of perspiration in the same manner. Half of this liquid was evaporated by a gentle heat; there remained a small residue on the glass, which had a very slight taste

taste of *salt*. The other half was suffered to stand many days, in which time no change appeared: it did not then alter the colour of the vegetable blue. Into one portion of this watery liquor marine acid was dropped, which caused no coagulation, or precipitation of animal matter: into the other some caustic alkali was poured, which produced no visible effect. I therefore conclude that the water of perspiration, in a state of health, contains little, or any thing, except a very small portion of salt.

Perspiration is generally said to be sensible, or insensible; perhaps it may be better distinguished as *aeriform*, or *watery*. It may be expected, that a general estimate of the quantity of this secretion should be attempted; but the difficulties which oppose any accuracy of statement are considerable. In these experiments the process was not continued under its usual circumstances; the arm was surrounded by water, or quicksilver; and when in the latter fluid, the circulation was in some degree interrupted by its ascension, and pressure against the edge of the jar.—For the uncertainty which these circumstances occasion, allowance must be made, but before an estimate of the quantity of perspiration be attempted, the extent of the surface of the body should be known. Mr. Cruikshank supposes the extent of the hand to be to that of the body as one to sixty: it is much more, according to my computation.

After ineffectually endeavouring in different ways
to

to measure the surface of the body, I concluded that I should approach nearest to its true extent by measuring the circumference of the trunk and limbs at different parts, and having thus obtained the mean circumference, I could then calculate the extent of their surface, as if they were cylinders, the dimensions of which were ascertained. The surface of the head, hand, and foot, I computed, by applying paper, cut as the occasion required, over these parts: afterwards placing the separate pieces of paper so as to form an extended plane, I measured its extent. I shall mention these measurements, that the reader may correct them if he should think them in the least erroneous. If a man be five feet six inches high, I will suppose the mean circumference of the trunk of his body to be thirty-three inches, and its length, from the top of the sternum to about the hip, twenty-two inches.

Square Inches.

The extent of surface of the trunk will there-	
fore be - - - - -	726
The circumference of the neck 13 inches, its	
length from the sternum to the chin 3 inches	39
The surface of the head, and back of the neck	286
The mean circumference of the arm 10 inches,	
its length 12. Surface of both arms - -	240
The mean circumference of the fore-arm 8	
inches, its length 10. Surface of both	
fore-arms - - - - -	160
The	

The surface of the hands and wrists measuring to the extremities of the bones of the fore-arm	140
The mean circumference of the thigh 17 inches, its length 16. Surface of both thighs	544
The mean circumference of the leg 11 inches, its length 14. Surface of both legs - -	308
Surface of both feet - - - - -	182
Allow for folds of the skin, inequalities of the surface, &c. - - - - -	175

The extent of the surface of the body will be 2700

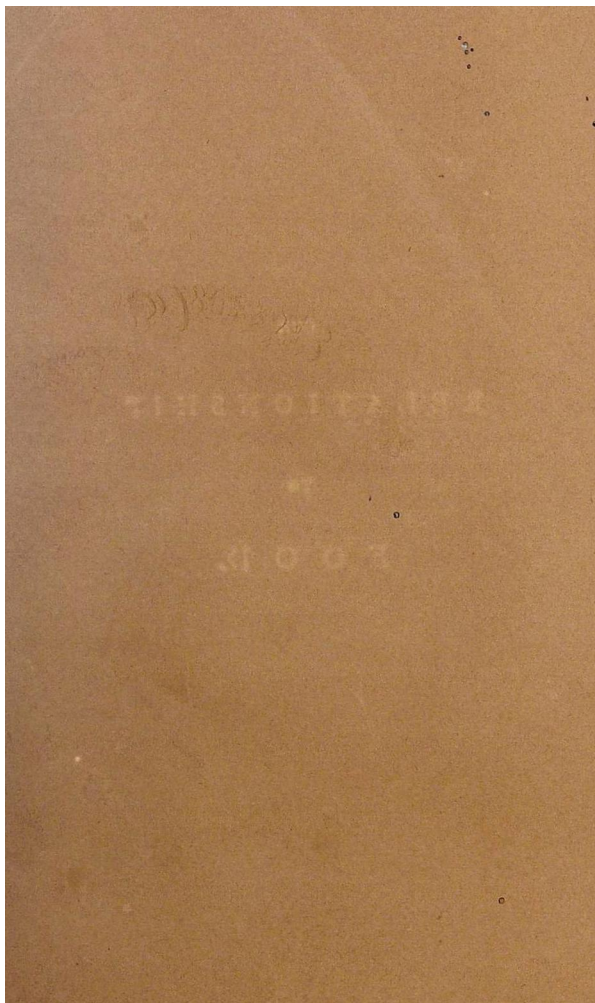
The superficial extent of the hand and wrist, according to this calculation, is to that of the body as one to about thirty-eight and a half.

In Experiment IV. the least quantity of *carbonic gas* emitted from the hand, in one hour, was three drams by measure; it may be supposed that the heat of the weather increased the secretion from the skin, let us therefore consider two drams as the ordinary quantity. If then the perspiration of all parts were equal, *seventy-seven dram measures* of *carbonic gas* and *one third* of that quantity of *azotic gas*, would be emitted from the body in the space of *one hour*. If we also suppose perspiration to be at all times equal, nearly *three gallons of air* would be thrown out from the body in the course of *one day*.—Although the quantity of air perspired is so large, yet the weight of the body will not be much altered by its loss; it is the *aqueous perspiration* by which this will be principally diminished. When the thermometer was between 60° and 70°, I obtained about *thirty*

grains of fluid from my hand and part of the fore-arm in an hour; the surface from which this secretion was made I compute to be one twenty-fifth part of the extent of the body. The supposition being allowed, that perspiration is at all times, and in every part, equal, about *two pounds and a half* is the loss of *water* which the body would in one hot day sustain. In most of the experiments which I have made, the *absorption* of air was equal to the *perspiration*; in many, it was much greater, especially if the air was salubrious to which the skin was exposed. Experiment VI. makes it appear probable, that if the *naked body* was exposed to fresh currents of the atmosphere, that only the *oxygenous* part would be absorbed; the decomposition of which, in the body, would produce an increase of animal heat; which might, in some degree, make up the loss sustained by the exposure. Our *clothing* probably prevents, very much, this effect, and perhaps makes it less necessary. If the perspired *carbonic gas* be confined by our garments, it seems likely that it will be taken up again by the absorbents. Whether the body does usually imbibe *water* from the atmosphere, adequate to the loss sustained by aqueous perspiration, is uncertain. But I am inclined to suppose, that the absorption of *air* from the skin is nearly equal to the secretion*.

* The Reader is requested to turn to page 126, Sect. XII. ON CLEANLINESS, which should have followed, but has somehow, or other, got misplaced.

OUR
RELATIONSHIP
TO
FOOD.



S E C T. VIII.

ON FOOD.

AT first, the food taken into the stomach retaining its peculiar properties, *irritates* the inner coat of that organ, and occasions a contraction of its two orifices. The food, thus confined, then undergoes a constant agitation by means of the abdominal muscles, and of the diaphragm, and by the motion of the fibres of the stomach itself. By these movements, every part of the food is exposed to the action of a fluid secreted in the stomach, called *the gastric juice*, which (as water dissolves sugar) gradually dissolves and attenuates the food (as presently will be proved*), and prepares it for its passage into, and farther change in, the intestines.

The painful sensation of *hunger*, which is the irritation of the gastric juice on the inner coat of the stomach, or the sensation of a defective supply of chyle in the arterial system†, being removed by the
food

* Vide the next Section.

† Nothing better illustrates this, than what happened to Admiral Byron, Captains Cheat and Hamilton, when shipwrecked on the west coast of South America; who, after suffering months of hunger and fatigue, were reduced to skin and bone. A table, says Byron, was spread out for us by the

food, we soon feel a mild and undescribable delight, first from the stimulus of the aliment ; and secondly, from the distention of this, and the increased action of other parts.

If it should seem strange that *pleasure* arises from *the stimulus* of food on the sentient nerves of this important organ, let us recollect only the effect of a moderate dose of *opium* to those unaccustomed to *that stimulus*. They are commonly so transported with the pleasing sensation it induces, that they feel, as they oftentimes express themselves, as though they were in heaven, and enjoy so perfect a pleasure, that no happiness in the world can surpass the charms of this agreeable ecstasy. On the other hand, what a terrible agony will two or three grains of *crocus metallorum* throw the whole fabric into ? this part being of so acute a feeling, that some philosophers have for this reason thought it to be the seat of the soul itself.

Besides this consideration, we must here take notice, that the stomach, being distended with food, presses on *the spleen**, and thereby occasions a greater

Indians, with cold ham and fowls, which only we *three* sat down to, and in a short time we dispatched more than *ten* men with common appetites would have done, and yet we complained of being *unsatisfied*. For a long while we got up two or three times in the night to cram ourselves. Captain Cheat used to declare, that he was quite ashamed of himself.

* The true office of the SPLEEN was *the happy discovery* of the ingenious Dr. Haighton, Lecturer on Physiology to the Pupils

greater quantity of blood to pass into the *pancreas*, and consequently a greater increase of the secretion from that viscus;—and by obstructing in some degree the passage of blood in the descending trunk of the *aorta*, causes an increased flux of blood to the *head*, and hence, after a full meal, inactivity and drowsiness* and sometimes apoplexy† ensue; and hence also proceed those flushings or redness in the face, so conspicuous in weak and exhausted persons, after eating.

We will now attempt to trace the food in its digested form, after it is thrown out from the stomach into *the intestines*.

The aliment having remained during two or more hours in the stomach, is converted, first, into a greyish pulp, which is usually called *chyme*. This chyme, or fluid, passes out of the *pylorus*, or right orifice of the stomach, the fibres of which relax to afford it a passage; while the grosser and less altered particles remain in *the living retort*, to adopt the expression of the reverend Mr. Townsend, till they acquire

Pupils of Guy's and St. Thomas's Hospitals. It did not escape the penetrating mind of the Reverend Mr. Townsend, and this coincidence of thought is a further proof of its truth. See *the Guide to Health*, page 33.

* Mr. Brindley, the famous canal engineer, mentioned to Dr. Darwin that he had more than once seen the experiment of a man extending himself across the large stone of a corn-mill, and that by gradually letting the stone whirl, the man fell fast asleep. Dr. DARWIN.

† See *the Guide to Health*.

a sufficient fluidity, to pass into the intestinal canal. As the digested food enters the *duodenum**, it stimulates the common duct of the *gall bladder* and the *liver*, and from a law in the animal œconomy, which has given the highest sensibility to the nerves at the mouths of the several ducts, which, by a sympathetic communication, occasions their several glands either to secrete or pour out a greater quantity of fluid, the *chyme* receives a full supply of *bile*, and of *saliva*, secreted from the *pancreas* †; it also intermingles with *mucus* from innumerable exhalent arteries, which still farther animalizes the chyme.

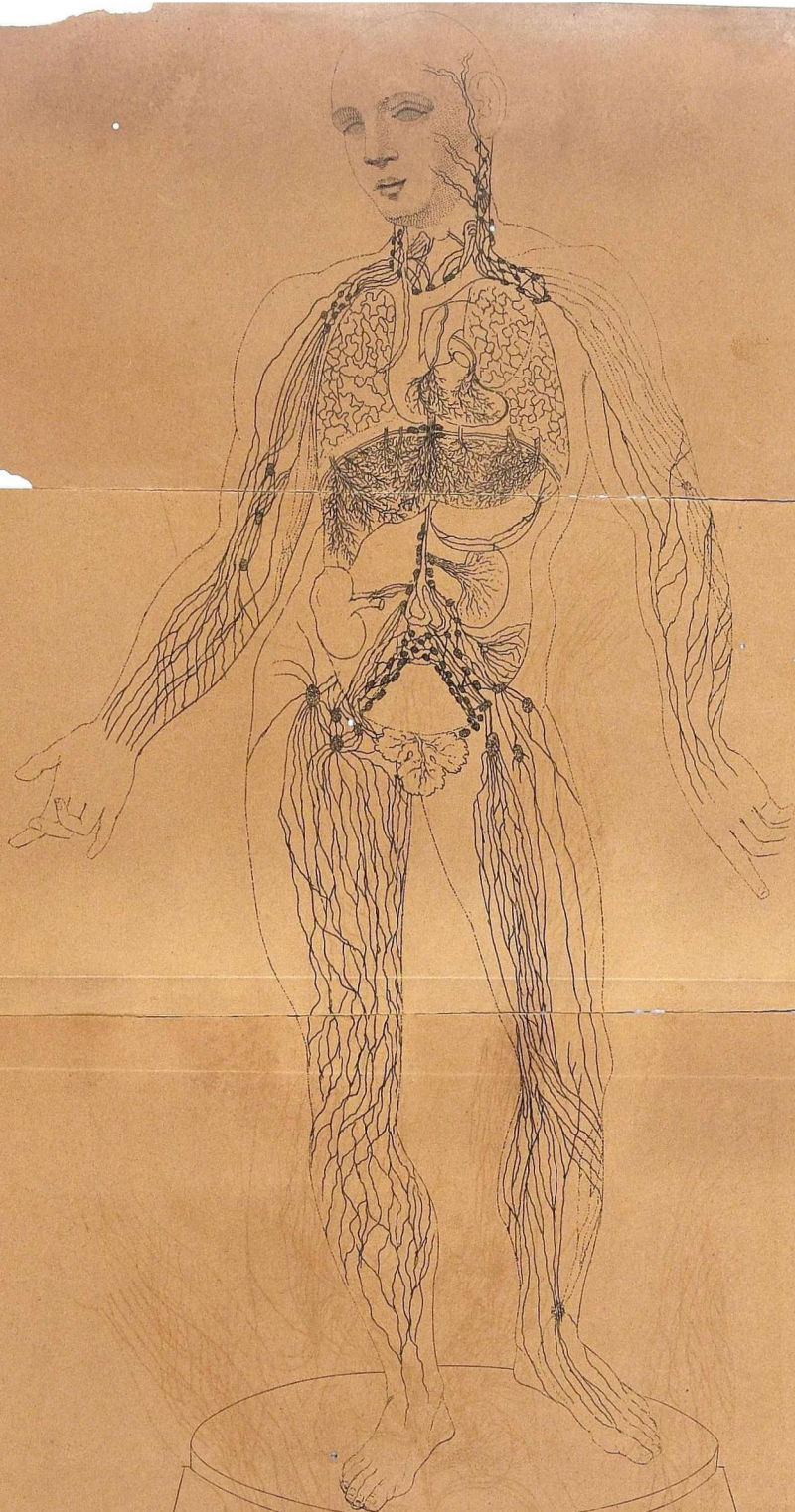
The *intestinal canal* is five or six times as long as the body, and forms many circumvolutions in the cavity of the abdomen, which it traverses from right to left, and again from left to right. The inner coat of the intestines, by being more capacious than their exterior tunics, occasions a multitude of *plaits*‡, at certain regular distances from each other, and

* Vide the Map of the Viscera.

† The *pancreas* is a large gland, which lies near the stomach, and discharges by a short duct, into the intestines, a liquor, which it separates from the blood. It is difficult to collect any quantity of this juice, because it is not lodged in any particular receptacle, but flows from the gland into the intestines, near the upper orifice of the stomach. However in dogs this has been executed by tying a bottle near the duct of the gland, while the animal was living, by which a quantity of the juice has been collected, and found in appearance to resemble the *saliva*.

‡ Called by anatomists *valvulae conniventes*.

these



THE ABSORBENT SYSTEM

From M. Cruikshank's admirable History of the Absorbents.

these become less and less, and at farther intervals as they descend. This disposition will be found to afford a still farther proof of that divine wisdom, which the anatomist and physiologist cannot fail to observe in all their pursuits; for if the intestinal canal was much shorter than it is; and if its inner surface was smooth and destitute of plaits; the aliment would consequently pass with great rapidity to its termination, and sufficient time would be wanting to assimilate the chyme, and for the necessary absorption of it by the numerous *villi*, or hair-like projections which terminate in *lacteals**: so that the body, unless constantly

* I think I have proved, says the illustrious Dr. Hunter, that the lymphatic vessels are the absorbing vessels, all over the body; that they are the same as the lacteals; and that these altogether, with the thoracic duct, constitute *one great and general system*, dispersed through the whole body for absorption; that this system *only* does absorb; that it serves to take up, and convey, whatever is *to make, or to be again mixed with the blood*, from the intestinal canal, from the skin, and from all the internal cavities and surfaces whatever. In our times, after schools of anatomy have long flourished in all the civilized nations of Europe, and when, from the number of men who have been employed in such researches, it might have been imagined that discoveries were exhausted, PROVIDENCE has allowed me a greater share of that sort of honour, than at first I could have expected. My discovery of the ABSORBENT SYSTEM gains credit daily, both at home and abroad, to such a degree, that I believe we may now say, that it is almost universally adopted: and, if we mistake not, in *a proper time*, it will be allowed to be the *greatest discovery*, both in *physiology* and in *pathology*, that anatomy has suggested, since the discovery of the circulation of the blood.

constantly replenished, would be deprived of the supply of nutrition, which is so essential to life and health :—but the length and circumvolutions of the intestines, the inequality of their internal surface, and the course of the aliment through them, all concur to perfect the separation of the chyle from the facæ, and to afford the necessary nourishment to the body.

Having ventured to throw out, continues Dr. Hunter, so bold a proposition, that my reputation may not suffer through want of a little reflection upon the subject, I must beg leave to explain my opinion. The discovery of a duct of a gland, an undescribed muscle, an artery, or a concealed vein, all such discoveries certainly are trifling, when compared with the introduction of a *new and general system*, which is interwoven with, and performs a peculiar and important function in every part of the body ; so *important*, indeed, that it was necessary, and accordingly has since actually been found out in brutes, likewise in birds, and in fish. *Such is the discovery* of the ABSORBENT SYSTEM : and every person, who is really an anatomist, or physiologist, will, upon a little reflection, admit what has been here advanced ; and, looking over the whole progress of anatomy, he will allow, that since the time of Aristotle to the present day, there have been only *two great discoveries* with regard to the physiology of our bodies ; to wit, the VASCULAR SYSTEM, and the ABSORBENT SYSTEM, the BRAIN and NERVOUS SYSTEM having been long before known. Vide Dr. Hunter's Second Lecture.

S E C T. IX.

OF THE GASTRIC SOLVENT,
AND
THE RELATIVE DIGESTIBILITY OF FOOD.

IN serpents, some birds, and several kinds of fish, which swallow whole animals, and retain them long in their stomach, *digestion* seems to be performed, says Chiselden, by *some unknown menstruum*; for we frequently find in their stomachs animals so totally digested, *before their form is destroyed*, that their very bones are made soft. One may indeed draw very plausible inferences concerning human digestion, from observation on other species of animals, especially from birds of prey, the cat and dog, which resemble us so much in the structure of the stomach. But analogical arguments are *probable* indeed, but not *conclusive*. And it is an object of much higher importance to attain *certainty* in man than in animals. In the writings of ancient and modern physicians no topic is more frequently discussed, yet there is little else beside *supposition*: direct experiments upon *man* are entirely wanting, and their researches are illuminated only by the *twilight* of conjecture, and supported by *precarious hypothesis*. Upon reflection, says Spallanzani, it appeared that direct experiments might be made on man, and for this purpose it was necessary to swallow tubes full of various vegetable

and animal substances, in order clearly to ascertain *the changes* they undergo in the stomach.³ I will candidly own, says he, that the experiment gave me at first some apprehension. The histories of indigestible substances occasioning troublesome symptoms, and being vomited up after a considerable time*, occurred to my imagination. I also recollected instances where such bodies had stopped in the alimentary canal.

Dr. Coe, in his Treatise on Biliary Concretions, gives an instance of a woman, from whose rectum was extracted a concretion, the nucleus of which was a *plum stone*. In the Edinburgh Medical Essays, we have an account of a similar fact. In the Essays and Observations, Physical and Literary, there is the history of a boy who had three stones extracted from the rectum, the nuclei of which were the small bones of *sheep's trotters*. In the Philosophical Transactions, we have an account of a concretion formed upon a *plum-stone*, and retained in the blind gut: and in the London Medical Journal, Mr. Johnson relates the case of a woman, who passed a ball of hardened fæces, weighing three quarters of an ounce, the nucleus of which was a *plum-stone*.

Other facts however, where the result was contrary, and of more frequent occurrence, gave me also some confidence. Thus we every day see the stones of cherries, medlars, plums, &c. swallowed

* Vide Baron Haller, T. 6.

and voided with impunity. This consideration at last determined me to make the trial with as great caution as possible.

I swallowed, in the morning fasting, a linen bag, containing 52 grains of *masticated bread*. I retained the purse 23 hours without experiencing the smallest inconvenience, and then voided it quite *empty*. The string used for sewing and tying it was entire, nor was there any rent in the bag itself. The fortunate result of this experiment gave me great encouragement to undertake others.

From *vegetable* I proceeded to *animal* substances. In a similar bag 60 grains of *boiled veal* were enclosed, previously masticated. The purse was voided in 18 hours and three quarters, and the flesh was *consumed*. Only a few fibres remained, and these were void of succulency, as if they had been set under a press.

My next experiments were made to see, whether digestion was accomplished or aided by a *trituration power* in the stomach.

Boerhaave, neither satisfied with the system of digestion in the human stomach by heat, as suggested by Galen, and adopted by his followers; nor yet better pleased with attributing this process to the vital energy of the soul residing in the stomach, as conceived by the fertile imagination of Van Helmont; invented a system of his own, in which he attributes the digestion of our food partly to *fermentation*, but principally to *trituration*, *pressure*, and
powerful

powerful quassation. He describes the folds of the stomach as grinding the more solid parts of the aliment; and, to assist in this process, he calls in the aid of its external coat, with the diaphragm, and the numerous muscles of the abdomen. Not satisfied with these, he takes into his account the violent pulsations of the subjacent aorta, with the vibrations of innumerable surrounding arteries, which he estimates at no less than three thousand six hundred pulsations in the hour.

This distinguished physician reasoned from analogy, and took particular notice of the *ostrich*, which he had observed to swallow pieces of iron and of glass, evidently for the purpose of triture, because the sound of *grinding* was perceptible to those who listened.

In the *granivorous birds* he had remarked, beside the crop, furnished with salivary glands to mollify their food, a gizzard, or second stomach, provided with strong muscles to *triturate* the grain; and the avidity with which they swallow gravel to assist the operation had not escaped his notice. Having examined the structure of the *lobster*, he saw at the mouth of the stomach a curious mechanism, *three teeth*, of which *one* moved by a strong muscle, *tritulates* the food against the other two.

In the larger *crawfish* of the sea, he might have noticed a structure somewhat different, where to answer the same intentions, instead of *three teeth*, we observe a *pestle* supplied with a strong muscle and placed between *two mortars*.

No wonder, then, that this great mechanic on the subject of digestion had mechanical ideas.

To prove that digestion in the human stomach is not performed by *trituration*, I was under the necessity, says Spallanzani, of swallowing thin tubes. These tubes were voided in about 22 hours. Among the tubes employed in these experiments I procured some to be made so *thin* that the slightest pressure would have crushed them to pieces, or have bent in their edges; but though I frequently used them, *not one was ever broken*, nor on examination could I perceive the *smallest fissure*.

Having thus established this fundamental proposition, viz. *that digestion is produced by the gastric fluid independently of trituration*, I had before me, says he, a fine field for experiments, which could not fail to suggest some important truths.

The necessity of mastication deserves to be well known. There is, perhaps, no person who has not some time or other been subject to indigestion for want of having chewed sufficiently his food. I took *two* pieces from a pigeon's heart, each weighing *forty-five* grains, and having *chewed one* as much as I used to chew my food, enclosed them in two spheres, and swallowed them at the same time. Both these tubes happened to be voided at the same time, and then I saw *how much digestion is promoted by mastication*. Of the *masticated flesh* there remained only *4* grains, whereas of the other there were *18* left. This was confirmed by two other experiments, one
made

made with *mutton*, the other with *veal*. The reason of this is obvious. Not to mention the *saliva* which moistens and attenuates the food, it cannot be doubted, that when it is reduced to pieces by the action of the teeth, the *gastric juice* meets it at all points, and therefore the more speedily dissolves it, just as other *menstrua* dissolve soonest those bodies that have been previously broken into fragments.

I now wished to make some experiments with the *gastric fluid out of the body*. A sufficient quantity could not be obtained by killing birds and other animals, and it became necessary to invent a contrivance for obtaining it from them alive. Three tubes containing *sponge* were therefore introduced into the stomach of a crow, and after four hours these were vomited up. The pieces of *sponge* being saturated with the fluids of that cavity, were then taken out and pressed between the fingers. These afforded 37 grains of *gastric liquor* of a transparent yellow colour, possessing a somewhat bitter and saltish taste.

I now attempted, says the Abbé, to produce *artificial digestion* with the *gastric juice* thus obtained.

It was January, and Fahrenheit's thermometer, placed near the vessel used for the experiment, stood at 42 and 43 degrees. For greater certainty in these experiments, I established a term of comparison, by employing similar vessels, containing the same flesh, infused in water. I also took care, upon the present occasion, that the flesh should be
completely

completely immersed in their respective liquors, and that the phials should be closed with stopples. *For seven days the flesh kept in the gastric juice, and in water continued the same.* On the eighth I perceived, says Spallanzani, a slight solution, for upon agitating both liquors, several particles separated from the larger mass, and fell down to the bottom of the phials. No further progress was afterwards made, and the gastric fluid did not seem at all more efficacious than common water; only the flesh immersed in the former *in a surprising manner was preserved from putrefaction.* In this experiment I had used beef; I verified the same observation upon the more tender flesh of calves, chickens, and pigeons; the temperature of air was about 48 degrees of Fahrenheit's thermometer.—While I was making these experiments in the natural temperature of the air, I was employed about others of a like nature in a warmer medium, viz. in a stove, in which the heat varied from 79 degrees to 80 of heat. *And now the effects produced by the gastric fluid, greatly differed from those produced by water*.* In the latter the flesh began to be a little dissolved in two days; this was the effect of incipient putrefaction from heat and moisture. The *fætid smell* continued to increase during the following day, and in a week became in-

* This shews how much digestion depends upon *animal heat*, and as this arises from the *oxygenation of the blood*, the relationships are concatenated. Vide Sect. X. on the *balance between digestion and the oxygenation of the blood.*

tolerable, when the flesh was reduced to a nauseous pulp. In the gastric juice the solution was more rapid, and exhibited very different phenomena; twenty-five hours were sufficient to decompose the flesh contained in it, and in a little more than two days there remained only a very small morsel entire. These solutions never emitted any bad smell; whence it is evident, that they did not arise from incipient putrefaction, like those in water, but from a more efficacious and a different menstruum, viz. the gastric liquor.

To Edinburgh there came by accident a hussar, a man of weak understanding, who gained a miserable livelihood by swallowing pebble-stones, and chewing flints*, for the amusement of the common people. The stomach of the *stone-eater*, as he chose to style himself, was so much distended, that he was able to swallow a great number of pebble-stones during the day; and these might be plainly felt, and be *chinked*, if you pressed forcibly with your hand below the short ribs on the left side.

Dr. Stevens tried many experiments similar to those above related, with this man, who swallowed

* His front teeth were *filed down*, and he had the art of splitting into pieces *flint stones*, by striking them with his fore-teeth in a particular direction, just as they fashion *flints* for guns. These pieces he would shew to his astonished visitants, put them under his tongue, and pretending to have swallowed them, he would then proceed actually to gulp down some *smooth pebble-stones*, which he took care to have by him on the table.

silver spheres, which were perforated so fine as hardly to admit a needle into each opening, and he always found the food that he inclosed in these bodies dissolved. He next turned his attention to the different degrees of *solubility*; or, as it was formerly called, to the *hard* or *easy digestion* of *different substances*, and the result of his experiments are equally curious as important.

Having procured a whelp five months old, it was kept fasting sixteen hours, and four of the globes, as used in the foregoing experiments, each containing a like quantity of food, were forced into its stomach. The substances had been previously cooked, and weighed each 16 grains. Seven hours afterwards the animal was killed, and the globes were taken out of the stomach; when the *beef* was found to have lost $10\frac{1}{2}$ grains, the *mutton* 6 grains, the *potatoe* 5 grains, the *fowl* 4 grains, and the *parsnep* 0.

To another dog that had fasted twelve hours I gave, says he, 16 grains of *roasted beef*, in a second sphere the same quantity of *veal*, in a third only *fat*, and in a fourth *wheaten bread*. In ten hours the animal was killed and opened, and the tubes were taken out of its stomach. The *beef* and *bread* were quite dissolved; the *veal* had lost only ten grains, and the *fat* $8\frac{1}{2}$ grains.

As in the last experiment the *veal* was not so soon dissolved as the *beef*, I began, says he, to suspect that the flesh of *young animals* in general is less easy
to

to digest than *that of old ones*. I therefore took care to repeat the experiment with *lamb* and *mutton*, which were put in equal quantities into two tubes. The result was as before. In seven hours the *mutton* was *quite dissolved*, whereas the *lamb* had lost only 10 grains.

Having kept a dog fasting eighteen hours, that his stomach might be free from the remains of food, I killed it, and collected about half an ounce of pure gastric fluid, which was put in separate phials. I then made trial of *mutton, veal, lamb, chicken*, and other *animal* and *vegetable substances*, and imitating the heat of the stomach, they were all readily dissolved; but the time requisite for the completion of this process was different, and answered exactly to the results of the preceding experiments*.

Mr. Belcher happening to dine at a callico printer's, was surprised to find the bones of the pork at table of a very red appearance. They had eat *madder*. This eminent surgeon mixed that substance with different foods, and gave it to fowls, and other animals, and a similar change of colour in all the bones, and even in the teeth, took place: but,

* We are apt to imagine, that *hard* substances are more difficultly dissolved than *soft*, but a little attention shews us that *the menstruum* being adapted to the subject, *hardness* has nothing to do in it: oil of vitriol dissolves *steel*, and yet does not touch *wax*, and oil dissolves *wax*, and does not touch *iron*; and so in a thousand instances. Nurses call *lamb* harmless only from the nature of the animal. Dr. SHEEBEARE.

after

after a certain time, if these were fed on food containing *no madder*, the bones *regained* their natural appearance. To prove that the different parts of the body are renewed, John Hunter fed two ducks, the one with *barley*, the other with *sprats*, for about a month, and killed both at the same time. When they were dressed and served at his table, that fed wholly with *sprats* was *hardly eatable*, it *tasted so strongly of fish*. These facts prove, that our fabric is ever being pulled to pieces and renewed; that the matter is continually changed, though the same *identity* remains! They also prove that our body may be composed of parts *unassimilated*, though *changed* by the wonder-working powers of the body from *inanimate to animate matter*!

The *husk* of the seeds of plants appears to be indigestible in its natural state; whether this arises, says the celebrated John Hunter, from the *nature of the husk* itself, or from its *compactness**, I am not certain, but am inclined to *suppose the last*; as we find the *cocoa*, which is only a husk, to be digestible, when ground to a powder and well boiled. We know, likewise, that cuticle, horn, and bone, although animal substances, are not affected, in

* This doubt, the author of the present work would have answered himself by experiment, but having felt the tortures of pain, he could not bear to inflict death on any animal incapable of doing him an injury from its nature, unless where the importance of the subject had justified, or rather had demanded, the cruelty.

the first instance, by the gastric juice; yet if reduced in Papin's digester* to a jelly, that jelly can be acted upon in the stomach; we must therefore suppose that a certain natural degree of solidity in animal and vegetable substances render them indigestible. This compactness in the husk seems to be intended to preserve, while under ground, the farinaceous part of the seed, in which the living principle is placed; the husk having probably no other power of resisting putrefaction than what arises from its texture. Of twenty-five ripe grapes, which Spalanzani swallowed, by way of experiment, eighteen were voided *entire*, of the other seven the *skins* only appeared. He made the same experiments with cherries, and currants, as well ripe as unripe, and by far the greater number were voided *entire*. Although most husks are not capable of being dis-

* The advantage of Papin's digester is to give *boiling water* a greater heat than it is capable of naturally having. To do this, the vapour must not be suffered to escape. The lid is so contrived as to open inwards, that the steam may not force its way out. There is a stopple, however, on the lid, to which is fixed the arm of a lever, suspended on a balance. Weights are applied at the end nearest the stopple. Now when the water within is so very much heated, that the steam *will* force open the stopple, and so raise up the arm of the lever; by knowing what weight is suspended, we can determine exactly the degree of heat. Vide what was before said on the cooling effects of *evaporation*, or the quantity of *caloric* that escapes when water is *aerIALIZED* or converted into *steam*.

solved

solved in the gastric juice, they generally allow of transudation; and that the seed is in some degree affected, is known by its swelling in the stomach; yet it can only admit by that means a certain portion of the gastric juice, and that not sufficient to convert it into chyle; therefore we see grain when swallowed whole, unless in birds, whose gizzards serve them as our teeth, to grind or divide the grain, pass entire, though much swelled; and even the kernels of some nuts, as *Spanish chestnuts*, are not digestible when eaten raw.

But not only *very compact substances* are difficult of digestion, but also those that are *fluid* are so likewise: and we may observe, that nature has given us very few fluids as articles of food, and to render the few fitter for the digestive powers, a *coagulating principle* is provided to give them some degree of solidity*.

* All milk turns in the stomach into curds and whey. The property of calves *rennet* is well known. When too much *acidity* prevails in the stomach, a little *magnesia* corrects it, and prevents the curd from being *too hard*, and consequently difficult of digestion. It is often proper to dilute milk, in order that the *coagula* may be broken into very small fragments.

SECT. X.

ON THE BALANCE BETWIXT DIGESTION AND
THE OXYGENATION OF THE BLOOD.

It is impossible, says the author of the *Medical Spectator*, indeed, to peruse the following extract from a late publication of Dr. Beddoes without feeling the warmest approbation, and the most anxious desire to co-operate with him and Drs. Darwin, Ewart, Thornton, and those other physicians whose letters he has published, in their laudable attempts to render the PNEUMATIC CHEMISTRY *useful to mankind*.—These, I am well persuaded, must be the sentiments of every medical man, who possesses a ray of true science; and to me, it is particularly pleasing, because I also have many years ago entertained an opinion nearly similar. “A firm persuasion,” says Dr. Beddoes, “had long settled on my mind, *that the system might be as powerfully and as variously affected by means of the lungs as of the stomach. And the more knowledge we have acquired of the properties of elastic fluids, the more has this my opinion been confirmed. Of all the functions, RESPIRATION is, I think, the best understood; and it will also be found in philosophic and cautious hands to be the most easily managed. It is impossible,*” adds Dr. Beddoes, “*now to doubt, that we are nourished by the lungs as truly,*”

“as

“ as by the stomach ; and that what we take in at the for-
 “ mer entrance becomes, like our food, a part of the sub-
 “ stance of our solids as well as our fluids.—By the lungs
 “ we can also introduce effectual alteratives of the blood,
 “ and by consequence act on all the parts nourished by the
 “ blood. For some time,” adds this illustrious philoso-
 “ pher, “ I breathed oxygen air, with a certain portion of
 “ atmospheric air, and I felt at the time of inspiration, that
 “ agreeable glow and lightness of the chest, which has
 “ been described by Dr. Priestley and others. In a very
 “ short time I perceived a genial warmth, and a greater
 “ flow of spirits than usual, and by degrees my complexion
 “ from an uniform brown became fairer and somewhat
 “ florid ; I perceived also a carnation tint at the ends of
 “ my fingers, and my lips became of a bright red. I
 “ even think it probable that OXYGEN, or VITAL
 “ AIR, which, by uniting with the blood, creates such a
 “ beautiful colour to the complexion, may supersede all
 “ other cosmetics ; one decisive advantage it will cer-
 “ tainly have over them all, for while it improves the
 “ looks, it will, if rightly administered, amend the health
 “ also*.” This experiment points out, in the
 strongest point of view, that oxygen or vital air,
 by blending with the blood, becomes one of the
 CONSTITUENT PRINCIPLES of the body.

I have had, says the celebrated Spanish traveller
 the Rev. Mr. Townsend, frequent opportunities of

* From Dr. Beddoes's Letter to Dr. Darwin on the New
 Method of curing Pulmonary Disorders.

remarking a beautiful balance betwixt RESPIRATION and DIGESTION.

During a putrid fever which attacked him last summer, it was too evident to escape the observation even of his *nurses*. *When the stomach was oppressed, respiration laboured; and when the lungs were plentifully supplied with vital air, the breathing became easy, and the superabundant quantity of food was no longer a burthen.*

Mr. Townsend's words are*, "whenever the air of my bed-chamber was artificially oxygenated, as my physician Dr. Thornton often witnessed, my respiration was pleasant, my oppression at my chest relieved, and I was enabled to breathe freely through the nostrils without the assistance of my mouth, which I could not do before the room was oxygenated. At the same time I am convinced that my appetite was greatly increased, and my digestion considerably quickened."

The celebrated Dr. Ingenhousz observes, that the air at Vienna contains more OXYGEN than in the low country of Holland; hence the increase of appetite of those who go from Holland to Vienna, and the reverse effect with travellers to Holland.

When Dr. Beddoes inhaled the *vital air*, his appetite was so far increased, that he says, "that although before he could eat only a certain quantity and was full, he now eat double that quantity, and yet did not feel himself satiated."

* Vide the *Guide to Health*,

Every one must have experienced the difference of appetite after walking in a clear air, or when staying at home.

Certain foods increase the attractive power of blood for *oxygen*. Dr. Withering, writing to Dr. Beddoes, says, the experiments you wish for have been in part made. The late ingenious Mr. Spalding, who did so much in improving and using the diving-bell, and had practised with the greatest success for many years, was a man of nice observation, and had he not fallen a sacrifice to the negligence of drunken attendants*, would have thrown much additional light upon more than one branch of science. He particularly informed me, "*that when he had eaten animal food, or drank fermented liquors, he consumed the air in the bell much faster than when he lived upon vegetable food and drank only water.*" Many repeated trials had

* Mr. Spalding twice went down, accompanied by a young man, who was educated by him, to view the wreck of the Imperial East Indiaman on the coast of Ireland. On descending the third time, in June 1783, they remained above an hour under water, and had barrels of air sent down to them, but not sufficient for their wants, probably from the drunkenness of their attendants, hence they were both found dead in the bell. This unhappy event, says the celebrated Dr. Darwin, may for a time check the ardour of adventurers in traversing the bottom of the ocean, but it is probable in another half century it may be as safe to travel *under* the ocean, as *over* it, since Dr. Priestley's discovery of procuring *vital air* in the greatest abundance from the calces of metals, as well as nitre.

so convinced him of this, that he constantly abstained from the *former diet* whilst engaged in diving.

We now see the reason why men who are oppressed with food, more especially animal food; *pant*; and why in a close room, where they are confined within the curtains of a bed, where the air is vitiated by passing frequently through their lungs, they open their mouths wide to breathe, and therefore why they *snore*.

I have often had opportunity to converse with miners in Cornwall, Mr. Townsend relates, who had been almost deprived of life by breathing a mephitic air, and have been informed by them, that on reviving they have constantly been seized with *nausea*, and that commonly the stomach has rejected its contents quite *crude*.

Whenever the imperfect tribe of animals, or such as sleep out the winter, are exposed to a cold so great as, in a great measure, to rob them of their *inbred heat*, their powers of *motion* are proportionably diminished, and as they cannot have, at that season, a very copious generation of caloric, but only enough to keep up the spark of life (their animal oil, which is composed of principles attractive of *oxygen*, being sufficient for that purpose), they lose all the power of *digestion*.

At Bellisle, in the beginning of the winter 1761, I conveyed, says John Hunter, worms, and pieces of meat, down the throats of lizards when they were going into winter quarters, keeping them afterwards

in a cool place. On opening them at different periods, I always found the substances which I had introduced entire, and without *any the least alteration*.

A hedge-hog, while the heat of the body was at 30 degrees, had neither *desire for food* nor power of *digesting it*; but when by artificial means it was increased to 93 degrees, the animal seized a toad which happened to be in the room; and upon being offered some bread and milk, it immediately eat it. The heat roused up the actions of the animal economy; the breathing became quickened; and the blood, having imbibed a greater quantity of OXYGEN AIR, containing latent fire, to be extricated by the principles separated by the stomach; hence the immediate call on the *digestive powers* of that organ.

PRACTICAL OBSERVATIONS.

SECTION XI.

I. OF THE FOOD PROPER FOR CHILDREN.

NATURE not only points out the food fit for infancy, but also kindly prepares it. When the babe, soon after it is born in this *cold* world, is applied to its mother's bosom, its sense of perceiving *warmth* is first agreeably affected; next its sense of *smell** is delighted with the odour of the milk; then its

* Any one may observe this, when very young infants are about to suck; for at those early periods of life, the perfume of the milk affects the organ of smell, much more powerfully than after the repeated habits of smelling has inured it to odours of common strength, and the lacrymal sack empties itself into the nostrils, and an increase of tears is poured into the eyes. And in our adult years, the stronger smells, though they are at the same time agreeable to us, as of volatile spirits, continue to produce an increased secretion of tears. Dr. DARWIN.

A calf discovers its mother by its sense of smell; and each pig has its peculiar teat to which it always goes. What is very remarkable, when a lamb dies, to make the ewe take to another lamb, it must be covered for a few days with the fleece of the dead one.

taste

taste is gratified by the flavour of it; afterwards the appetites of *hunger* and of *thirst* afford pleasure by the possession of their objects, and by the subsequent digestion of the aliment; and lastly, the sense of *touch* is delighted by the softness and smoothness of the milky fountain, which the innocent embraces with its hands, presses with its lips, and watches with its eyes. Satisfied, it smiles at the enjoyment of such a variety of pleasures. It feels an animal attraction, which is love; a sensation, when the object is present, a desire, when it is absent; which constitutes the purest source of human felicity, the cordial drop in the otherwise vapid cup of life, and which overpays the fond mother for all her solitudes and care.

It appears from the annual registers of the dead, that almost one half of the children born in Great Britain of great families die in their infancy. To many, indeed, this may appear a natural evil; but on due examination, it will be found to be one of our own creating. Were the deaths of infants a natural evil, other animals would be as liable to die young as man, but this, we find, is by no means the case.

A mother who abandons the fruit of her womb, as soon as it is born, to the sole care of a hireling, hardly deserves that tender appellation. Nothing can be so preposterous as a mother who thinks it below her to take care of her own child. If we search nature throughout, we cannot find a parallel to this. Every other animal is the nurse of its own
offspring,

offspring, and they thrive accordingly. Were the brutes to bring up their young by *proxy*, they would share the same fate with those of the human species.

Connubial fair ! whom no fond transport warms
 To lull your infant in maternal arms ;
 Who, bless'd in vain with tumid bosom, hear
 His tender wailing with unfeeling ear ;
 The soothing kiss and milky rill deny
 To the sweet pouting lip, and glistening eye !—
 Ah ! what avails the cradle's damask roof,
 The eider bolster, and embroider'd woof !—
 Oft hears the gilded coach, unpity'd 'plains,
 And many a tear the tassel'd cushion stains !
 No voice so sweet attunes *his cares* to rest,
 So soft no pillow, as his *mother's* breast !—

DE DARWIN.

A child, soon after the birth, shews an inclination to suck ; and there is no reason why it should not be gratified. It is true, the mother's milk does not always come immediately after the birth ; but this is the way to bring it * : besides, the *first milk* that

* Dr. Armstrong, Physician to the British Lying-in Hospital, in this particular, seconds the advice given to mothers by the benevolent Dr. Buchan. An infant, says he, although for some time it has no great need for food ; yet doubtless ought to be laid to the breast, as soon as the mother may, by sleep, or otherwise, be sufficiently refreshed to undergo the little fatigue that an attempt to suckle may occasion. This method, however



C. R. Poley. Del.

J. Colver. Sculp.

A HIRELING.

that the child can squeeze out of the breast answers the purpose of *cleansing*, better than all the drugs in the apothecary's shop, and at the same time prevents inflammations of the breast, fevers, and other dangerous diseases, from the suppression of this natural secretion. It is strange how people came to think that the first thing given to a child should be *drugs*. This is beginning with medicine by times, and no wonder that they generally end with it. It sometimes happens, indeed, that a child does not discharge the *meconium* so soon as might be wished; this has induced physicians, in such cases, to give something of an opening nature to cleanse the first passages. Midwives have improved upon this hint, and never fail to give syrups, oils, &c. &c. whether they be necessary or not. Cramming an infant with such *indigestible stuff*, as soon as it is born, can hardly fail to make it sick, and bring on a real occasion for medicines.

Almost as soon as the babe is born the *officious*

however unusual with some, is most agreeable to nature. By means of putting the child *early* to the breast, especially the first time of suckling, the nipple will be formed, and the milk gradually brought on. Hence much pain, and its consequences, will be prevented, as well as the frequency of sore nipples, which, in a first lying in, have been wont to occasion no small inconvenience. To teach the child how to suck, a little milk and water, sweetened with white sugar, may be given it at the end of a tea-spoon, which the innocent will clasp in its mouth; or a finger wetted with it may be frequently put between its gums.

nurse,

nurse, knowing what is comfortable to herself, imagines that what is good for her, and her mistress, cannot be bad for the poor infant. This naturally suggests the idea of cordials. Accordingly wine is universally mixed by nurses with the first food of children, or Dalby's carminative is administered. Nothing can be more fallacious than this mode of reasoning, or more hurtful than the conduct founded on it. Children need very little food for some time after their birth, and what they receive should be light and of a cooling quality; a small quantity of *wine* hurries on the *respiration*, and consequently the *circulation*, which nature for wise purposes has made already very *rapid**.

If the mother or the nurse has enough of *milk*, the child will need no other food. Milk itself is produced from food taken in by the mother. It is in her stomach that the aliment is dissolved, or digested, which by a combination of powers in the *chylipoietic viscera*, or parts preparing the chyle, is so far animalized † as to be converted into a kind of white

* In a *new born infant* the pulse is about 134 in a minute, in *middle age* from 60 to 80, and in *extreme old age* from 50 to 24. Dr. ADAIR.

† We may observe the hen hunting after *worms* and *little insects* for its young; and poulterers follow without the bias of theory the same method of rearing them. Reaumur gave several ducks, the one *animal*, and the other *vegetable* food, and having killed them, he found the animal substances *always* sooner digested than the grain. Thus then it seems, that

white blood. Hence it is very apparent, that previous to an infant having acquired strength enough to convert solid food into bland and wholesome chyle, and while the fibres of the stomach and intestines are peculiarly *irritable*, the parent, by a wise substitution in nature, has previously accomplished this work for the infant she is about to nourish.

After the second or third month, it may then be proper to give the child, once or twice a day, a little of some other food *. This will ease the mother, will accustom the child by degrees to take food, and will render after weaning both less difficult and less dangerous. Nature abhors all sudden transitions. For this purpose, the food of children ought not only to be simple, but to resemble, as nearly as possible, the properties of milk. Indeed *milk* should make a principal part of their food, not only before they are weaned, but for a long time after.

Bread may be given to a child as soon as it shews an inclination to chew. The very chewing of bread will promote the cutting of the teeth, and the

ANIMAL FOOD is much easier digested and transmuted in children into *animal substance*, by the powers of digestion, than the vegetable; and this plainly appears, if you begin from the first moment of the *fœtus* increasing in the womb, where, till its coming into light, it is formed entirely of animal substance.

* As *soft biscuit* or *crust of bread*, which are easier digested than *crumb*, with *milk* and *water*.

discharge

discharge of saliva. Children discover an early inclination to chew whatever is put into their hands. Parents observe the *inclination*, but know not how to apply the *remedy*. Instead of giving to the child something which may at once exercise its gums and afford it nourishment, they commonly put into its hands a piece of hard metal, or impenetrable coral. A crust of bread, or a piece of stick liquorice, is the best *suck-thumb*. It not only answers the purpose better than any thing else, but has the additional properties of nourishing the child, and carrying the saliva down the stomach, which is a great promoter of digestion.

It is soon enough to allow children *animal food*, when they have got teeth to tear it. Then we should remember that their pulse is usually at 130, and from the observation of Mr. Townsend and others, the pulse is quickened by *animal food*, and the same is not observed, when we have been eating only *vegetables* *. We should then employ a plentiful mixture of vegetable with their animal food, which, as the proper food of manhood, the formation of his *teeth* † naturally points out to the physio-

* Vide *the Guide to Health*, page 27.

† He has the *canine* or tearing teeth, the *incisors* or clippers, and the *grinders*. Those animals that have *only* the *canine teeth*, as the lion, &c. have a *gastric juice* that does not dissolve *vegetables*; and on the reverse, those that have only the *incisors* and *grinders*, as the horse, &c. have a *gastric juice* that *only* dissolves *vegetable substances*.

logists,

logists, and the experience of ages has proved to be the most conducive to health *. As the stomachs of children cannot bear repletion, because of their temperament, and as they require food not only to keep up the parts already formed, but also to make an addition to them, they ought therefore to have *sleuder* but *frequent* meals, and this in proportion to their tender age.

II. OF THE FOOD PROPER FOR MANHOOD.

It is an ancient and approved maxim, that a life guided entirely according to the directions of art, must be a miserable one; and the most judicious practitioners, sensible of the justness of the observation, and that what is prohibited is often the more eagerly coveted, have endeavoured, even to persons labouring under disease, to give as great latitude as possible in the articles of diet, and to recon-

* *Poverty*, says the celebrated Adam Smith, though it no doubt discourages, does not always prevent marriage. It seems even to be *favourable* to *generation*. A half-starved highland woman frequently bears more than *twenty children*, while a pampered fine lady is incapable of bearing any, and is generally exhausted by two or three. But *poverty*, though it quickens the powers of generation, is also extremely *unfavourable* to the rearing of children. *The tender plant is produced in so cold a soil, that it soon withers and dies. It is not uncommon in the highlands of Scotland, for a mother who has born TWENTY children to have but TWO alive.*

cile every part of the regimen they prescribe, as nearly as they can, to the common mode of living, in order that the patient may be reminded as little as possible of his misfortune. Our directions therefore shall not be frivolously minute, but as short as possible on this subject.

In the first place we ought carefully to *chew* our food, otherwise we shall impose much unnecessary labour on the stomach, and retard digestion.

With respect to *quantity*, it is evident that this must be regulated by our feelings. A healthy man cannot be said to exceed in the quantity of his meal, if he finishes it with a relish for more; if, immediately after eating, he can, if required, follow any employment, that does not demand strong exercise or violent exertions; which to persons in easy circumstances will rarely be necessary, and ought in general to be avoided, as it disturbs digestion*; though daily practised, from necessity, by the labouring poor †.

Gluttony is so ungentlemanlike a vice, that it would be an affront to suppose that persons of polished manners,

* Dr. Adair.

† This has been before very *seriously* adverted to, and it is hoped that it will finally have its *due weight*, the conduct of masters being here (like the traffic in human flesh) both *cruel* and *impolitic*. Dr. Harwood, the Professor of Anatomy at Cambridge, took two pointers equally hungry, and equally well fed; the *one* he suffered to lie *quiet* after his meal, the *other* he kept for above two hours in *constant exercise*. On returning

manners, who are the persons who will probably read this book, could be capable of it. I shall therefore forbear to mention the innumerable train of evils that in time is certain to attend this beastly practice.

With respect to the *proper times* for eating, first,

OF BREAKFAST.

As our ancestors breakfasted early, they dined also early, and had at least two meals after this, as appears from the allowance appointed for a *Lady Lucy*, who seems to have been one of the maids of honour in the court of Henry the VIIth. I may be allowed to mention their articles of food, as a matter of curiosity, to shew in what manner the *fine ladies* lived in those days.

This lady was allowed for BREAKFAST,

{ a chine of beef,
a loaf, and
a gallon of ale.

We have an account also of the BREAKFAST of an *earl* and *countess* in the lent season, viz.

turning home he had them both killed. *In the stomach of the dog that was quiet and asleep, all the food was digested; but in the stomach of the other dog that procefs was scarcely begun.*

- { a loaf of bread,
- { 2 manchettes (which seem to have been
loaves of a coarser bread),
- { a quart of beer,
- { a quart of wine,
- { 2 pieces of salt fish,
- { 6 baconed herrings,
- { 4 white herrings, and
- { a dish of sprats.

With respect to the *quality* of our different meals, we seem to depart more from the custom of our hardy ancestors with regard to *breakfast*, than any other meal. The contrast at first sight appears truly ridiculous. *A maid of honour* in the court of Queen Elizabeth, breakfasted upon *beef*, and drank *ale* after it; whilst the *sportsman*, and even the *day-labourer*, now breakfast upon *tea*.

The philosopher here humbly attempts to vindicate the present race; he believes that *sleep*, which hereafter will be fully considered*, *accumulates* the irritability of the fibre, disposing it to be more readily affected by stimuli of all kinds, hence the violent effects of all cordials taken in the morning, and hence perhaps the propriety of the gently stimulating power of coffee or bohea tea†. He would

* Vide Law III. on the Accumulation of Excitability.

† TEA, whether *green* or *bohea*, is thought to be, though I doubt it, the produce of the *same* plant, the *green tea* being the shoots and earlier leaves, and *bohea* those more advanced and expanded

would also recommend here *bread* moulded into such shapes as to produce a great deal of crust*, and he would recal the reader, who reckons health as the first blessing, and as the means of enjoying and heightening all other blessings, to reflect on the utility of the *saliva*, and to remember that bread when buttered absorbs little or no saliva, while a pound of dry bread carries down with it the same weight of this necessary moisture†. We would here, therefore, only caution the reader against taking his tea *too hot*, and if he has been engaged throughout

expanded. Like other stimuli, *green tea* made very strong is an *emetic*, or occasions *tremors*; if moderately strong it *agreeably refreshes* after a fatiguing journey, and from its excitement is productive of *wakefulness* to habits unaccustomed to *that stimulus*. GREEN TEA is suited *only* to old age, and cold *unirritable habits*.

* We saw before that *solid substances* are easier acted upon than *glutinous*. Thus *hot water* sooner dissolves *white sugar* than *soft gum*, and *aqua fortis* corrodes copper, though it does not touch *wax*. It is less subject to *acescency*, and does not swell in the stomach.

† Pieces of meat, that may happen to get between the teeth, are *dissolved* by this menstruum, or at any rate are so *softened*, and *their texture broken*, that this inconvenience is speedily removed. If not a fluid, possessing properties the same as the *gastric fluid*, it must be allowed, certainly, that it *greatly aids that solvent*. If this penance be too great for the middle period of life, and muffins and crumpets soaking in butter must be indulged in, *children*, however, may be prohibited *butter*, and be made to have *good constitutions*, by which the contagion of *bad example* will afterwards be less severely felt.

the preceding day, or that morning, in much exercise, to join with this necessary meal *one or two soft boiled eggs**.

OF DINNER.

The *same lady* who had *so solid a breakfast*, had for DINNER,

{ *a piece of boiled beef,*
a slice of roasted meat, and
a gallon of ale.

IN THE AFTERNOON,

{ *a manchette, and*
half a gallon of ale.

FOR SUPPER,

{ *a mess of porridge,*
a piece of mutton,
a cheat (or finer loaf),
and a gallon of ale.

To be sociable after supper, there was left on the table,

{ *a manchette loaf,*
a gallon of ale, and
half a gallon of wine.

This lady had therefore four *heavy meals*. Instead of this we are led to recommend the modern practice of late dinners.—But because long fasting is

* This custom universally prevails in *Ireland*, and is better than *hung-beef* and *achovies*, which accompany the *Scotch* breakfast.

injurious, and when very hungry we may be induced to eat more at this principal meal than can be properly digested, we would recommend *cold meats or soups* by way of COLLATION.

For dinner we would advise those, who have a due sense of the importance of health, to keep as much as possible to *one dish*. To prefer MUTTON* to lamb, LAMB to *chicken* or *veal*, and BEEF, if tender, to either of the *three* last, and as *fish* is soon digested, to unite some *flesh meat* with it, and to add to these *vegetables*. Could I believe I should be listened to with indulgence, and not incur the general censure of prejudice, having nothing but *philanthropy* and the *improvement of science* for my object, I would condemn, for convalescent and weak persons, those heterogeneous combinations called *puddings*†, and am inclined to condemn also, though not the fruit, yet the *crust* of *all pies*. Let my readers here call to mind, that eggs and milk are both reckoned wholesome *separate*, but when combined, form a compound suited only for *strong stomachs*.

* When Sanctorius eat MUTTON, which was a food peculiarly grateful to his stomach, his *feelings* were *pleasant*, and his *perspiration* was *copious*;—when he eat *pork*, *goose*, *duck*, *mushrooms*, or *melons*, he was *heavy* and *oppressed*; and found by the balance, that *his perspiration diminished one half*. This proves that even the *perspiratory discharge* is very much under the influence of the STOMACH.

† Very few exceptions to this rule. The plainest puddings are generally very *compound*.

The art of cookery I am inclined to compare with the diabolical art of *undermining a town*. We all avoid the *red poison berries*, and caution others against them, though we give our FRIENDS *poisoned pickles*, and preserves made in copper saucepans, &c. and hold out such temptations to *over-gorging*, which weak minds cannot resist.

They dine
 With dishes tortur'd from their native taste,
 And mad variety, to spur beyond
 Its wiser will the jaded appetite !
Is this for pleasure ?—Learn a juster taste ;
 And know, that TEMPERANCE IS TRUE LUXURY,
Or is it pride ?—Pursue some nobler aim.
 Dismiss your parasites, who praise for hire ;
 And earn the fair esteem of honest men,
 Whose praise is fame, Formed of such clay as yours,
 The sick, the needy, shiver at your gates.
 Even modest want may bless your hand unseen,
 Though hush'd in patient wretchedness at home.
 Is there no virgin, graced with every charm
 But that which binds the mercenary vow ?
 No youth of genius, whose neglected worth
 Unfoster'd sickens in the barren shade ?
 No worthy man, by fortune's random blows,
 Or by a heart too generous and humane,
 Constrain'd to leave his happy natal seat ?
There are, while human miseries abound,
A thousand ways to waste superfluous wealth. •

ARMSTRONG.

OF

OF DRINKING AFTER MEALS.

A foreigner was invited to a party consisting as, he was told, of *English philosophers*, of whom he conceived a great deal. After a very plenteous dinner the cloth was cleared, and the bottles were placed on the table. He was pressed after five glasses to drink on; but the stranger persisted in assuring the company "*he felt no drought.*" These *philosophers* began then to be *angry*, and the foreigner rang the bell, and *insisted* on another course, for *they* ought as much to *eat* against reason and inclination, as *he* had to *drink*.

I would here recommend the excellent saying, a *glass* for *digestion*, another for *my relations*, a *third* for *my king*, a *fourth* for *my country*, and if a *fifth*, it must be for *my enemy*.

It will not, I think, admit of a doubt, that *beer* or *water* is the only drink necessary in *early youth*; and that *wine*, and *spirituous liquors*, of which luxury has introduced a variety, ought to be appropriated solely to the *middle period*, to the comfort of *invalids*, and the invigoration of *old age*.

The great objection, however, against *geneva* and *water*, and *brandy* and *water*, is, that *invalids* are very apt to increase the proportion of the spirit ordered, and the great Dr. Fothergill, who was among the first who gave sanction to this practice, declared, some time before his death, that he repented of
having

having done so, from the *unfortunate habit* that had *stole* on some of his patients.

On pleasure's flowery brink we idly stray, •
 Masters as yet of our returning way.
 Seeing no danger—we disarm our mind,
 And give our conduct to the waves and wind.
 Then in the flowery mead, or verdant shade,
 To wanton dalliance negligently laid,
 We weave the chaplet, and we crown the bowl,
 And smiling see the *nearer waters* roll,
 Till the *strong gust* of *raging passions* rise,
 Till the dire tempest mingles earth and skies,
 And swift into the boundless ocean borne,
 Our *foolish confidence* too late we mourn;
 Round our devoted heads the billows beat,
 And from our troubled view the *lessering lands* retreat.

Spirits, says the Abbé Raynal, were the gift the most fatal the old world ever made to the new. It was soon observed, that it disturbed their domestic peace, deprived them of their judgment, and made them furious. In vain did some Frenchmen expostulate with them, and endeavour to make them ashamed of *these excesses*. “It is you,” answered they, “who have taught us to drink this liquor, and we cannot do without it. You have done the mischief, and it admits of no remedy.”

To the credit of the present age, *hard drinking* is rarely practised by persons of liberal education; though,

though, from the habit of sitting at table some hours after dinner, we are tempted to *exceed* in the quantity of wine; which even with persons in health too frequently destroys, in time, the tone of the stomach.

Were the pleasure of the palate lasting, says Cornaro, there would be some excuse for inebriety, but it is so transitory, that there is scarce any distinguishing between the beginning and the ending; whereas the diseases it produces are very durable. This fact is well known in the distilleries, where the *swine* which are fattened by the spirituous sediments of barrels, all acquire *diseased livers*.

Mark what happens to that man who drinks a quart of wine or of ale, if he has not been habituated to so violent and exhausting a stimulus. He loses the use both of his limbs and of his understanding! He becomes a temporary idiot, and has a temporary stroke of the palsy! And though he slowly recovers after some hours, is it not reasonable to conclude, that a frequent repetition of so powerful a poison must at length permanently affect him?—If a person accidentally becomes intoxicated by eating a few mushrooms of a peculiar kind, a general alarm is excited, and he is said to be poisoned; but so familiarized are we to the intoxication from vinous spirits, that it occasions merriment rather than alarm.

The story of Prometheus seems to have been invented by physicians in those ancient times, when
all

all things were clothed in hieroglyphic, or in fable. Prometheus was painted as stealing *fire* from heaven, which might well represent the inflammable spirit produced by fermentation; which may be said to animate or enliven the *man of clay*: whence the conquest of Bacchus, and heedless mirth and noise of his devotees.—*But the after punishment of those, who steal this accursed fire, is a vulture gnawing the liver; which well allegorizes the poor inebriate lingering for years under painful hepatic diseases*.*

Drinking is undoubtedly the most miserable refuge from misfortune. It is the most broken of all reeds. This solace is truly short lived; when over, the spirits commonly sink as much *below* their usual tone, as they had been before raised *above* it. Hence a repetition of the dose becomes necessary, and every fresh dose makes way for another, till the miserable wretch is rendered a slave to the bottle; and at length falls a sacrifice to what, at first, perhaps, was taken only as a medicine. No man is so dejected as the drunkard when the debauch is over. Hence it is, that those who have the greatest flow of spirits while the glass circulates freely, are of all others the most hipped when sober. It may be pleasant to get drunk, but the next day is a day of uneasiness, and the third ought to be a day of repentance. To those who drink to drive away care, I would recommend the careful perusal of the following lines.

* Dr. Darwin.

Unhappy

Unhappy man, whom *sorrow* thus and *rage*,
 Two different ills, alternately engage.
 Who drinks, alas! *but to forget*,—nor sees
 That melancholy, sloth, severe disease,
 Memory confused, and interrupted thought,
 Death's harbingers, lie latent in the draught,
 And in the flowers that wreath the sparkling bowl
 Fell adders hiss, and poisonous serpents roll.

PRIOR.

OF SUPPER.

A *late dinner* gives a long morning, and precludes the necessity of a hearty supper, and tea may become its substitute, and call together, to a cheap entertainment and the pleasures of social intercourse, a meeting of cheerful friends. Abstracted from the cares of the busy day, having no variety of objects to draw off the attention, viewing the expressive and brilliant countenance of those he is in converse with, with spirits gently agitated, and cares dispelled, he returns with the partner of his choice, from the splendid circle, and wakes the next morning refreshed by a sound and tranquil sleep.

III. OF OLD AGE.

The *food* proper for *old age* has been before considered, when discoursing on *temperaments*.

SECT.

SECT. XII.

ON CLEANLINESS.

THE under garment of *fleecy hosiery* ought to be frequently changed, as it promotes the perspiration, and is continually absorbing it. Diseases of the skin are chiefly owing to want of cleanliness. They may indeed proceed from other causes; but they seldom continue long where cleanliness prevails. To the same cause must we impute the various kinds of vermin which infest the human body, &c. These may always be banished by cleanliness alone, and wherever they abound, we have every reason to believe it is neglected. It is remarkable that, in most eastern countries, cleanliness makes a great part of their religion. Indeed the whole system of the jewish laws has a manifest tendency to promote cleanliness. Whatever pretensions people make to politeness and civilization, I will affirm, that as long as they neglect cleanliness, and appear nasty, they are styled Goths and barbarians.

Few things are more unreasonable, than the dread of cleanliness in sick people. They had rather wallow in all manner of filth, than change a tatter of their apparel. Yet how refreshed, how cheerful, how comfortable do people feel, when in
health,

health, upon being shaved, washed, and shifted! If cleanliness be proper for persons in health, it is certainly more so for the sick. By being neglected the slightest disorders are often changed into the most *malignant*. The same mistaken care which prompted people to prevent the least admission of *fresh air* to the sick, seems to have induced them to keep them dirty. If the *fleecy hosiery* waistcoat was changed on going to bed, which is the time we are in the habit of being exposed to cold, there can be no danger of catching cold, nor can there be any impropriety of doing this at least twice a week in the summer, and once in the winter. The only caution necessary, is to see, previous to its being put on, that it contains no dampness.

Cleanliness is certainly agreeable to our nature. It sooner attracts our regard than even finery itself, and often gains esteem where that fails. It is an ornament to the highest as well as the lowest station, and cannot be dispensed with in either.

I had occasion, says the author of the *Spectator*, to go a few miles out of town, some days since, in a stage coach, where I had for my fellow travellers a dirty beau, and a pretty young quaker woman. Having no inclination to talk much, I placed myself backward with a design to survey them, and to pick a speculation out of my two companions. Their different figures were sufficient to draw my attention. The gentleman was dressed in a suit, the ground whereof had been black, as I perceived
from

from some few spaces that had escaped the powder, which was incorporated with the greatest part of his coat: his perriwig, which cost no small sum, was after so slovenly a manner cast over his shoulders, that it seemed not to have been combed since the year 1782; his linen, which was not much concealed, was daubed with plain *spanish*, from the chin to the lowest button; and the diamond upon his finger (which naturally dreaded the water) put me in mind how it sparkled amidst the rubbish of the mine, where it was first discovered.

On the other hand, the pretty quaker appeared in all the elegance of cleanliness. Not a speck was to be found upon her. A clear, clean oval face, just edged about with little thin plaits of the purest cambric, received great advantage from the shade of her black hood; as did the whiteness of her arms from that sober coloured stuff in which she had clothed herself. The plainness of her dress was very well suited to the simplicity of her phrases; all which put together, though they could not give me a great opinion of her religion, they did of her innocence.

This adventure occasioned my throwing together a few hints upon *cleanliness*, which I shall consider as one of the *half virtues*, as *Aristotle* calls them, and shall recommend it under the three following heads: as it is a mark of politeness; as it produces regard; and as it bears analogy to purity of mind.

First, It is a mark of politeness. It is universally

fally agreed upon, that no one unadorned with this virtue can go into company without giving a manifest offence. The easier or higher any one's fortune is, this duty arises proportionally. The different nations of the world are as much distinguished by their cleanliness, as by their arts and sciences. The more any country is civilized, the more they consult this part of politeness. We need but compare our ideas of a female *Hottentot* and an *English* beauty, to be satisfied of the truth of what has been advanced.

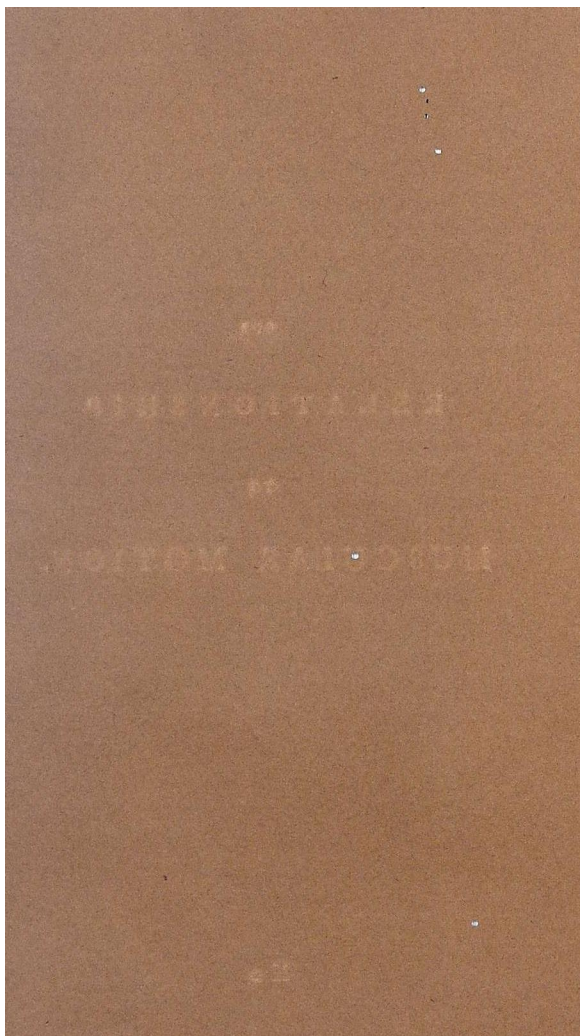
In the next place, cleanliness may be said to be the foster mother of love. Beauty indeed most commonly produces that passion in the mind, but cleanliness preserves it. An indifferent face and person, kept in perpetual neatness, has won many a heart from a pretty flattern. Age itself is not unamiable, while it is preserved clean and unfulled: like a piece of marble constantly kept clean and bright, we look on it with more pleasure than on a new vessel that is cankered with rust.

I might observe *farther*, that as cleanliness renders us agreeable to others, so it makes us easy to ourselves; that it is an excellent preservative of health; and that several vices, destructive both to mind and body, are inconsistent with the habit of it. We find from experience, that through the prevalence of custom the most vicious actions lose their horror, by being made familiar to us. On the contrary, those who live in the neighbourhood of

good example, fly from the first appearance of what is shocking. It fares with us much after the same manner as to our ideas. Our senses, which are the inlets of all the images conveyed to the mind, can only transmit the impressions of such things as usually surround them. So that pure and unfulfilled thoughts are naturally suggested to the mind by those objects that perpetually encompass us, when they are beautiful and elegant in their kind.

OUR
RELATIONSHIP
TO
MUSCULAR MOTION.

K 2



S E C T. XIII.

ON ANIMAL ELECTRICITY; OR THE CAUSE OF
MOTION IN THE VOLUNTARY
ORGANS, OR MUSCLES.

DOES there appear any principle in all nature, says our English historian, more mysterious than the union of soul and body, by which the spiritual part possesses such an influence over the material, that it is able to direct the motion of any muscle, or even sometimes a part of a muscle? Were we empowered by a secret wish to displace mountains, or control the planets in their orbit; this extensive authority would not seem more extraordinary or more unaccountable*. An accident, fortunate for philosophy, has thrown, however, some light on this hitherto mysterious subject.

Whilst Professor Galvani, at Bologna, was dissecting a frog, in a room where some of his friends were amusing themselves with an electrical machine, one of them happened to draw a spark from the conductor, as the professor touched one of the

* Vide Hume's *Essays*. The same observation, in nearly the same expressions, may be found in Voltaire's *Ignorant Philosopher*.

nerves of the animal. In an instant the whole body of the frog was shook by a violent convulsion.

The professor was astonished at the phenomenon, and believing it to be owing to his having wounded the nerve; to assure himself, whether this was really the case, he pricked it with the point of his knife, without any motion being produced: he now touched the nerve with the instrument as at first, and desired a spark to be taken from the machine, on which the contractions were renewed.

The experiment was repeated a third time, but the animal remained motionless; however, as the ivory handle of the dissecting knife was a bad conductor of electricity, he changed it for a metallic one, and re-excited the movements, which he constantly failed in doing whilst using an electric substance.

After having made a great number of experiments with the electrical machine, he resolved next to make trial of atmospheric electricity. To this end he raised a conductor upon the roof of his house, from which he brought an iron wire into his room, and to this attached metal conductors, connected with the nerves of the animals destined to be the subject of his experiments, and to their legs he tied wires, which reached the floor. Considerable movements were observed in the animals, whenever it lightened. These preceded the claps of thunder, and always corresponded with their intensity and repetition; and even when it did not
lighten,

lighten, the movements took place, whenever any thunder cloud passed over his house.

Having next laid bare the nerve leading to the wing of a duck, the scissars of the operator being under it, whenever any of the company present applied a shilling, or a half crown, to the nerve so disposed, the nerve was agitated by a violent movement, which occurred as often as the shilling or half crown was employed, till the nerve was exhausted of its power, which happened commonly in about 15 minutes.

It was afterwards found, that if an half crown be placed in contact with the under part of the tongue, and a plate of zinc be applied to the upper part, on bringing the two metals into contact with each other, a pungent disagreeable feel, which it is difficult to describe, is produced at the point of the tongue.

And if a plate of zinc be placed between the gums and the upper lip, and a plate of gold be placed in the upper part of the tongue, when the gold is brought into contact with the zinc, the person feels immediately a flash of lightning.

After performing this experiment repeatedly, I constantly felt, says Dr. Monro, the Professor of Medicine at Edinburgh, a pain in my upper jaw, which continued for more than an hour. And in one experiment, after I had applied a blunt probe of zinc to the partition which divides the nose into two nostrils, and repeatedly touched it with a crown piece of silver applied to the tongue, I thereby pro-

duced the appearance of a flash of lightning, and several drops of blood fell from that nostril. Dr. Fowler, after making a similar experiment on his ears, observed a similar effect.

The experiment of producing sparks by stroking the back of a cat in frosty weather, readily shews that the electric fluid naturally exists in a very active state in the bodies of some animals. Possibly, says the celebrated Dr. Priestley, the *light* which is said to proceed from animals, as from wild beasts, when they are in pursuit of their prey in the night, may not only arise, as it has hitherto been supposed to do, from the mere friction of their hairs or bristles, but violent *muscular exertion* may also contribute to it. *This light* may, with the electric flashes from their eyes, assist them occasionally to catch their prey; as glow-worms and other insects are provided with a constant electric light for that purpose.

Mr. Hartman having neglected to supply his paroquet with water to wash himself, he observed that its feathers, in a state of dryness, were endued with a proper electrical virtue, repelling one another, and retaining their electricity even a long time after they were plucked from the body of the bird, just as they would have done if they had received electricity from an excited glass tube.

The following is a very remarkable instance of the existence of this fluid in the human frame, and of the ease with which it is put into action. Bridone, in his travels, mentions the story of a lady, who, on
 combing

combing her hair in frosty weather in the dark, had sometimes observed sparks of fire to issue from it; this made him think of attempting to collect the electrical fire from the hair, without the assistance of any other electrical apparatus. To this end he desired a young lady to stand on wax, and comb her sister's hair, who was sitting in a chair before her; soon after she had begun to comb, the young lady on the wax darted out sparks of fire against every object that approached her. Her hair was strongly electrical, and affected an electrometer at a considerable distance. He charged a metallic conductor from it, and in the space of a few minutes collected a sufficient quantity of electric fire so as to kindle common spirits, and by means of a small jar, gave many smart shocks to all the company present.

Cavallo also mentions, that he obtained, by means of a small condensing plate, very sensible signs of electricity from various parts of his own body, and from the head of almost every other person on whom he made the experiment.

The celebrated John Wesley relates, that Mrs. Susanna Sewall, in New England, at a certain time of the year, never changed her apparel without observing a strange flashing of sparks. In the company of several persons, having taken off some of her wearing apparel, and shaking it, sparks flew forth, making a noise much like bay leaves thrown into the fire. They desired Mrs. Sewall one day to put

on her sister's garment; and when she put it off, in the evening, it sparkled as her own used to do.

It has often been observed, that when we wear worsted under-stockings, and silk over them, if we chance to draw off the silk stocking in the dark, the bright electric fluid is seen flashing from every part of the worsted under-stocking.

A variety of other curious facts clearly evince, that the electric fire is essentially connected with the animal body, and is continually exerting its influence on it.

The electric fluid, however, is far more conspicuous in the body of the GYMNOTUS, which has the remarkable property of generating and throwing out its electricity much beyond the limits of its own system. I have often, says Dr. Garden, when I have taken hold of the *gymnotus* with one hand, and put the other into the water over its body, without touching it, received a *smart shock*; and I have observed the same effect to follow, when a number of persons joined hands, the person at one extremity of the circle taking hold of, or touching the electric fish, and the person at the other extremity putting his hand into the water over the body of the fish. The shock was communicated through the whole circle as smartly as if both the extreme persons had touched the fish. I am told, continues Dr. Garden, that some of these fish in Surinam river, are upward of 12 feet long, whose stroke

stroke or shock proved *instant death* to any person who had the misfortune to touch it.

Mont. Fermin, in his Natural History of *Surinam*, published in 1765, also tells us, that making 14 persons grasp each other by the hands, while he grasped the hand of the last with one of his, and with the other touched the *GYMNOTUS* with a stick, the whole number felt the shock, and he could not prevail on any of them to repeat the experiment *.

Dr. Priestley relates, that the sensation is strongest when the fish is in motion, and is transmitted to a great distance, so that if persons in a ship happen to dip their fingers or feet in the sea, when the fish is swimming at the distance of 15 feet from them, they are affected by the shock.

Mr. Walfé gives us the following beautiful experiment, to prove that the *gymnotus* is very sensible whether the substances brought near him are proper or not for receiving the electric shock.

The ends of two wires were put into the water of the vessel, which contained the animal; these wires were of some length stretched to their extent, and terminated in two glasses of water placed at a considerable distance from each other. Whilst the apparatus remained in this state, and the circulation was of course *interrupted*, the animal did not prepare

* Vandelott makes two species of the *electric eel*, the black and reddish; though he acknowledges that, excepting the difference of colour and degree of strength, they are not materially different.

to exercise his power, but the instant a spectator, or any conducting substance filled the interval, and rendered the circle complete, it instantly approached the wires, arranged itself, and gave the shock.

The surprising property of the TORPEDO, in giving violent shocks to the person who takes it in his hands, or who treads upon it, was long an object of wonder. For some time it was generally reckoned to be a fabulous history; but at last the matter of fact being ascertained beyond a doubt, *philosophers* have endeavoured to find out the cause.

As an insulated person cannot receive a shock from either of these extraordinary fishes, the identity of this fluid, and the electric fluid, is clearly ascertained.

Mr. Hunter has well observed, says Sir John Pringle, that the magnitude and number of the nerves bestowed on the electric organs of the *torpedo* and *gymnotus*, must appear as extraordinary as their effects; for if we except the important organs of our senses, there is no part, even of the most perfect animal, which, for its size, is more liberally supplied with nerves than the *torpedo*: nor yet do these nerves of the electric organs seem necessary for any *sensation* that can belong to them; and with respect to *actions*, there is no part of any animal, however strong and constant its actions may be, which enjoys so large a portion of them. If then it be probable, that *these nerves* are *unnecessary* for the purpose either of *sensation* or *action*, may we not conclude, that they

they are subservient to the management of the *electric fluid*?

Mos. Reaumur has also resolved it into the action of a vast number of *minute nerves*, situated in a line under the skin, which by their accumulated force gives a sudden and violent shock. He observes, also, that when these animals have exhausted their electric powers, they submit quietly to every insult; but having by a little rest and time recovered their former force, they then hastily repay the offence.

May not animals have a power, is the conjecture of the celebrated Dr. Priestley, of extracting from the blood the *electrical fluid*; the BRAIN then would be the great laboratory for that purpose; and by means of the NERVES, that great principle, thus exalted, would be directed into the *muscles*, and contract them as *ab extra*.

The ingenious Mons. Valli observes, also, that the size and number of the *nerves*, which are bestowed upon the *electrical organs* of the TORPEDO and GYMNOTUS are truly extraordinary and astonishing.

The nerves of the *muscles* in animals are likewise very large, and their minute ramifications so great, that several physiologists have been led to believe that muscular contractile fibres are the same thing as nervous fibrils.

The blood-vessels of the *electrical organs* are very numerous, follow the course of the nerves, and distribute the smaller branches along with them.

The

The quantity of vessels expended upon the *muscles* is also prodigious, and they likewise are found to accompany the course and distribution of the nerves.

There exists in *muscles* as well as in the *electrical organs* of the torpedo and gymnotus, cylinders, partitions, and a great subdivision of parts.

Have we not therefore every reason to believe that our *muscles* are so many *electrical organs*, each muscle being as it were a battery, and muscular intumescence and contraction, in consequence of a sort of explosion produced by the animal or nervous electricity*? According to this hypothesis our nervous and muscular systems may be considered,

says

* I once happened, says Dr. Priestley, to lay a chain near my electric batteries, so as to make it return at a sharp angle, in order to impress the form of the letter *b* upon the table; and observed, that on the discharge, the part of the chain that had been *doubled* was displaced, *and pulled about two inches towards the rest of the chain*. At this I was surprised, as I thought it lay so that it could not slide by its own weight. Upon this I repeated the experiment with more accuracy. I stretched the whole chain along the table, laying it double all the way, and making it return by a very sharp angle. The consequence always was, that the chain was *SHORTENED* about *two inches*, and sometimes more, *as if a sudden pull had been given it*.

The contraction of a muscular fibre may be compared, says the illustrious Dr. Darwin, to the following electric experiment. Let twenty very small Leyden phials, properly coated, be hung in a row by fine silk threads at a small distance from each other; let the internal charge of one phial be positive, and of the other negative alternately; if a communication be made from the internal surface of the first to the external surface of the

the

says Dr. Beddoes, as a beautiful machinery, and muscular motion, at least that of animals analogous to man, would be a chemical operation combining *hydrogen* and *azot* with OXYGEN. This hypothesis, though not perhaps capable at present of the strictest proof, appears highly probable. It accounts for the perpetual necessity of our imbibing OXYGEN AIR, and enables us to trace the changes undergone by this substance, from the moment it is received, till the moment it is expelled. During the contraction of the muscles, OXYGEN combines with the elements above mentioned into *water* and *various salts*, among which the *marine* and *phosphoric acids* deserve particular notice. *In this state* it is taken up by the *absorbents*, and afterwards *exhaled* or *excreted*. Hence the necessity for OXYGEN AIR in the blood for *muscular action*, and hence the reason why *motion languishes*, whenever *this principle is scantily supplied by the lungs*.

A very delicate experiment was made by Dr. Mayow, in the last century. A dog that was *panting* and *breathing* deeply, on receiving *arterial*, that is, *oxygenated* blood into one of his veins, instantly began to breathe so *calmly* that his respiration was scarce *sensible*. The animal here receiving from an *unusual source* the sustenance which is probably ex-

the last in the row, they will all of them instantly *approach* each other. and thus *shorten* a line that *might connect* them together like a muscular fibre. Vide ZOONOMIA, p. 61.

pended

pended by violent muscular action, it became *therefore* no longer necessary to inhale it *rapidly*.*.

The

* The first hint of TRANSFUSION was given at Oxford, Anno 1658, by Dr. Christopher Wren, Savilian Professor of Astronomy there, who proposed, to the honourable Mr. Boile, a method of TRANSFUSING LIQUOR into the veins of living animals.

In 1666 his hint was farther improved, at the same constant source of ingenuity and learning, by Dr. Richard Lower, who invented the method of TRANSFUSING BLOOD out of one animal into another.

He was followed by several ingenious men at London, and particularly by Dr. Edmund King, who rendered Lower's method of transfusion still more easy and commodious. And as it was intended by the *Royal Society* that those trials should be prosecuted to the utmost variety which the subject would bear, by exchanging the blood of old and young, sick and healthy, fierce and timid animals; various experiments were accordingly made with surprising effects upon lambs, sheep, dogs, calves, and horses, &c.

From England this invention passed into France and Italy, where, after old and decrepit animals had the agility of their limbs restored by the transfusion of young and healthy blood into their veins, and other wonderful things had been achieved, J. Denis, Doctor of Physic, at Paris, with the assistance of Mons. Emerez, ventured to perform the operation on men in that city; and J. G. Riva, a surgeon of great reputation, made the same experiments at Rome.

After some trials, Mons. Denis published an account of a young man, that was cured of an uncommon *lethargy*, by transfusing the arterial blood of a lamb into his veins: and another account of the cure of *madness* performed on a man 34 years old, by transfusing the arterial blood of a calf into his veins, in the presence of several persons of quality and learning.

This

The paviours always make a deep inspiration before they strike down the stones, whereby they acquire a large proportion of *oxygen*, and make a loud

This daring enterprize having succeeded so well at the first setting out in France, it was also practised in England from the arteries of a young sheep, into the veins of Arthur Coga, Nov. 23, 1667, at Arundel-House, before a splendid company, by Dr. Edmund King, and Dr. Richard Lower. And Coga published, under his own hand, an account of the *great benefit* which he received from the operation.

The illustrious Haller observes, in his *Physiology*, that by transfusion of blood, the whole machine of the animal is thereby endowed with a remarkable degree of *vivacity*.

Unfortunately this operation was performed on Baron Bond, the son of the first minister of state in Sweden, who had an inflammation of the bowels, and was given over by his physicians, and soon after on a person in a *consumption*; which attempts turning out unsuccessful, the *practice* being yet in its infancy, and *unsupported* by *sufficient documents*, it fell into *discredit*, and was *prohibited* by the KING'S AUTHORITY in *France*, and by the POPE'S MANDATE at *Rome*.

Thus was defeated a noble essay, begun with prudence in England, but imprudently pursued in France and Sweden, which, had the first trials on the human species been conducted with care and caution, might in time, says Dr. Mackenzie, have produced most useful and surprising effects.

The introduction of the *vital air* into the practice of physic, has thrown great light upon this intricate question, and as, in TRANSFUSION, *venal* blood was removed while *oxygenated*, or *arterial* blood was supplied to the veins, the lungs the while imbibing the *vital air*, the constitution was made to *superabound* with *oxygen*; hence arose, as Dr. Thornton observes in a letter to Dr. Beddoes, all the surprising phenomena of

loud and forcible expiration, to admit of a larger portion of this principle to be expended in muscular motion. Dr. Beddoes having for some time inhaled *vital air*, says "he not only felt himself "warmer, but certainly more *disposed towards* and "*capable* of MUSCULAR EXERTION."

TRANSFUSION: but in the present instance, it acts also by *dilention*, and the utmost care must be taken to adjust the right quantity of blood, which must be done by carefully noting the alteration of the pulse.

When this experiment was made some years back at Cambridge, by Professor Harwood, the blood of a *sheep* was transfused into the veins of a *pointer*, who was previously bled; and more *arterial blood* being admitted than was *proper*, the animal, sensible of *plethora*, immediately set about eating *grafs*. An old bed-maker who happened to be present, cried out, "Lord, "Maister, your dog is already turning into a *sheep*!" In other trials, the animal, after the operation, has wagged his tail, forgiven his master, and seemed, if any thing, more lively than usual.

S E C T. XIV.

HEAT PRODUCED BY EXERCISE.

IT was shewn in the last section, that when muscular intumescence took place, the *vital air* in the blood was decomposed, forming certain chemical combinations, productive of the *vital flame*.

If I walk slowly along, for the space of a quarter of a mile upon even ground, my *breathing* and *pulse* are but little accelerated, and the *heat* of my body remains nearly the same as before. But if I walk at the same pace, and for the same distance, up a *steep hill*, or bearing a *heavy burthen*, my *breathing* becomes *short and full*, and my *heart* beats *strong and quick*, and the *heat* thrown off from my body corresponds with these increased internal movements.

It is natural to ask, what is the cause of this *difference*, when the *space*, the *speed*, and the *actual movement* of the muscles, are the same? It must certainly arise from the *quantity* of *nervous electricity* transmitted from the BRAIN to the muscles in the *latter case*, where the body was *raised up hill*, or where a *weight* was carried, being *much greater* than when the body is *only moved*, without being lifted up, or without any additional weight upon it. For

though the *motion* of the muscles be the *same* in both cases, yet the *increased* weight to be moved, required the *nervous exertion* to be much *greater* in the latter instance than in the former; and therefore the *will*, or *determination of the mind*, propelled a *greater quantity* of *nervous electricity*, from the BRAIN to the muscles employed.

To the increased demand on the system of OXYGEN AIR, to be *decomposed* by the *nervous electricity* *, the accelerated *respiration* must be attributed; and from the increased quantity of OXYGEN AIR in the blood, we can account for the improved *digestion* †, and a more rapid *circulation*; and from all these causes, concurring with the *electricity* of the nerves, we are able to see clearly the reason of the increase of the VITAL FLAME.

If an animal, a man, for instance, in good health, be exposed to a *temperate air*, in a state of *rest*, the quantity of *vital heat*, generated by the continued attractions of *oxygen* going on in the body, will be sufficient, with a certain quantity of clothing, for maintaining the temperature of about 97 degrees,

* The *oxygen air* thus procured to the blood from the want of the system, is said to proceed from the *vis medicatrix naturæ*, and by others from association or sympathy. Thus the call of the stomach for food after a fever does not arise from the stimulus of the gastric juice, but from the *want* of the system.

† Vide Sect. X. on the Balance betwixt Respiration and Digestion.

by which the solids receive their natural stimulus, the fluids retain their proper fluidity, and all the functions of life are duly performed, and a sufficient quantity abounds to carry off the perspirable fluid. If a man, exposed to a *frosty air*, continues at *rest*, the principles in his body attractive of *oxygen*, cannot generate a sufficient quantity of *vital heat* to keep every part of the body at its right temperature; because the coldness of the surrounding medium carries off *the heat* faster than *they* can produce it; consequently the solids and fluids of the extremities, and at the surface of the body, will become frigid, and the fibres torpid, and the death of the extreme, and lastly of the vital parts, ensue. But, on the contrary, when a man exposed to a *frosty air*, perceives the coldness, and torpor, arising from his body being deprived of its heat, faster than the principles in his body attractive of *oxygen* can furnish it; if he throws the *voluntary muscles* into action, the quantity of *heat* generated by the *nervous electricity*, will be sufficient to warm every part, and recover and maintain the natural temperature; although the air shall still continue to withdraw rapidly the *vital heat* from the surface of the body.

Some very pleasing experiments were made by the ingenious Dr. Peart, which prove that *partial exercise* conveys a glow over the *whole body*.

I. EXPERIMENT.

I put my hand, says he, first into cold water at 56 degrees of temperature. After fifteen minutes I withdrew it, and found the temperature of the water raised to 65.

It had gained, therefore, in fifteen minutes, 9 degrees of heat.

II. EXPERIMENT.

The same day I put my hand as before, but instead of keeping it, and my body, in a state of perfect rest, I threw many of the voluntary muscles into action, and in fifteen minutes the water at 56 degrees was raised to 73.

Here it had gained 17 degrees of heat.

III. EXPERIMENT.

To prove that the exertion of any set of muscles affects the quantity of heat generated within, and thrown off from the whole body, I introduced my hand into the same quantity of water, and at the same temperature as in the first experiment, and I pushed my feet against a large book-case, firmly fixed by its own weight, and my arms were forcibly stretched out. By the exertion of these few muscles only, without any motion of the fibres, so much of the *electric fluid** was transmitted to these

* Dr. Peart has the *nervous fluid*.

parts, and so much *heat* disengaged, that its *stimulus* extended over the *whole body*, and the water in fifteen minutes rose in consequence to 14 degrees, that is, five degrees more than when the body was in a state of perfect rest.

The same is proved, though not quite so philosophically, by the vulgar mode of warming the body by throwing the arms across; or by the more elegant, but partial, exercise of what are called dumb bells.

PRACTICAL OBSERVATIONS.

SECT XV.

ON THE NECESSITY OF USING EXERCISE.

To shew the absolute necessity of EXERCISE in *cold climates*, I must beg leave to relate the botanical excursion of Sir Joseph Banks, Dr. Solander, and others, on the heights at *Terra del Fuego*. Dr. Solander, who had more than once crossed the mountains which divide Sweden from Norway, well knew that *extreme cold* produces a torpor and sleepiness almost irresistible, he therefore conjured the company to keep always IN MOTION, whatever pain it might cost them, and whatever relief they might be promised by an inclination to rest: "*Whoever sits down, says he, will sleep; and whoever sleeps, will wake no more.*" Thus, at once admonished and alarmed, they set forward; but while they were still upon the naked rock, and before they had got among the bushes, the cold was so intense, as to produce the effects that had been most dreaded. Dr. Solander himself was the *first* who found the inclination, against which he had warned others, irresistible; and insisted upon

upon being suffered to lie down. Sir Joseph Banks intreated and remonstrated with Dr. Solander in vain: down he lay upon the ground, though it was covered with snow; and it was with great difficulty that his friend kept him from *sleeping*. One of his *black servants* also began to linger, having suffered from the cold in the same manner as the Doctor. Partly by persuasion, and partly by force, the company made them go forward. Soon, however, they both declared "they would go no farther." Sir Joseph Banks had recourse again to expostulation, but these produced no effect: when the black was told that if he did not go on he would in a short time be frozen to death; he answered, *that he desired nothing so much as to lie down and die*. The Doctor did not so explicitly renounce his life; he said he would go on, but that he must first take some "*sleep*," though he had before told the company that "*to sleep was to perish*." They both in a few minutes fell into a profound sleep, and after five minutes Sir Joseph Banks happily succeeded in waking Dr. Solander, who had almost lost the use of his limbs, and the muscles were so shrunk, that his shoes fell from his feet; but every attempt to relieve the unfortunate black proved unsuccessful.

The ten thousand Greeks in their memorable retreat in passing through Armenia were exposed, says Xenophon, to a contest still more dangerous than the enemy, in which neither skill nor valour could avail. The snow fell in such quantities during the night as
completely

completely covered the men with their arms. Their bodies when freed from the snow were benumbed and parched with the piercing coldness of the north wind. Many slaves and sumpter horses perished, with about thirty soldiers. It was observed that those died who did not use sufficient exercise. Xenophon came up to several soldiers who were lying down upon the snow, insisting upon their marching on; but although they had traversed such a great extent of country, and had the prospect of reaching their homes, such, says the historian, was the inclination to remain quiet, that many refused to move until their general threatened or inflicted violent punishment on them, even though they themselves knew it to be the only remedy against their distress. As the severity of the weather still continued during the remainder of their march through Armenia, several soldiers lost their sight by the glare of the snow, and their toes and fingers by the intenseness of the cold. The eyes, says Xenophon, were best defended by wearing something black before them, and the feet were preserved by *constant motion* in the day, and by stripping them bare during the night, and when frost-bitten, the friction was obliged to be with snow.*

It was a principle among the ancients, that *acute diseases* are from heaven, and *chronical* from ourselves; to die, says Dr. Johnson, is the fate of man,

* Vide On Asphyxia from Cold.

but to die with *lingering anguish* is generally his own folly. *Inactivity* never fails to induce an universal relaxation of the contractile fibres. When these fibres are relaxed, neither the *digestion*, the *circulation*, nor the *peristaltic motion*, can be duly performed.

It is absolutely impossible to enjoy health, where the *perspiration* also is not duly carried on; and that can never be the case where *exercise* is neglected.

The necessity of *action* is not only demonstrable from the fabric of the body, but evident from the observation of the universal practice of mankind, who for the preservation of health in those, whose rank or wealth exempts them from the necessity of lucrative labour, have invented sports and diversions, though not of equal use to the world with agricultural employments, yet of equal fatigue to those who practise them, and differing only from the drudgery of the husbandman, as they are acts of choice, and therefore performed without the painful sense of compulsion. The huntsman rises early, pursues his game, through all the dangers and obstructions of the chace, swims rivers, and scales precipices, till he returns home, no less harassed than the soldier, and has perhaps sometimes incurred as great hazard of wounds or death: yet he has no motive to excite his ardour; he is neither subject to the commands of a general, nor dreads any penalties for neglect and disobedience; he has neither profit nor honour from his perils and his conquest, but toils without the hopes
of

of mural or civil garlands, and must content himself with the praise of his tenants and companions.

But such is the constitution of man, that *labour* may be styled its *own reward*; nor will any *external excitements* be requisite, if it be considered *how much happiness* is gained, and *how much misery escaped*, by frequent and violent agitation of the body.

The desire of *exercise* is *coeval* with life itself. Were this principle attended to, many diseases might be avoided. But, while *indolence* and *sedentary* employments prevent two thirds of mankind from either taking sufficient exercise themselves, or giving it to their children, what have we to expect but disease and deformity? The *rickets*, so destructive to children, called by the *French* the *English disorder*, never appeared generally in Great Britain till manufactures began to flourish, and people, attracted by the love of gain, left the country to follow *sedentary* employments in great towns*.

Every animal makes an early use of its organs of motion; and many young creatures, even when under no necessity of moving in quest of food, cannot be restrained without force. This is evidently the case with the calf, the lamb, and the kitten. If these harmless animals were not permitted to *frisk* about and *take exercise*, they would soon die, or become diseased; and so strong is this *principle* implanted in the human breast, that a healthy youth can hardly

* Dr. Buchan.

be kept from exercise. This love of motion is surely a strong proof of its *utility*. Nature implants no disposition *in vain*. It seems a catholic law throughout the whole brute creation, that no creature, without *exercise*, shall be able to find subsistence. Every creature, except man, takes as much exercise as his nature requires. He alone sleeps till late in the morning in beds of down, and often lolls all day in easy chairs, and deviating from the great law of his Creator, he suffers accordingly.

If fashion must prevail, and young children be sent to *crowded* schools, we would recommend it to their teachers, as *they value the lives of those entrusted to their care, and the account they must one day give*, that they would allow their pupils a sufficient time to *run* and *frisk* about, instead of keeping them *hour after hour* in close and irksome confinement, which subjects them to a dreadful train of disease, flatulence, indigestion, colics, worms, &c. &c. and hinders them hereafter from being *happy* and *useful* members of society. From *this criminal folly*, says the emphatic Dr. Johnson, proceed most of those pains which wear us away slowly with periodical tortures, and which, though they sometimes suffer life to be long, condemn it to be useless, chain us down to the couch of misery, and mock us with the hopes of death.

Certainly man was never designed to be sitting all day *cross-legged* on a board. The *master*, who denies a sufficient time for *exercise* to those unhappy beings, whom PROVIDENCE has subjected to his will, has a
dreadful

dreadful reckoning to make, when each individual shall receive from the *same measure* he has meted out to others.

Were sedentary employments intermixed with a due quantity of exercise, they would never do much hurt. It is constant confinement that ruins health. A man will not be injured by sitting at his work three or four hours at a time; but if he be *obliged*, by an *unfeeling master*, to sit eight or ten, he will soon be said to drag on life instead of enjoying it. Weak and ailing, he will languish out a few miserable years, and at last sink into an untimely grave.

Weak fibres are the constant companion of *inactivity*. Nothing but daily *exercise* in the *open air* can brace and strengthen the powers of the *stomach*, and prevent therefore an endless train of diseases, which proceed from a relaxed state of that organ. We seldom hear the active or laborious complain of what are called *nervous diseases*; these are reserved for the sons of idleness. Many have been completely cured of these disorders by being reduced, from a state of opulence, to labour for their daily bread. This plainly points out the sources from whence *nervous diseases* flow, and the means by which they may be prevented.

Dr. Cheyne, in his excellent Treatise on Health, says, that the weak and valetudinary ought to make EXERCISE *a part of their religion*. We would recommend this, not only to the weak and valetudinary, but to sedentary artificers, shopkeepers, studious persons,

persons, &c. &c. Such ought to consider *exercise* as necessary a duty as to *take food*; and this might be usually done without any great loss of time or interruption to business.

Every man, in short, should oblige himself by some absolute rule to engage in *daily exercise*. *Indolence*, like other vices, when indulged, gains ground, and at length becomes agreeable. Hence many who were fond of *exercise* in the early part of life, become quite averse to it afterwards. Diseases are engendered destructive of the resolution of the mind. Nauseous drugs are had recourse to. The stimulus at the stomach spreads its influence for a time over the whole body. It at last loses its efficacy, or becomes prejudicial, and the *pale, flatulent, and bloated hypochondriac*, flies from physician to physician, none of whom dare advise him *EXERCISE*, which he is averse to, and says he cannot take, and he falls at last into diseases of a more serious aspect, and dies of spasm in the stomach, or dropsy, or asthma, or jaundice, or a cough with mucous expectoration, or palsy, or hæmoptoe, or some other disease that either arises from, or is always *engrafted* upon, a *weak and debilitated frame*.

————— Weariness

Can snore upon the flint, when resty sloth
Finds the down pillow hard.

SHAKESPEARE,

I

I shall

I shall conclude this long but *useful* essay with some beautiful lines from Armstrong, whose poem, entitled *the Art of Preserving Health*, might have possibly promoted the *discoveries* of the late Dr. Brown.

The shades descend, and midnight o'er the world
 Expands her sable wings. Great NATURE droops
 Through all her works. How happy he whose *toil*
 Has o'er his languid powerless limbs diffus'd
 A *pleasing lassitude*. He not in vain
 Invokes the gentle deity of dreams.—
By toil subdu'd, the warrior and the hind
 Sleep fast and deep:—*their active functions soon*
With generous streams their subtle tubes supply.
 Ere morn *the tonic irritable nerves*
 Feel the fresh impulse, and awake the soul. ♪

SECT. XVI.

OF THE BRAIN AND NERVOUS SYSTEM.

May not animals have a power of extracting from the blood the *electrical fluid*? The BRAIN then would be the great laboratory for this purpose. PRIESTLEY.

IT would be foreign to this publication to enter here into a minute description of the BRAIN, the MEDULLA SPINALIS, and the NERVES which proceed from thence, affording *sensation* and *motion* to the different parts of the animal frame. Suffice it then to say, that these are composed of two distinct parts; the MEDULLARY, or FIBROUS; and the CORTICAL PART, or VASCULAR: which parts are invested by their proper membranes, called the PIA, and DURA, MATER.

The *outer* or *cortical part* of the brain, spinal marrow, and nerves, are exceedingly *vascular*. Rhuyfch has made this very evident by his preparations. After a successful injection of his ceraceous matter into the carotid arteries, he found the cortical part of the brain became red; then separating a red portion of it from the rest, but cohering with the branch of an artery, and macerating it in water, till the mem-

branes putrified and dissolved off, he put what remained in spirits of wine, and found it to be red, very tender, flocculent, a fleecy, coherent substance, filled and tinged red, as far as the injection had reached; the oily nature of which had hindered it from being dissolved in water, as the membranes, and other parts that were not filled, had been. Such preparations Rhuyfch often made, and found the experiment succeed in like manner with the CEREBELLUM, SPINAL MARROW, and NERVES.

Now we have before shewn, that in every contraction of the heart, a very large quantity of blood was sent almost in a straight line from the heart, and therefore the blood, from its proximity to the brain, must move with a proportionate velocity. Haller computes that the heart sends to the brain one sixth of the whole mass of blood, Moirò at less. Let us therefore suppose, that the quantity thrown out by the left ventricle, at every pulse, is only one ounce and a half, which is a very low value, as the exactest and latest measures of the capacity of the ventricle run from one to three ounces. A sixth part of this is a quarter of an ounce. Let us take the number of pulses to be 60 in a minute, or 3600 in an hour, which is a very slow pulse. By this estimate, 900 ounces, or fifty-six pounds and four ounces, of *oxygenated* or arterial blood must arrive at the cortical part of the brain in an hour, which amounts to 1349 pounds in the natural

natural day to be returned to the four jugulars back again to the heart *unoxygenated*.

As so great a quantity of blood arrives at the brain in so short a space of time *oxygenated* (and though it were taken double, there would be no exaggeration of the matter), and passes thence *un-oxygenated*, is it not reasonable to suppose, that in the subtle vascular texture of the *cortical substance* there is strained off, or secreted from the *arterial blood*, a fluid, the finest, most attenuated, and most moveable in all the animal body, a fluid analogous to the matter of fire, or the *electric fluid*? and since the *medullary substance* of the brain is of a *fibrous composition*, the threads of which are disposed in a parallel direction (as is particularly obvious, even to the naked eye, in the corpora striata, the thalami of the optic nerves, especially of fishes, in the fornix and other parts of the brain when immersed in the nitrous acid), does not this subtle and penetrating fluid therefore cling to the MEDULLA, and pass along the NERVES at the command of the will, which are evidently of the same texture as the *brain*, just as the *electric fluid* is retained by the *main conductor*, and passes along a *wire* connected to it? If so, we have answered the question proposed by Sir Isaac Newton, "Is not *Vision* produced by an "*ethereal fluid*, or something analogous to this medium, excited in the bottom of the eye by the "*impulse of light*, and propagated along the solid, M 2 "pellucid,

“pellucid, and uniform fibrillæ of the optic nerves
 “to the place of sensation?”—“And is not *Hearing*
 “performed by the movement of this, or some other
 “analogous fluid, excited in the auditory nerves by
 “the percussion of the air along the solid, pellucid,
 “and uniform fibrillæ of those nerves into the place
 “of sensation, and so of the *other senses*?”—If
 so, these threads or fibres, called NERVES, are so
 many *electric conductors*. The *electricity* of each fi-
 bril is excited apart, and each part impresses a
 stroke upon the brain, which is proportioned to the
 impulsion they receive, and to the excitement of
 the *electric matter*. In this case, every nerve excites
 distinct impressions. Not only several impressions
 are made at the same time, but they are effected
 with a rapidity that refutes the idea of sluggish mat-
 ter, and which belongs uniquely to the *electrical fluid*.
 One may hear three or four sounds in succession,
 very distinctly, in the space of a quarter of a second.
 Between the time of touching a body, and the con-
 sciousness of it taking place, there is scarce any
 intermediate space which can be calculated by the
 known measures of time. However the sensation
remains for a short time after the object is gone.
 Thus, to use again the expressions of the immortal
 Newton, “If a stick burnt at one end be nimbly
 “moved round in a circle, with gyrations conti-
 “nually repeated, the whole circle will appear like
 “fire; the reason of which is, that the sensation of
 “the burning body, in the several places of that
 “circle

" circle *remains* impressed upon the brain until the
 " burnt end returns again to the same place. And
 " so in the quick consecution of colour, if all the
 " several colours into which light may be divided
 " by the prism, be painted on a card in their due
 " proportion, and whirled round any pointed body,
 " the impresson of every colour *remains* on the sen-
 " sorium, until a revolution of all the colours be
 " completed, and that first colour return again.
 " The impressons therefore of all the successive
 " colours *are at once in the sensorium*, and beget a
 " sensation of *white*." Thus also common *electricity*
 has a loitering pace, not easily reconcileable with
 its common immeasurable velocity.

The causes which excite sensation being without
 the body; to wit, the objects of the five senses;
 and external with respect to the medullary part of
 the brain, is it not reasonable to infer, that sensation
 is produced by the reflux of the *electric* or *nervous*
fluid moving along the nerves towards their origin,
 occasioned by the impulse of its objects or causes?
 Or is this fluid expended, and drawn off, and sen-
 sation the result of the determination of the *electric*,
 or nervous fluid, to the part stimulated?

In the exercise of voluntary muscular motion, it
 is no less natural to conclude, that the *electric fluid*
 is, by an effort of the mind, operating in a manner
 instantaneously, sent from its origin in the beginning
 of the medullary part, along the nerves, which are
 continued into the mechanism of the muscles.

With respect to the operations of the mind or soul, as *will, consciousness, memory, imagination, judgment, &c.* it is reasonable to suppose, that these are attended with respectively different motions of *this fluid*, separated from the CORTICAL and attracted by the MEDULLARY PART of this *wonderful organ*, the masterpiece of creative skill. We see this verified every day, when more or less of stimulating food, altering the action of the heart, a few drops of a certain liquor, or some grains of opium, entirely change our manner of seeing things, and consequently of judging of them. Do we but stand for a few seconds on our head, or turn round, and alter in the brain the current of blood, and how is the image of man, erect, and viewing the heavens, reversed ! He who could exclaim, "*These are THY wondrous works ; how wondrous then THYSELF !*" If more or less blood, or that not duly supplied with the vital principle in the air, be transmitted to the brain, how would the ideas of this sublime poet, respecting hideousness and holiness, vice and virtue, be confounded ! In the delirium of a fever, even in the mind of a Locke, how unproportioned to the reality would be the representation of things !

Moreover, as the faculty of thinking in general ripens and comes to maturity with the body, it is also observed to decay with it ; and if, in some cases, the mental faculties continue vigorous in extreme old age, or when the body is enfeebled, it is evidently because, in such particular instances, the
brain

brain is not much disturbed by the general cause of bodily weakness. But, on the other hand, if the brain itself be disturbed, as by actual pressure within the skull, by tumours, abscesses, inflammation, and, in a natural way, by sleep, the mental faculties are always proportionably affected.

At Paris there was a man whose head had been broken and trepanned. If the silver plate was removed, and the *cortical part* of the brain pressed, his sight would become dim; and if the pressure was increased, he would exhibit the abolition of sense and motion, or apoplexy, and immediately upon taking away the pressure (which he earnestly begged might be continued but a very short time), all his faculties returned unhurt.

The connexion of *mind* and *matter* however must not be *confounded*. The UNDERSTANDING, indeed, is the result of *mechanism*. The brain is an infinite assemblage of minute threads. These acquire force by exertion; thus, in learning to repeat by memory, the *electric* impulse of each word becomes concatenated, so that by reading the same thing over and over again, the whole lesson is acquired: thus the multiplication table is readily got by rote, and, when a boy is asked, how much is 4 times 9? he begins 4 times 4 is 16, and so gets down at last to 4 times 9 is 36.

To evince the *fibrous structure* of the organs of sense, the *retina* of an ox was suspended in a glass of warm water, and some caustic alkali being added

to it, as the adhering mucus was corroded, the *hair-like fibres* remained floating in the vessel.

Hence it seems, that the *organs* of *sense* are composed of *minute fibres*; and it is probable that the *locomotive muscles*, as well as the *vascular ones*, of microscopic animals have much greater *tenuity* than *these fibres* of the *retina*.

Besides the *similar laws*, which will be shewn in this volume to govern alike the actions of *sentient* and *muscular fibres*, there are many *other analogies* which exist between them.

They are both originally excited by *irritations* from without, are *alike* strengthened and fatigued by exertions, are *alike* painful if excited into action when *inflamed*, and are *alike* subject to *spasm*, *paralysis*, and the *torpor* of declining years.

The *retina*, as was before shewn, is an expansion of the optic nerve. Its branches are composed of infinite fibres. A part of these being exercised conveys a distinct idea. If the impulse be strong, the object is clear; if weak, the object is distant, and confused.

It is probable that sight bears no reference to the image of objects; no more than a looking glass sees, because it reflects the image of different objects: the image on the concavity of the eye is topsy turvy, and double to those who have two eyes; but the idea is the result of *impression* upright and single.

By this organ we can clearly explain our notion of INTELLECT as dependant upon *mechanism*. If the
 5 mechanism

mechanism of the eye be defective, we can acquire no ideas which result from this sense. If the optic nerve be palsied, or, on the contrary, if inflamed, that is, supplied with too much *blood*, or if *jaundiced*, sight is lost or imperfect; or if we make gyrations round one foot with the eyes shut, when we afterwards open them, the image of objects will appear in rotatory motion.

The anatomist, contemplating the *different structures* wherein the *same offices* are designed by an OMNIPOTENT POWER, discovers, "*that in animals the differences in structure affixed to the organs of sensation constitute the main differences in perception;*" for where the sense of smell, &c. as in the dog, is more acute than in us, the figure of that organ is more complex, and disclosing a greater degree of art: and "*that the powers of the nerves depend on the structure of the parts to which they are connected.*" Thus the nerve, which goes to the tongue, gives the sensation of taste, and supplies also the muscles moving that organ. The par vagum, which gives sensation to the stomach and lungs, likewise affords the power of motion to the muscles of the throat. And thus the sensation of touch may arise from the same nerves which pervade the muscular fibres.

This doctrine is beautifully displayed by the invaluable museum prepared by that first of anatomists and naturalists, the late John Hunter. Let it not, however, lead the enemy to philosophy (for some such characters there are) to object to him on
that

that account Materialism and the Disbelief of the doctrine of a future state.

For, however light may depend on *mechanism*, still it must not be *confounded* with it. The MIND or SOUL has a much higher origin than that of the perishable frame with which it is at present connected. It is neither *nerve* nor the *electric fluid*. These are only *its agents* in this its incarcerated state. When the "*silver cord*" is broken, which connects MIND and MATTER together, vitality ceases, the *body* then, with all its artful and numerous vessels, fibres, and nerves, and other exquisite *machinery*, undergoes decomposition, and is turned into its original elements; but the IMMORTAL SOUL, having shaken off this coil, is destined for a new residence; to flourish in eternal youth; to outlive the wreck of elements, and the crash of worlds. It is embodied even in its residence in another world. "Thou fool," says the philosopher and apostle, "that seed which thou sowest is not quickened except it die. And that which thou sowest, is not *that body* which shall be: but God giveth it a *body* as it hath pleased HIM, and to *every seed* its *own body*. —So also the *resurrection* of the dead. The body is sown (in the earth) in *dishonour*, it is raised in *glory*; it is sown in *weakness*, it is raised in *strength*. It is sown a *natural body*, it is raised a *spiritual*. Behold, I shew you a mystery. We shall not all sleep, but we shall all be *changed*. In a moment, in the twinkling



C. Rygle Del.

Engraved by J. Caldwell

EMBLEMS OF IMMORTALITY

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ling of an eye, at the last trump; for the trumpet shall sound, and the dead shall be raised *incorruptible*, and we shall be *changed*. For this *corruptible* must put on *incorruption*, and this *mortal* must put on *immortality*."

Man, therefore, is not what he will hereafter be. What we discover of him here below, is only the *gross foldage* under which he drawls upon the earth, and which he must shortly *cast off*.

Could not the *omnipotent* AUTHOR OF NATURE, who pre-ordained all beings from the beginning, who originally enclosed the *gaudy* and *winged butterfly* in the *chrysalis*, the *plant* in the *seed*, comprise the *spiritual body* in the *animal*?

The *animal body* has no other relation than to this earth. The *spiritual body* will have *enjoyments* which ear hath not heard, nor hath it entered into the heart of man to conceive; *new senses* will disclose themselves, and, by multiplying in an almost infinite degree his perceptions, his sphere will be aggrandized, and he will be equal to superior intelligences.

REVELATION informs us *it will be so*; and the parable of the *seed* is the most expressive and philosophic emblem of this wonderful pre-ordination.

The *senses*, as they will be brought into subjection to the soul, will no longer rule over her. Separated from *flesh* and *blood*, there will remain in her none of those earthly affections which resulted from them. Transported into the regions of light,
the

the human understanding will present no ideas to the will but those of the highest good. It will then have no other than lawful desires, and God will be their constant and ultimate end. It will love HIM from gratitude; will fear HIM from a principle of love; and will adore HIM as the *supremely amiable Being*, and as the *Eternal source* of life, perfection, and happiness.

Christians, who believe this doctrine of life, can ye have any dread of *death*? Your immortal spirits continually cleave to matter, and they are indissoluble; being henceforth united to an *unperishable* and *differently organized body*, she looks upon *death* as a happy *transformation*, which, by disengaging the seed from its foldage, will give a new being to the plant. “O *death*, where is then thy sting! O *grave*, where is thy victory!”

SECT. XVII.

OF GANGLIONS.

BESIDES progressive motion, the various movements of the hands, and other parts of animal bodies, which are performed by *muscles* curiously fashioned for each purpose and wisely distributed, there are *other motions* that, on the contrary, have little or no dependance on our inclination. Of this kind are the actions of the heart; the circulation of the blood; the motions of the stomach, and intestines; the progress of the chyle to the subclavian vein; the movement of the various secreted liquors, such as the gall, the saliva; &c. These, together with the lungs in respiration, have received the denomination of VITAL OR INVOLUNTARY MOTIONS, because they go on without any conscious exertions of the intellectual principle.

If such a variety of nice and complicated movements had been left to the determination of the will, it had occupied every moment of our thought, and had stopped during sleep, when consciousness is totally obliterated. We therefore here clearly discern the goodness of the ALMIGHTY, which has given man the absolute direction of no movements, but what are easily performed, and which contribute also to health and pleasure.

Physiologists

Physiologists were long perplexed to account, *how parts supplied with NERVES could be insensible*; and *how, though all the nerves terminate in the common sensorium or brain, over some organs the influence of the will extended, whilst the motions of others were INDEPENDANT of that principle*. They allowed the propriety of the final cause, and referred it to the wisdom of God primarily, whereas *philosophy* should look for *second causes**, which demonstrates the same goodness, with still greater power, in our beneficent CREATOR.

The solution of this difficulty was reserved for the glory of the present age. The GANGLIONS, which are hard and callous bodies attached to those nerves which supply the organs which have involuntary motion, did not indeed escape the all prying eye of anatomy: but their *uses* were long wholly unknown. Conjectures were indeed formed that they were muscles capable of contractions by which the nervous spirit was accelerated and impelled forwards: but they have been since found, from the experiments of the illustrious De Haller, incapable of such contraction, being wholly devoid of irritability. They have been represented as little brains to supply that afflux of nervous fluid which the incessant motions of the organs to which they went

* Aristotle, Cicero, Galen, Bacon, Boyle, Newton, and Locke, all concur in allowing that the *last link* in the chain of natural causes terminates at the throne of God.

seemed to require. Repetition and authority gave considerable weight to these conjectures, and we therefore are the less surpris'd that Dr. Johnson, the ingenious and learned discoverer of their *real use*, should complain :

“ It requires a long series of years for the admission of *new* truths. The period cannot be limited to thirty or forty years.

“ It depends on circumstances peculiar to the age, the subject, and the author's situation: and mine has no peculiar advantages.

“ It is thirty years since my early thoughts on the *uses* of the GANGLIONS of the nerves was communicated to my correspondents Dr. Whytt and Baron de Haller ; and twenty years since, on maturer reflection, I published an account of this *discovery* to the world.

“ My opinion has been silently attacked, and as silently adopted, without any explicit acknowledgment of the author, or any direct quotation from his work. Several of the objections which I have answered, were communicated in a correspondence with which I was honoured by Baron de Haller: and I have reason to think, from a letter afterwards received, my answers were satisfactory.

“ My ideas were received by Dr. M'Kettrick, and my work ingeniously analyzed by the celebrated Tiffot. I say nothing of the private, and perhaps partial, testimonies of my correspondents.

“ *But before truth, in its silent or disputed march,*
“ *has*

*“has roused the attention of the indolent, converted the
“supercilious, subdued the interested and obstinate, and
“reached the ears of all, an age has passed away.”!!!*

GANGLIONS, as we before observed, are attached wholly to nerves which supply the organs which have *involuntary motion*, and being NON-ELECTRIC BODIES*, *are the CHECKS which prevent our volitions from extending to them †, and also sensation from reaching the common sensorium.*

The motions of the largest masses, and the most minute particles of matter, all performed with the same order and ease, and regulated by laws surprisngly simple and extensive, penetrating the inmost recesses of bodies, and extended throughout the universe, evince the direction of an OMNIPOTENT ALMIGHTY POWER actuating the whole.

In every part and operation of nature, the fitness of things to one another, and their subserviency to the best ends, and to the use and felicity of intelligent

* If you stimulate any where a nerve *not* supplied with GANGLIONS, all the irritable fibres will be thrown into a state of action through the whole extent of the minute ramifications of that nerve: but, on the contrary, stimuli do not affect the heart, intestines, &c. when applied on the nerves *above* the GANGLIONS, but acting just *below* them, these organs are instantly strongly affected.

† In violent fits of passion the accumulated electric fluid of the nerves however passes these barriers, and the vital organs are immediately in agitation, and sometimes death ensues.

beings,

beings, point out the consummate wisdom and goodness of one GREAT ARTIFICER, one ORIGINAL MIND.

The course of nature is undoubtedly the effect of the incessant direction of the DEITY, no less than its creation and original arrangement: it seems impossible, and incomprehensible, that any mechanical power, any organization of mere matter, could of itself, without direction, or art, produce vegetables and animals, all machines of exquisite construction, at all times and every where arising, being in the strictest regularity and astonishing profusion: tasting life, and by an established order, made instinctive and blind instruments to bestow it upon others, and then retiring from this stage of existence as it were to make room for these.

The verdure of the field, and all its flowery plants, the humble shrub, the lofty trees, in infinite variety, are his constant care, as well as his bounteous gift. Sole giver of life, HE inspires with animation the meanest insect, and most abject reptile, no less than the more perfect and nobler animals, and by HIS wisdom guides them all to the several ends of their existence.

Every thing, in fine, on earth and in the heavens, manifests and presents HIM to us; and in the wonders of the lowest, as well as the most magnificent of his works, the understanding with adoration traces the perfections of a CREATOR, who is not far from

any one of us, for "*in his image created he man* *."

The mechanism of our body, the connexion and subserviency of all its parts to a common purpose, the exquisite contrivance of its organs, consisting of such various minute vessels, interwoven with wonderful art, have led anatomists in all ages to acknowledge an infinite wise and powerful MAKER. Among the most precious remains of antiquity, are those commentaries of Galen written on the uses of the several parts of the human body, as hymns and offerings of praise to the great CREATOR.

* If we impose a silence on our senses, and shut ourselves up for a while in the inmost recesses of our thoughts, and banish all earthly ideas, we shall then perceive the image of the TRINITY we adore. "Let us create *man after our image*," says our CREATOR.—We must now separate all idea of earthly parts, in order to comprehend this sublime mystery. Buried in deep contemplation, we first cannot but acknowledge a MIND which begets IDEAS, from whence proceed inward SATISFACTION or PAIN.—The *mind* is the UNDERSTANDING; the *ideas*, if written, are expressed by WORDS, and the *satisfaction* or *pain* is the DISPOSITION of soul resulting from both.—We cannot separate the *three*;—and supposing the *three* ETERNAL, neither is *one*, *before*, or *after the other*.—The THOUGHT, which we perceive springs up in our mind, is an image of the SON OF GOD.—Wherefore this SON OF GOD is called the WORD, and resulting from BOTH is the HOLY GHOST, or LOVE, for GOD is LOVE. With this conception of the *Trinity*, which may be seen in the works of St. Augustin and other of the ancient fathers, the Scriptures are *intelligible* to all persons, and not that *incomprehensible thing* which an improper interpretation may render it.



Engraved by J. Caldwell.

GALENI CONVERGIO.

Is it, indeed, otherwise conceivable how such consistency and harmony could have taken place in the different parts of our wonderful frame? How they could have so exactly fitted to each other, and to the exterior objects, which have an evident relation to them, and the system they compose? Could the bones*, which in all amount to four hundred, and the muscles, which are still more, and are each so well disposed for motion, be adjusted without a superior knowledge in mechanics? The eye, so admirably adapted to light, and appropriated to vision, was it formed without a knowledge of optics? Or the ear, without the science of sounds? Even our inclinations and passions, those sources of so much apparent ill, are, by the DEITY, providentially rendered the means of our preservation, both as individuals and a race; and the selfish and social affections, like centripetal and centrifugal forces, conduct us with proper force to the ends intended by our MAKER to be produced by them. Yet the love of life and all its enjoyments, the fear of death and all its dreadful harbingers, and the social affections and all its endearments, would not have been sufficient security for our carrying on the *vital motions*, with that constancy and uniformity necessary to the preservation of life, if, thus engaged, these motions had depended upon our will and choice.

* Vide the Plate, GALENO CONVERSIO, *The Conversion of Galen.*

Reason would have deliberated concerning them with too much slowness, and volition would have executed them often with a dangerous and fatal caprice. For, if the heart had been subjected to the soul's authority as much as the voluntary muscles are, if its motions could have been suspended or stopt with the same facility, death would then have cost us no painful pang: and, whenever the body was tortured with disease, and the mind in anguish from grief or disappointment, a remedy so easily applied might have been too frequently resorted to, and yet more unfortunate beings might have rushed uncalled into the presence of HIM who stationed us for the wisest reasons here on earth.

The preservation of life therefore greatly depends upon our *vital motions* being entirely subject to the wise government of the Author of our lives; who charges HIMSELF with the immediate care of them, and of us.

All this, when attentively considered, must affect us with a sense of GOD's goodness; who, respecting the imbecility of man's nature, hath been pleased, by appetites and passions, to excite him to acts of self-preservation; where the violence of these might have been hurtful, no less than the slowness and instability of reason, hath taken our safety under his more immediate direction. To attribute contrivances like these, and even understanding itself, to unintelligent causes, rather than to the all-wise

PARENT

PARENT OF NATURE, seems an incomprehensible perversion of reason and philosophy.

That mind must be strangely prepossessed and bewildered with false science, which rather seeks for the cause of these involuntary motions, in dead matter, organization, chance, necessity, something that, without knowledge or power, acts wisely and powerfully, than in *the great Fountain of power, wisdom, and animation.*

If chance could be supposed to produce a regular determined action, yet it is beyond the highest degree of credulity, to suppose it could continue this regularity for any time. But we find it remains through life independant of our will; and the same incessant vital actions have been carried on from the commencement of the world. It is thus that the sun's influence upon the earth hath ever been regular. The production of trees, plants, and herbs, hath ever been uniform. Every seed produces now the same fruit it ever did. Every species of animal life is still the same.—Could CHANCE continue *this regular arrangement*? Could any thing continue it but the hand of an OMNIPOTENT CREATOR?

MENTAL STIMULI.

SECT. XVIII.

OF VISION.

WHEN the sun rises on the face of the earth, *all nature* seems to have received *a new creation*. What *majesty*!—What *splendour*!—What *beauty*!

We will attempt, in as familiar a manner as possible, to explain to the attentive reader, *the nice mechanism* by which the sight is thus capable of communicating to the mind these *lively, varied, and abundant perceptions*.

In relation to the following law, “*that the rays of light are refracted* (or turned inwards) *according to the density of the medium through which they pass,*” our eyes consist of 3 *distinct humours of different densities*, each lodged in a transparent capsule, viz.

1. The EXTERNAL, OR AQUEOUS;
2. The CENTRAL, OR CRYSTALLINE; and
3. The INWARD, OR VITRIOUS.

Because light is subjected also to another law, the law of *reflection*, a DARK MEMBRANE lines the whole of the inside of the globe.

The OPTIC NERVE expands itself over the concave

cave bottom of this darkened sphere, whose fibres, in a collected body, terminate obliquely * in the brain.

At the fore part of the eye there is, as it were, a *partition*, in the center of which a round orifice, called the PUPIL †, is seen, which contracts or dilates itself, to admit of more or a less degree of light, by means of the muscular fibres of the IRIS or UVIA ‡.

* This might be adduced as a beautiful illustration of the beneficent intention of THE DIVINE ARCHITECT. A vein and artery accompany this nerve, so that when an object strikes upon it, sight is prevented. From the obliquity of the entrance of the optic nerve this does not often happen, but may be made to appear, if you form a dark spot on a piece of paper, and shutting one eye, turn this paper about, until the spot strikes on the trunk of the vein covering the optic nerve, when it will immediately disappear.

† This is the *small black circle* in the middle of the eye.

‡ Called *uvia*, from its supposed resemblance to a grape, being usually grey or black. This part is surrounded *externally* by the white of the eye, and *internally* by the pupil. The iris or uvia of a greyhound being put into an alkalescent mixture by Dr. Haighton, the *longitudinal fibres* were rendered visible. These *sympathize* with the optic nerve: for in gutta serena, or decay of energy in that nerve, the pupil remains unaltered in dimensions, however the light may vary. The *sympathy* of parts was before shewn, when discoursing on the synchronous action of the opposite sides of the heart, and is also displayed, when we irritate the nostrils, and excite into action the muscles of expiration, or when exciting the stomach by an emetic, the abdominal muscles, to favour each rejection, are thrown into convulsive efforts.

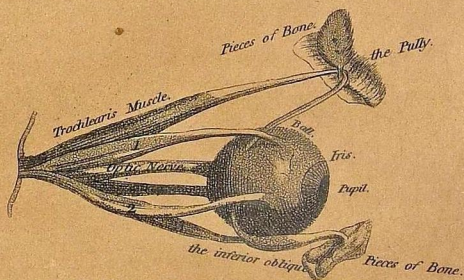
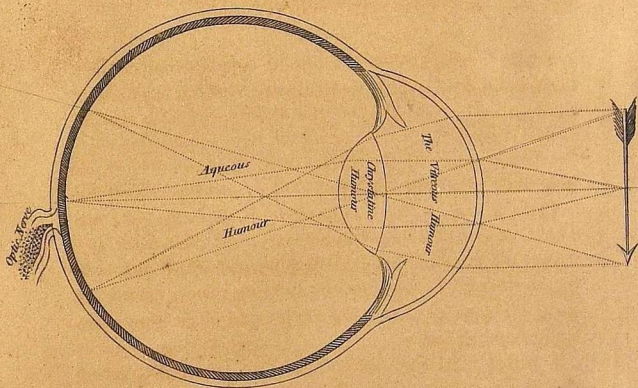
Six muscles * are placed behind, so as to turn this beautiful and useful organ on every side.

* The four right muscles arise near together from the bottom of the orbit, where the optic nerve enters, which they surround. The one lifts the eye directly upwards, another turns it downwards, a third draws the sight toward the nose, and the fourth turns it the contrary way. They terminate each in a broad, flat, and very white tendon, which covers all the fore part of the eye, up to the circle of the *cornea* (or outer convex capsule of the aqueous humour); and their white and shining tendons form that enamelled like part which surrounds the coloured circle, and which is, from its colour, named *the white of the eye*, or the *tunica albuginea*, as if it were absolutely a distinct coat.

So perfectly balanced are these muscles, that if they act all at once the eye is immoveably fixed. So that sometimes in an operation, the eye is found more firmly set than it could be either by instruments or the finger.

The two oblique muscles deserve also particular attention. The inferior oblique arises from the orbit, and obliquely descends into that cavity to be inserted under the eye-ball; and the superior oblique, on the contrary, arises along with the recti muscles, but sends forth a long tendon, which passes through a ring near the nose, and by this beautiful contrivance, it gets inserted into the upper part of the eye-ball. They project the eye forward, as when we strain to see distant objects.

Brutes have *another muscle* not found in our eyes. A surgeon attempting to extract the cataract from the eye of a blind horse, discovered this by accident, for as soon as the eye was touched, it receded deep into the head. This could be effected only by this *seventh* muscle; which therefore seems to be provided for defending the eye, by drawing it thus into the orbit, in creatures who have no hand, like us, to screen the eye upon the approach of danger.



1. 2. 3. 4. the four Recti,
or straight Muscles.

Thus have we a perfect *camera obscura*, with its different lenses; and the image painted in the darkened chamber of the eye (owing to the reflection of the rays of light from the objects around), by affecting the optic nerve, presents to the mind the varied and agreeable impression.

Should it be inquired, "*in what way* the optic nerve conveys the image of the objects around; and whether this arises from *vibration*, or *the motion of some fluid*?" The answer is, it must be confessed, of very difficult solution. But it seems highly improbable that a *soft inelastic cord*, like a nerve, can *vibrate*, and no *inert heavy fluid* can *equal the quickness of perception*.

We are then induced, says the celebrated naturalist, Bonnet, to admit that there is a subtle fluid in the nerves, whose tenuity prevents our seeing it; and which serves alike for the propagation of sensible impressions, as muscular motion. The *instantaneousness* of this propagation, and *some other phenomena*, indicate that there is *a certain analogy* between *this fluid* and the *electric fluid* *.

As we know, indeed, that a sixth part of the whole mass of blood is driven to the brain from the heart in an *oxygenated* form, and quickly returns thence *unoxxygenated* †, and is as speedily supplied by fresh *oxygenated* blood, it was attempted to be proved that this quantity of blood, when passing into so small

* Vide Sect. on *Muscular Motion*.

† Vide Sect. on the *Brain*.

an organ as the brain, could not be intended by frugal NATURE solely for nourishment, and the generation of vital heat, but most probably gave out its *oxygen* to be formed by the action of the brain into the *electric fluid*.

As *the nerves* of sight, and the other organs of sense, terminate in the BRAIN, we have the highest reason to believe that the SOUL is seated there.

A substance, therefore, indifferent to motion and rest, is related to a substance that thinks, and though unagitated by external impression, can generally at will regain the former connexion. From this surprising bond there springs a reciprocal commerce between two distinct beings, a kind of action and reaction, which constitutes the life of organized sentient beings.

The brain may therefore be compared to a *carte blanche*, receiving every impression; and to a *cabinet*, wherein the different portions of the universe are painted in miniature, and may be drawn out at pleasure.

S E C T. XIX.

OF HEARING.

As we saw different humours in the eye in relation to the laws of light, so we find a no less complicated structure of the ear in reference to the vibrations of the air. The uses, however, of the several parts forming the ear is not so well understood: but it behoves us, in contemplating the work of THE CREATOR, not to question the utility of any part; but to say, we find it here in this particular form, and therefore it must have its use.

The tremulous motions of the air are first received by the external ear. In men this part is much flatter than in brutes, but formed with certain folds, or inequalities, constituting a kind of winding passage for the air into the canal, which leads to the internal part of the ear.

THIS CANAL by its form would probably invite insects to make a lodgment in it, were it not defended by a tenacious and bitter substance, called the wax of the ear. But in birds, whose organs of hearing are sufficiently defended, no such secretion is observed.

Through this canal the pulsations of the air are conveyed to a membrane, called *membrana tympani*, stretched

stretched across it, and dividing the *external*, from what is called by anatomists, the *internal ear*.

From the tympanum, or drum, is an opening into the mouth. On one side of this passage, called the *Eustachean tube*, there is a cartilage, to which there is affixed a muscle, by which the passage may be varied, just as the muscular fibres of the uvula vary the dimension of the pupil for the admission of light. This opening is of so much importance towards hearing, that those who are in some measure deaf, are generally observed to open their mouths when they listen, whereby the vibrations of the air have a freer passage to the tympanum*.

Within the tympanum are lodged *four small bones* subservient to the office of hearing. These communicate with certain *bony* and *winding cavities*† lined on their inside with *nervous filaments*, which go to the brain by a common trunk.

It is generally believed, that the *tympanum* of the ear vibrates mechanically, when exposed to audible sounds, like the strings of one musical instrument,

* The charming contrivance for preventing the food from passing into the wind-pipe by means of a flexible covering, was before observed, and we may remark here a no less kind intention in PROVIDENCE towards man in furnishing him with the *wuala*, which, as the food is passing into the œsophagus, is drawn back, and closes the opening into the nose and Eustachean tube. Animals who are prone, not being subject to have any of their aliment pass through the nose, want therefore this defence.

† To wit, the *vestibulum*, *femicircular canals*, and *cochlea*.

when

when the same notes are struck upon another. Nor does this opinion seem improbable, as the muscles and bones of the ear seem adapted to increase or diminish the tension of the tympanum for the purposes of mechanical vibrations.

But it appears from dissection, that *the tympanum* *
is

* The situation of the *membrana tympani* is nearly horizontal in men and in brutes, which is the best position to receive sounds reverberated from the earth. In them it is *concave* outward; but in birds it is *convex* outward, so as to make the upper part of it nearly perpendicular to the horizon, which is best fitted for receiving of sounds in the air. This membrane does not entirely close the passage, but has, says Cheselden, on one side a small aperture covered with a valve. I found it, says he, once half open in a man that I dissected, who had not been *deaf*; and I have seen a man snook a whole pipe of tobacco through his ears, which must go from the mouth, by the passage of the Eustachean tube, through the tympanum; yet this man *heard* perfectly well. These cases occasioned me to break the tympanum in both ears of a dog, and it did not destroy his hearing, but he was much shocked at any loud sounds. In very young children I have always found this membrane covered with a *thick mucus*, which seems kindly provided for them, to prevent loud sounds from affecting them too much. A gentleman well known in this city, having had *four* children born deaf, was advised to lay blisters behind the ears of the next children he might have, which he did to *three* which were born afterwards, and every one of these heard perfectly well. It seemed not unreasonable to suppose that too great a quantity of this mucus upon the drum, or the deposition of coagulable lymph thrown out by inflammation, might be the cause of deafness in the four children, and that the discharge made by the blisters in the three latter cases,

was

is not the immediate organ of hearing, but that like *the humours of the eye*, it is only of use to *prepare* the object for the immediate organ. For *the auditory nerve* is not spread upon the tympanum, but upon the *vestibulum*, and *cochlea*, and *semicircular canals* of the ear; while between the tympanum and the expansion of the auditory nerve, the cavity is said by Dr. Meckel, to be filled with *water*; as he had frequently observed by freezing the heads of dead animals before he dissected them; and water being a more *dense fluid* than air, is much better adapted to the propagation of vibrations.

was the cause of their escaping the same misfortune. From these, and other like cases, it may be concluded, that the *membrana tympani*, though useful in hearing, is not the seat of that sense; and if any disease in that membrane should obstruct the passage of sounds to the internal parts of the ear, which are the seat of that sense, an artificial passage through that membrane might recover hearing, as the removing the *crystalline humour*, when that obstructs the light, recovers sight. Some years since a malefactor, who was deaf, was pardoned on condition that he suffered this experiment. As soon as this was publicly known, Mr. Cheselden, the lecturer on anatomy and surgery, and surgeon of St. Thomas's Hospital, was hooted and insulted in the streets, and having entered the theatre, the play was arrested by the cry of DRUM! DRUM! and he was obliged to leave the theatre, so violent at all times has been the indignation against men, who are inclined, from a philosophic conviction of truth, to *innovate*, or rather I might say, to *improve* the routine of things, and he was constrained by the public voice to desist from the attempt, and it is probable that the world will lose for ever the benefits that might have resulted from this experiment!

I shall not expatiate on *these reclude parts*; only there is one special contrivance of the nerves ministering to this sense of hearing, which I think ought not to be passed by. One of the branches of the auditory nerves is distributed partly to the muscles of the *ear*, partly to the *eye*, partly to the *tongue* and instruments of *speech**, and inosculated with the nerves that go to the *heart* and *breast*. By which means there is an admirable and useful *consent* between these parts of the body; it being natural for most animals, upon hearing any strange sound, to erect their ears, to open their eyes, and to be ready with the mouth to call out, or utter what the present occasion shall dictate. And accordingly it is very

* Every one in his childhood has repeatedly bit a part of the glass or earthen vessel, in which his food has been given him, and has thence had a very disagreeable sensation in the teeth, which sensation was designed by nature to prevent us from exerting them on objects harder than themselves. The jarring sound produced between the cup and the teeth is always attendant on this disagreeable sensation: and ever after, when such a sound is accidentally produced by the conflict of two hard bodies, we feel by association of ideas, the concomitant disagreeable sensation in our teeth. Others have, in their infancy, frequently held the corner of a silk handkerchief in their mouth, whilst their companions in play have plucked it from them, and have given another disagreeable sensation to their teeth, which has afterwards recurred on running the finger along those materials. DR. DARWIN.

A consent of parts may also exist, where the nerves cannot be traced as connected together.

common

common for most animals, when suddenly surpris'd in sleep with any loud noise, presently to shriek and cry out, and display a great palpitation of the heart.

Hearing is a sense much more necessary to man than to animals. With these it is only a warning against danger, or an encouragement to mutual assistance. In man, it is the source of most of *his pleasures*; and without which his reason would be of little benefit.

A man born deaf must necessarily be dumb; and his whole sphere of knowledge will in all probability be bounded only by sensual objects. We have an instance of a young man, who, being born deaf, was restored, at the age of twenty-four, to perfect hearing: the account is given in the Memoirs of the Academy of Sciences, 1703.

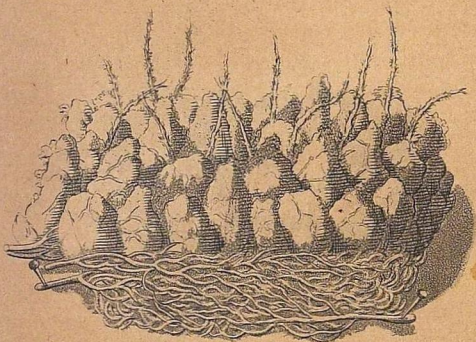
A young man of the town of Chartres, between the age of twenty-three and twenty-four, the son of a tradesman, and deaf and dumb from his birth, recovered his hearing, and in three months, by unremitting diligence, he understood what was said to him, and could join tolerably well in conversation. Soon after, some divines questioned him concerning his ideas of his past state; and principally with respect to God, his soul, and the morality and turpitude of actions. The young man, however, had not driven his solitary speculations into that channel. He had gone to mass, indeed, with his parents, had learned to sign himself with the cross, to kneel
down

down and assume all the grimaces of a man that was praying; But he did all this without any manner of knowledge of the intention or the cause; he saw others do the like, and that was enough for him; he led a life of pure animal instinct; entirely taken up with sensible objects, and such as were present, he did not seem even to make so many reflections upon these, as might reasonably be expected from his situation: and yet the young man was not in want of understanding; but the understanding of a man deprived of all commerce with others, is so very confined, that the mind is in some measure totally under the control of its immediate sensation.

Every country has its martial music, which is either marches, imitations of battles, or lamentations for the catastrophes of war, and the fall of chiefs. These strains, though often rude and untutored, seize the imagination in a high degree. The march is generally in regular measure, sometimes slow, and at other times lively and quick. The music, in imitation of battles, is constantly in every country wild, and abrupt in its transitions from interval to interval, and from key to key; various and desultory in its movements; frequently irregular in the return of its cadences; and, in short, through the whole, seems inspired with such fury and enthusiasm, that the hearer is irresistibly infected with all the rage of precipitate courage, however rude may be the accents by which it is kindled.

All nations, even the most barbarous, have their instruments of *music*; and what is remarkable, the proportion between their notes is in all the same as in ours. This, however, is not the place for entering into the nature of these sounds, their effects upon the air, or their consonances with each other. We are not now giving an history of sound, but of human perception.

All countries are pleased with *music*; and, if they have not skill enough to produce *harmony*, at least they seem willing to substitute *noise*. Without all question, noise alone is sufficient to operate powerfully on the spirit; and if the mind be already pre-disposed to joy, I have seldom found noise fail of increasing it into rapture. The mind feels a kind of distracted pleasure in such powerful sounds, braces up every nerve, and riots in the excess. But, as in the eye, an immediate gaze upon the sun will disturb the organ; so, in the ear, a loud, unexpected noise disorders the whole frame, and sometimes disturbs the sense ever after.



The Papillæ of the Finger as seen through a Microscope.

Waller del. et sculp.

London Published by G. & C. March 2. 1800.

SECT. XX.

OF THE TOUCH.

THE peculiar organ of this sense is *the skin*, which covers the whole body, it being needful that the surface should be provided with this sense, that nothing might come into contact with any part of our body, without being perceived.

If we consider the skin only, and reflect how accurately the mind distinguishes each particular portion, which is pressed by the several parts of any object, how surprising must it appear, that the nerves we find assigned to the skin, can supply such numbers of separate fibres, as are necessary for distinguishing in this manner the action upon each almost infinite minute part of so very extended a surface!

As one office of the skin is to be an emunctory, by which the redundancies or effete parts of the blood are thrown forth; for this end it is furnished with numerous pores in every part of it. But between these pores arise, from the external surface of the skin, NERVOUS PAPILLÆ, very minute and contiguous to each other, by which the office of touch is performed.

These are defended by a *mucous substance** spread between the *external* and *internal skin*, which being every where pierced through by *these papillæ*, receives the name of *RETE MUCOSUM*.

Besides the pain consequent upon injuries done to the skin, the primary object of sensation in these *papillæ* seems to be *hardness* and *softness*: such bodies as give way to the touch, we call *soft*; others, which resist pressure, so as to cause the skin to yield under them, we call *hard*. And how happily is this sense tempered between the two extremes; being neither too acute nor too obtuse!

By the touch, we correct the error of vision. Naturally every object we see appears to be within our reach, for a child, who has yet made but little use of his sense of feeling, would equally grasp at the moon as at objects within his reach. Mr. Chefelden, having couched a boy of thirteen for a cataract, who

* This gluey matter, soon after birth, grows of a *yellow tinge*, which increases in our riper age. It is *darker*, as the climate is hot, and as we become more exposed to it, and under the line it is of a perfect *black colour*, forming the chief contrast between *black* and *white* men. Dr. Beddoes, in the presence of some pupils who attended his chemical lectures at Oxford, having directed a *black* to immerse his hand in diluted oxygenated marine acid, the hand quickly became *milky white*; but the piebald negro resisted any further attempts. On the contrary, a French physician, it is said, by giving a reverend divine silver dissolved in the nitrous acid, converted him wholly into a *black*. Vide Dr. Beddoes' Works, and *La Médecine Eclairée par les Sciences*.

had hitherto been blind, and having thus at once restored him to sight, has curiously marked the progress of his recovery. He was, at first, couched only in one of his eyes; and when he saw for the first time, he was so far from judging of distances, that he supposed his eyes *touched* every object that he saw, in the same manner as his hands might be said to feel them. It may be for this reason that we often see horses frightened at things, which they have not become acquainted with by means of their nostrils, which serve them in some respects like our hands. The whiskers in animals serve them to measure apertures through which they have to pass.

It has been remarked, that even brutes are intelligent in proportion to the accuracy of their feeling, or as their extremities approach in resemblance to the human hand. The horse and the bull, whose feet are covered with callous hoofs, are less intelligent than the dog, and the dog is inferior in acuteness to the ape, who possesses a rude kind of hand.

This sense is the peculiar amusement of infants, and, as we before observed, perfects the sense of vision.

SECT. XXI.

OF THE SENSE OF PAIN.

BUT different from this, and constituting another species of *feeling*, are those sensations arising from different disturbances in the animal machine.

All these various sensations are so distinct one from another, that scarce any two parts of the body feel the same species of pain. The *head-ach*, *tooth-ach*, *ear-ach*, though ranged under one general name, are yet very different kinds of sensation. The pain which the *bowels* feel in cholics, is totally different from any of these; and the affection of the stomach, called *sickness**, is peculiar to that part, this organ being liable to other species of pain also. Again, the pain felt *in the breast* from the breath being straitened, has no kind of analogy with any of these, the breast being also subject to other pains, inflammation and the like. Nor are the several

* *Sickness* arises from *sensation*: hence it is always preceded by *nausea*. Van Swieten relates that Sydenham was once sick on seeing a putrid dead dog; coming past the same place *many years* afterwards, he felt a similar inclination to vomit. Hence if we cut the *par vagum*, the nerve leading to the stomach, no sickness can be excited in the dog by the most violent emetics.

modes of pain, to which our perishing bodies are subject in all their diverse parts, easily to be enumerated. But these variations principally merit our attention, as the different sensations of pain the same parts are subject to, may, so far as they can be described, point out the cause of each, and direct to the proper methods for removing them.

Pain always *stimulates* in proportion to its intensity and the sensibility of the part affected, and accordingly these convey their impression to the sensorium, which has a power even to stifle a part of the stimulus by resignation, or else add to it by the impatience of the will.

SECT. XXII.

OF THE SENSATION OF HEAT AND COLD.

THERE are many experiments in chemical writers, that evince the existence of HEAT *as a fluid element*, which covers and pervades all bodies, and is *attracted* by the *solutions* of some of them, and is *detruded* from the *combination* of others. Thus from the *combinations* of metals with acids, and from those *combinations* of animal fluids which are termed secretions, *this fluid matter of heat* is given out amongst the neighbouring bodies; and in the *solutions* of salts in water, or of water in air, it is *absorbed* from the bodies that surround them; whilst in its facility in passing through metallic bodies, and its difficulty in pervading resins and glass, it resembles the properties of the electric aura; and is like that excited by friction, and seems like that to gravitate amongst other bodies in its uncombined state, and to find its equilibrium*.

There is no circumstance of more consequence in the animal œconomy than a due proportion of this fluid of heat; for the digestion of our nutriment, and the conversion of it into chyle in the bowels,

* Dr. DARWIN.

and the proper qualities of all our secreted fluids, as they are produced partly by animal and partly by chemical processes, depend much on *the quantity* of heat; the excess of which, or its deficiency, alike give us pain, and induces us to avoid the circumstances that occasion them.

And in this the perception of heat essentially *differs* from the perceptions of the sense of touch, as we receive pain from too much pressure of solid bodies, but none from the absence of it. It is hence conjectured that our CREATOR has provided us with *the nerve of touch*, as distinct in itself as the optic, or any other nerve of sense, and *a set of nerves* for the reception of *this fluid*, which anatomists have not yet attended to.

There is another circumstance which would induce us to believe, that the perceptions of heat and cold do not belong to the organ of touch; since *the teeth*, which are the least adapted for the perceptions of solidity and figure, are the most sensible to heat or cold; whence we are forewarned from swallowing those materials, whose degree of coldness or of heat would injure our stomachs.

The following is an extract from a letter of Dr. Darwin of Shrewsbury, when he was a student at Edinburgh, to his friend Dr. Darwin of Derby.

DEAR SIR,

I MADE an experiment yesterday in the hospital, which much favours your opinion, "*that*
the

the sensation of HEAT and of TOUCH depend on different sets of nerves."

A man who had lately recovered from a fever, and was still weak, was seized with violent cramps in his legs and feet; which were removed by opiates, except that one of his feet remained insensible.

Dr. Ewart pricked him with a pin in five or six places, and the patient declared he did not feel it in the least, nor was he sensible even of a very smart pinch.

I then held a *hot iron* at some distance, and brought it gradually nearer and nearer, till it came within three inches, when he asserted he felt it quite distinctly.

I have the honour to be, &c. &c.

A gentleman, a patient of the author's*, had a paralytic stroke. He lost his feeling on one side and retained his muscular powers, and on the other he retained his feeling, and was deprived of all use of his limbs. A similar case is recorded by Dr. Falconer in his history of the Bath Waters. Does not this case seem to imply two distinct sets of nerves†?

* Mr. Kirkman of Broad-street.

† This subject deserves to be more particularly considered by both the anatomist and physiologist.

SECT.

SECT. XXIII.

OF SMELLING.

THE infinitely small particles that are continually detached from the surface of odoriferous bodies, float in the air, which transports them every where, and being drawn into the nostrils by the breath, are applied to the membrane that is distributed in the bony cavity in the inside of the nose. *This membrane* is totally covered with infinite ramifications, and convolutions of the *olfactory nerves*.

The great CREATOR, ever attentive to the ease and convenience of his creatures, has furnished the nostrils with a number of *glands*, or small arteries, which secrete a thick mucus, which defends the nerves from the slighter action of the air, or the too powerful stimulus of acrid odours.

Of all the senses, perhaps, there is not one in which man is more inferior to other animals than in that of *smelling*. A dog scents various kinds of game at considerable distances; and, if the fact were not confirmed by daily experience, it could hardly gain credit, that he can trace the odour of his master's foot through all the winding streets of a populous city!

In the selection of food, men are greatly assisted, even in the most luxurious state of society, by the sense

sense of smell. By *smelling* we often reject food as noxious, and will not risk the other test of *tasting*. Victuals, which have a putrid smell, as equally offensive to our nostrils as hurtful to our constitution, we avoid with abhorrence; but we are allured to eat substances which have a grateful and savoury odour. The more frequent and more acute discernment of brutes in the exercise of this sense is chiefly owing to their freedom, and to their using natural productions alone. But men in society, by the arts of cookery, by the unnatural assemblage of twenty ingredients in one dish, blunt, corrupt, and deceive, both their senses of *smelling* and of *tasting*.

It is not unworthy of remark, that, in all animals, the organs of *seeing*, *smelling*, and *tasting*, are uniformly situated very near each other. Here the intention of NATURE is evident. ° The vicinity of these three senses form a *triple* guard in the selection of food.

But assistance in the choice of food is not the only advantage that men and other animals derive from the sense of *smelling*. When our senses are not vitiated by unnatural habits, they are not only faithful monitors of danger, but convey to us the most exquisite *pleasures*. The fragrance of a rose, and the perfume of many other flowers, is not only pleasant, but gives a refreshing and delightful *stimulus* to the whole system, and may be considered therefore often as a species of wholesome excitement.

SECT. XXIV.

OF TASTE.

THE smell, as was before observed, has great connexion with the taste. We often are directed by it in judging of our food; and that part of taste which we usually call *flavour*, is a mixed kind of sensation compounded after some manner from both. By the communication between the nose and mouth, the olfactory nerves seem capable of being affected that way; insomuch, that persons who are at the pains to prevent the access of air by the nostrils, swallow nauseous draughts without tasting them.

The *gustatory nerves*, by which this sensation is received, rise upon the body of the *tongue* in a manner somewhat similar to those in the skin; for *PAPILLÆ* more visible than those of the skin (otherwise alike) appear in those parts of the tongue that are endued with this sense. These are always erected on the application of sapid or stimulating substances. This elevation and extension of the *papillæ*, by bringing larger portions of the nerves into contact with the substances applied to the tongue, give additional strength to the sensation, and enable us to judge with greater accuracy concerning their nature and qualities. The *saliva*, which perpetually moist-

ens the tongue, is a liquor which, though insipid itself, is found in all animals to be a very powerful solvent. Every substance applied to the tongue is partially dissolved by the saliva before the sensation of taste is excited. And hence when the tongue is rendered dry by disease, or any other cause, the sense of taste is either vitiated or totally destroyed.

The senses of *smell* and *taste* in many other animals greatly excel those of mankind, for in civilized society, as our victuals are generally prepared by others, and are adulterated with salt, spice, oil, and empyreuma, *we* do not hesitate about eating whatever is set before us, and neglect to cultivate these senses: whereas *other animals* try every morsel by the *smell*, before they take it into their mouths, and by the *taste* before they swallow it; and are led each to his proper nourishment by his organs of sense.

Nevertheless we may observe that *children*, having abundant excitability, are naturally inclined towards those foods which contain but little stimuli. And, on the contrary, *those* who are *more advanced in life*, and whose excitability is blunted, are fond of the most poignant dishes. Every one must remember how great a pleasure he found in sweets and milk while a *child*. As he *grew older* he insensibly calls to his assistance spices, salts, and aromatics; and delights in those tastes which in childhood he was unable to endure.

SECT XXV.

OF IMAGINATION.

AN animal may be said to fill up that sphere which he can reach by his senses; and is actually large in proportion to the sphere to which its organs extend. By *sight*, man's enjoyments are diffused into a wide circle;—that of *hearing*, though less widely diffused, nevertheless extends his powers;—the sense of *smelling* is more contracted still;—and the *taste* and *touch* are the most confined of all. Thus man enjoys *very distant objects*, but with *one sense only*; more *nearby* he brings *two senses* at once to bear upon them; his sense of *smelling* assists the *other two*, and at its own distance.

Each sense, however, the more enlarged its sphere, the more capable it is of making *combinations*; and is, consequently, the more *improveable*. Refined imaginations, and men of strong minds, take more pleasure, therefore, in improving the delights of the *distant senses* than in enjoying such as are scarce capable of improvement.

By combining *the objects* of the *extensive senses*, all the arts of poetry, painting, and harmony, have been discovered; but the *closer senses*, if I may so call them, such as smelling, tasting, and touching,
are,

are, in some measure, as simple as they are limited, and admit of little variety. *The man of imagination* makes a great and an artificial happiness, by the pleasure of *altering* and *combining*; the *sensualist* just stops where he began, and cultivates only those pleasures which he cannot improve. The *sensualist* is contented with those enjoyments that are already made to his hand; but *the man of refined pleasure* is best pleased with happiness of his own creating.

SECT. XXVI.

OF THE PASSIONS.

THE effect of different PASSIONS on the *voluntary* as well as *involuntary organs*, is a subject worthy of scrutiny, and has not been enough attended to by the physiologist. *Hope, fear, joy, grief*, are well known to display their signs externally. The character of each man can in general be read in his face. Dissocial passions, being hurtful by prompting violence and mischief, are noted by the most conspicuous external signs, in order to put us upon our guard: thus *anger* and *revenge*, especially when sudden, display themselves on the countenance in the most legible characters. The breathing is quick, with deep inspirations; hence the swelling of the nostrils, and projecting of the under lip; the accumulated nervous electricity now passes the GANGLIONS, which nature designed as *barriers* in the more tranquil hour, and flies to the heart, which propels with velocity the blood, which being very deeply *oxygenated* in its quick transit through the lungs, aids muscular exertion, inflames the eye, and reddens the countenance. The other internal viscera are also affected, and there is a suffusion of bile. In *fear* there is a deep inspiration, and it is long before the

air vitiated in the lungs is returned, the mouth is wide gaping, the nostrils closed and the heart receiving *unoxxygenated* blood palpitates, the countenance is livid, the hands pale, and swooning often ensues. The serpents in Africa, according to Vaillant, fix their eyes on a bird, and curling themselves up, so terrify these little creatures, that they are incapable of flight, and fall down from the bush or tree dead. *Sorrow* produces nearly the same inattention to respiration; hence the nostrils are drawn downwards, the mouth is half open for languid respiration, sighs are frequent, the face is of a lead colour, and the lips are pale. We shall not enter *now* more deeply into the question, but conclude by observing, that the *external signs* of passion are a strong indication that man, by his very constitution, is framed to be open and sincere. A child, in all things obedient to the impulses of nature, hides none of its emotions; the savage and clown, who have no guide but pure nature, expose their hearts to view, by giving way to all the natural signs. And even when men learn to dissemble their sentiments, and when behaviour degenerates into art, there still remains checks, that keep dissimulation within bounds, and prevent a great part of its mischievous effects. The total suppression of the voluntary signs during any vivid passion, begets the utmost uneasiness, which cannot be endured, but by the most practised villains. We may pronounce therefore, that *nature*, herself sincere and candid, intends that mankind should

preserve the same character, by cultivating simplicity and truth, and banishing every sort of dissimulation that tends to mischief.

I believe an attempt to set forth all the Emotions of the mind, and their Effects on the animal œconomy, would be a work extremely acceptable to the majority of readers: but our present task is only to consider some few emotions; though the variety of these is great, and worthy in every branch of that variety of an attentive investigation. The more accurately we search into the *human mind*, the stronger traces we shall every where find of HIS wisdom who made it. If a discourse on the use of the parts of the body may be considered as an hymn to the CREATOR; the use of the *passions*, which are the organs of the mind, cannot be barren of praise to HIM, nor unproductive of that union of science and admiration to ourselves, which a contemplation of the works of INFINITE WISDOM can alone afford to a rational mind; whilst, referring to HIM whatever we find of right, or good, or fair, in ourselves, discovering HIS strength and wisdom in our own weakness and imperfection, honouring them where we discover them clearly, and adoring their profundity where we are lost in our search, we may be inquisitive without impertinence, and elevated without pride; we may be admitted, if I may dare say so, into the counsels of the ALMIGHTY by a consideration of his works.

The *elevation* of the *mind* ought to be the principal end of all our studies. Whatever turns the soul inward on itself, tends to concenter its force, and to fit it for greater and stronger flights of science. By looking into physical causes, our minds are opened and enlarged; and in this pursuit, whether we take, or whether we lose our game, the chase is certainly of service. If we can direct the lights we derive from such speculations, whilst we investigate as far as possible the springs, and trace the effects of our *emotions*, we may not only communicate to the taste a sort of philosophical solidity, but we may *reflect back* on the *severer sciences* some of the *graces* and *elegancies of taste*, without which the greatest proficiency in those sciences will always have the appearance of something *disgustful* and *illiberal*.

SECT. XVII.

OF ANGER.

ANGER, in its operation on the animal œconomy, is one of the strongest of the *mental stimuli*. It rouses the heart and arteries into greater action, produces an ardent glow over the whole body, but more especially in the face; the eyes look red, the voice is loud, and the muscular powers are increased: hence gout, palsy, &c. have been all removed by violent paroxysms of rage.

But this stimulus is usually too active in its operation to be friendly to health.

Where revenge cannot be indulged, a paleness of the skin and cheeks quickly succeeds, the voice falters, and the limbs are affected with tremor. But where the object is perpetually calling for resentment, and this passion is not consumed in violent action, it then gives tone to the muscular fibre.

Upon the British fleet coming into the Bay of Hieres (February 1744), our men, says Mr. Ives, understood that the enemy's fleet and ours were soon to engage. There appeared, not only in the *healthy*, but also in the *sick*, the highest mark of satisfaction and pleasure, and *these last mended surprisingly daily*, insomuch that on the 11th of February, the day we

engaged the combined fleets of France and Spain, we had not above four or five but what were at their fighting quarters.

The Philadelphia militia who joined the remains of General Washington's army, in December 1776, and shared with them a few days afterward, in the capture of a large body of Hessians at Trenton, consisted of 1500 men, most of whom had been accustomed to the habits of a city life. These men slept in tents and barns, and sometimes in the open air, during the usual colds of December and January; and yet there were only two instances of sickness, and only one of death, in that body of men in the course of near six weeks, in those winter months. This *extraordinary healthiness* of so great a number of men, under such trying circumstances, can only be ascribed to the vigour infused into the body from the strong passions of the mind rendering the body insensible to the ordinary causes of disease.

Militia officers and soldiers, who enjoyed good health during the campaign, were often affected by fevers and other disorders, as soon as they returned to their respective homes. I knew one instance, says Dr. Rush, of a militia captain, who was seized with convulsions the first night he lay at ease, after having slept several months on a mattrass upon the ground. These affections appear to have been produced only by the sudden abstraction of that tone in the system which was excited by a sense of danger, and the other invigorating objects of a military life.

The

The patience, firmness, and magnanimity, with which the officers and soldiers of the American army endured the complicated evils of hunger, cold, and nakedness, can only be ascribed, continues this sagacious physician, to an insensibility of body, produced by an uncommon tone of mind, excited by the love of *liberty* and the *hatred* of the enemy: for the war was carried on by the Americans against a nation, to whom they had long been tied by the numerous obligations of consanguinity, laws, religion, commerce, language, interest, and a mutual sense of national glory; the *resentment* of the Americans rose of course, as is usual in all disputes, in proportion to the number and force of these ancient bonds of affection and union. On this same principle it is, that savages, to satiate their revenge, bear with uncommon patience, and without injury, all the severities of cold and hunger, and have been known to wait even eight or ten months in ambush to destroy an adversary.

SECT. XXVIII.

ON ENTHUSIASM.

It is well known that persons under strong pre-possessions of mind, have exposed themselves* to extreme bodily tortures without expression of pain, and have also endured long fastings, the extremities of heat and cold, the infection of contagious distempers, and other hazardous things without feeling the consequences that would most probably have taken place, had not the nervous feelings been more forcibly pre-occupied.

* *Tolerantia inediae atque algoris mirabilis.* Boerhaav. Aphorism. 1120.

SECT. XXIX.

OF LOVE.

Love, the most universal and grateful passion of human nature, which, in general, neither assumes the violence of *anger*, nor sinks into the depression of *grief*, may be considered as a *temperate stimulus*; but in its vicissitudes and extremes, it may acquire the impetuosity of the *first*, or the despondency of the *latter*.

In *love*, in *propitious love*, the heart beats with joy; vivacity cheers the countenance, the eye is brilliant, society is courted, language is animated, and vigour augmented.

But when this passion has taken deep possession of the heart and soul, with a *dubious*, or *adverse return*, it is expressed by deep involuntary sighs; every incident that excites emotion, especially the tender emotions of sympathy, makes the heart palpitate, and suffuses the face with faint blushes; the voice is low, languid, slow, or faltering; the eyes are downcast or pensive; and the breast heaves and falls, like the motion of gently disturbed waters. Solitude, shades, and evening walks, are frequented; objects of pity are cherished, and all the effusions of sentiment are tender, sedate, and sympathetic. The face at length becomes pale and wan, the eyes sink, the appetite for food is obliterated, and frightful dreams invade the tedious night.

SECT.

SECT. XXX.

OF SOCIAL AFFECTION.

THIS is the mildest and most agreeable of all the mental stimuli. It is this, says Lavater, which has sweetened every bitter of my life; this has alone supported me, when the sorrows of a wounded heart wanted vent. When my best endeavours were rejected, when the sacred impulse of conscious truth was ridiculed, hissed at, and despised, the tear of sorrow was ever wiped away by the gentle, tender, and affectionate address of a female mind, who had an aspect like that of unpractised, cloistered virginity, which felt, and was able to efface each emotion, each passion, in the most concealed feature of her husband's countenance, and by endearing means, without what the world would call beauty, always shone forth in countenance *heavenly* as an angel.

Sweet is the breath of morn, her rising sweet,
 With charm of earliest birds: pleasant the sun,
 When first on this delightful land he spreads
 His orient beams, on herb, tree, fruit, and flow'r,
 Glist'ning with dew; fragrant the fertile earth
 After soft show'rs; and sweet the coming on
 Of grateful evening mild: then silent night,

With

With this her solemn bird ; and this fair moon,
 And these the gems of heav'n, her starry train.
But neither breath of morn, when she ascends
With charm of earliest birds : nor herb, fruit, flow'r,
Glist'ning with dew : nor fragrance after show'rs :
Nor grateful ev'ning mild : nor silent night,
With this her solemn bird : nor walk by moon ;
 Or glitt'ring star-light, WITHOUT THEE IS SWEET.

MILTON.

SECT. XXXI.

OF VIRTUE.

VIRTUE, the strength and beauty of the soul,
 It pleases and it lasts;—a *happiness*
 That even above the smiles and frowns of fate
 Exalts great Nature's favourites: a *wealth*
 That ne'er encumbers, nor to baser hands
 Can be transferr'd: it is the only good
 Man justly boasts of, or can call *his own*.
 Riches are oft by guilt and baseness earn'd;
 Or dealt by chance, to shield a lucky knave,
 Or throw a fairer sunshine on a fool.
 But for one end, one much-neglected use,
 Are riches worth your care: (for Nature's wants
 Are few, and without opulence supplied.)
 This noble end is, to produce *the soul*;
 To shew the virtues in their fairest light;
 To make humanity the minister
 Of bounteous Providence; and teach the breast
 That *generous luxury* the good enjoy.
 Oh! blest of heav'n, whom not the languid songs
 Of luxury, not the inviting bribes
 Of fordid wealth, nor all the gaudy spoils
 Of pageant honour can seduce to leave
 Those ever-blooming sweets, which from the store
Of

Of Nature fair imagination culls
 To charm th' enliven'd soul! *For him*, the spring
 Distils her dews, and from the silken gem
 Its lucid leaves unfolds: *for him*, the hand
 Of Autumn tinges every fertile branch
 With blooming gold, and blushes like the morn.
 Each passing hour sheds tribute from her wings;
 And still new beauties meet *his* lonely walk,
 And loves unfelt attract him. Not a breeze
 Flies o'er the meadow, not a cloud imbibes
 The setting sun's effulgence, not a strain
 From all the tenants of the warbling shade
 Ascends, but whence *his bosom* can partake
 Fresh pleasure, *unreproved*.—Or when lightnings fire
 The arch of heav'n, and thunders rock the ground;
 When furious whirlwinds rend the howling air,
 And ocean, groaning from the lowest bed,
 Heaves his tempestuous billows to the sky:
 Amid the mighty uproar, while below
 The nations tremble, he, *good man*, looks abroad,
 From some high cliff, superior, and *enjoys*
 The elemental war.

ARMSTRONG.

SECT. XXXII.

OF HOPE.

THERE surely never was a greater number of cures ascribed to one person, than those, which were lately said to have been wrought in France upon the tomb of Abbé Paris, the famous Jansenist, with whose sanctity the people were so long deluded. The curing of the sick, giving hearing to the deaf, and sight to the blind, were every where talked of as the usual effects of that holy sepulchre. But what is more extraordinary, many of the miracles were immediately proved upon the spot, before judges of unquestioned integrity, attested by witnesses of credit and distinction, in a learned age, and on the most eminent theatre that is now in the world. Nor is this all: a relation* of them was published and dispersed every where; nor were the Jesuits, though a learned body, supported by the civil magistrate, and determined enemies to those opinions, in whose favour the miracles were said to have been wrought, ever able distinctly to refute or detect them.

Where

* A book was written by Mons. Montgeron, counsellor or judge of the parliament of Paris, a man of figure and character,

Where shall we find such a number of circumstances, agreeing to the corroboration of one fact?
And

ter, who was also a martyr to the cause. There is another book in three volumes (called *Recueil des Miracles de l'Abbé Paris*) giving an account of many of these miracles

Many of the miracles of Abbé Paris were proved immediately by witnesses before the officiality or bishop's court at Paris, under the eye of cardinal Noailles, whose character for integrity and capacity was never contested even by his enemies.

His successor in the archbishopric was an enemy to the *Jansenists*, and for that reason promoted to the see by the court. Yet 22 rectors or *cures* of Paris, with infinite earnestness, press him to examine those miracles, which they assert to be known to the whole world, and indisputably certain: but he wisely forbore.

The *Molinist* party had tried to discredit these miracles in one instance, that of Mademoiselle le Franc. But, besides that their proceedings were in many respects the most irregular in the world, particularly in citing only a few of the *Jansenists'* witnesses, whom they tampered with: besides this I say, they soon found themselves overwhelmed by a cloud of new witnesses, one hundred and twenty in number, most of them persons of credit and substance in Paris, who gave oath for the miracle. This was accompanied with a solemn and earnest appeal to the parliament.

All who have been in France about that time have heard of the reputation of Monsr. Hérault, the *lieutenant de Police*, whose vigilance, penetration, activity, and extensive intelligence, have been much talked of. This magistrate, who by the nature of his office is almost absolute, was invested with full powers, on purpose to suppress or discredit these miracles; and he frequently seized immediately, and examined the witnesses and subjects of them: but never could reach any thing satisfactory against them.

In

And what have we to oppose to such a cloud of witnesses, but the absolute impossibility or miraculous

In the case of Mademoiselle Thibaut, he sent the famous de Sylva to examine her; whose evidence is very curious. The physician declares, that it was impossible she could have been so ill as was proved by witnesses; because it was impossible she could, in so short a time, have recovered so perfectly as he found her. He reasoned, like a man of sense, from natural causes; but the opposite party told him, that the whole was a miracle, and that his evidence was the very best proof of it.

No less a man than the Duc de Chatillon, a duke and peer of France, of the highest rank and family, gives evidence of a miraculous cure, performed upon a servant of his, who had lived several years in his house with a visible and palpable infirmity.

I shall conclude with observing, that no clergy are more celebrated for strictness of life and manners than the secular clergy of France, particularly the rectors or curés of Paris, who bear testimony to these cures.

The learning, genius, and probity of the gentlemen, and the austerity of the nuns of Port-royal, have been much celebrated all over Europe. Yet they all give evidence for a miracle, wrought on the niece of the famous Pascal, whose sanctity of life, as well as extraordinary capacity, is well known. The famous Racine gives an account of this miracle in his famous history of Port-royal, and fortifies it with all the proofs, which a multitude of nuns, priests, physicians, and men of the world, all of them of undoubted credit, could bestow upon it. Several men of letters, particularly the bishop of Tournay, thought this miracle so certain, as to employ it in the refutation of atheists and freethinkers. The queen regent of France, who was extremely prejudiced against the Port-royal, sent *her own physician* to examine the miracle,

who

lous nature of the events, which they relate? And this surely, in the eyes of all reasonable people, will alone be regarded as a *sufficient refutation*.

The siege of Breda, in the year 1625, affords an example almost equally striking. "That city, from a long siege, suffered all the miseries that fatigue, bad provisions, and distress of mind could bring on its inhabitants. Among other misfortunes, the *scurvy* made its appearance, and carried off great numbers. This, added to the other calamities, induced the garrison to incline towards a surrender of the place, when the Prince of Orange, anxious to prevent its loss, and unable to relieve the garrison, contrived, however, to introduce letters addressed to the men, promising them the most speedy assistance. *These were accompanied with medicines against the scurvy, said to be of great price, but of still greater efficacy; many more were to be sent there. Three small vials of medicine were given to each physician. It was publicly given out, that three or four drops were sufficient to impart a healing virtue to a gallon of liquor.* We now displayed our wonder-working balsams. Nor even were the commanders let into the secret of the cheat upon the soldiers. They flocked in

who returned *an absolute convert*. In short, the supernatural cure was so incontestable, that it saved, for a time, that famous monastery from the ruin with which it was threatened by the Jesuits. Had it been a cheat, says Hume, it had certainly been detected by such sagacious and powerful antagonists, and must have hastened the ruin of the contrivers.

crowds about us, every one who had the scurvy soliciting that some part might be reserved for his use. Cheerfulness again appears in every countenance, and an *universal faith* prevails in the sovereign virtues of the remedies. The effect of this delusion was truly astonishing, *for many were quickly and perfectly recovered. Such as had not moved their limbs for a month before, were seen walking the streets with their limbs sound, straight, and whole.* They boasted of their cure by the Prince's remedy, the motion of their joints being restored by simple friction with oil, and the belly now of itself performed its office, or at least with a small assistance from medicine. Many, who had declared that they had been rendered worse by all former remedies, recovered *in a few days* to their inexpressible joy, and the no less general surprise, by their taking what we affirmed to be their gracious Prince's cure. "*This curious relation,*" adds Dr. Lind *, "*would hardly perhaps gain credit, were it not in every respect consonant to the most accurate observations, and best attested descriptions of that disease. It is given us by an eye-witness, an author of great candour and veracity, who, as he informs us, wrote down every day the state of his patients, and seems more to be surprised with their unexpected recovery than he probably would have been, had he been better acquainted with the nature of this surprising malady. An important lesson in physic,*" adds

* Lind on the Scurvy, p. 349.

this excellent writer, "is hence to be learned, the wonderful and powerful influence of the passions of the mind on the state and disorders of the body. This is too often overlooked in the cure of disorders, many of which are sometimes attempted by the sole mechanical operation of drugs, without calling in to our assistance the strong powers of the imagination, or the concurring influences of the soul. Hence it is, that the same remedy will not always produce the same effect, even in the same person, and that common remedies often prove wonderfully successful in the hands of men not of the faculty, which do not answer the purpose in a timorous and distrustful patient."

SECT. XXXIII.

OF FEAR,

OCCASIONING EXERTIONS OF THE MIND.

IN chronic diseases, as in hysteria and hypochondriac patients, in persons afflicted with asthma, or with a fit of the gout, tooth-ach, ague, or rheumatism, I have known these several disorders suspended for a time, and often entirely cured, when the mind has been under the influence of fear, surprise, or roused to a fixed attention to some interesting object.

I have frequently observed delicate hysterical women, who, for many months, had seldom enjoyed one day's health, suddenly relieved from every complaint when a favourite child was attacked with a disease in which danger was apprehended, and they continued, in appearance, to be in perfect health during the whole course of the illness, and exhibited an unusual alertness in discharging their duty as nurses and as parents. But when they understood that the danger of the disease was over, their former complaints gradually returned, to their great surprise; for, from so complete a suspension of their complaints as they had lately enjoyed, and for so

considerable a time, they believed themselves perfectly cured.

I have been also informed, from the best authority, that during the troubles in Scotland, in the years 1745 and 1746, hysterical and nervous disorders scarcely ever made their appearance.

A very remarkable instance of the influence the mind has upon disorders of the body, occurred to the celebrated Boerhaave. A person fell down in an epileptic fit in the sight of the other patients. The effect of this operated so strongly, that great numbers of them became immediately affected in the same manner. The opinion of the great physician above mentioned was requested on this occasion. He judiciously reflected, that, as these fits were originally produced by an impression on the mind, that the most proper means of cure would be to eradicate these impressions by others still more powerful. He therefore directed *actual cauteries* to be prepared, and kept hot, in readiness to be applied to the person who should next be affected. *The consequence was, not one person was seized.*

A gentleman of great courage and honour, who had become valetudinary, and subject to the asthma, by long service in India, as an officer in the land forces, told me, he was attacked with a severe fit of that disorder during their encampment, which usually lasted from ten to twelve days: that, upon the third or fourth day of his illness, when he could only breathe in an erect posture, and without mo-

tion, imagining that it was not in his power to move six yards to save his life, the alarm guns were fired for the whole line to turn out, because a party of the Mahrattas had broke into the camp; and fearing certain death if he remained in his tent, *he sprung out with an alacrity that amazed his attendants; instantly mounted his horse, and drew his sword with great ease, which the day before he could not move from its scabbard, though he had used his whole strength in the attempt.* From the instant of the alarm and surprise, the *debility* left him, together with the *asthma*; nor did the disorder return for some time after.

SECT. XXXIV.

ON THE PLEASURES OF THE POOR MAN.

—————Turn we to survey
 Where roughest climes a noble race display,
 Where the bleak Swifts their stormy mansions tread,
 And force a churlish soil for scanty bread.
 No product here the barren hills afford,
 But man and steel, the soldier and his sword.
 No vernal blooms their torpid rocks array,
 But winter lingering chills the lap of May;
 No zephyr fondly sues, the mountain's breast,
 But meteors glare and stormy glooms invest.

Yet still, e'en here, *content* can spread a charm,
 Redress the clime and all its rage disarm.—
 Cheerful at morn, he wakes from short repose,
 Breathes the keen air, and carols as he goes;
 With patient angle trolls the finny deep,
 Or drives his vent'rous plough-share to the steep;
 Or seeks the den where snow-tracks mark the way,
 And drags the struggling savage into day.
 At night returning, every labour sped,
 He sits him down the monarch of a shed;
 Smiles by his cheerful fire, and round surveys

His childrens' looks, that brighten at the blaze ;
While his lov'd partner, boastful of her hoard,
Displays her cleanly platter on the board,
And haply too some pilgrim, thither led,
With many a tale repays the nightly bed.

GOLDSMITH.

SECT. XXXV.

ON THE ADVANTAGE OF A CULTIVATED MIND.

Such are the charms to barren states assign'd,
 Their *wants* but *few*, their *wishes* all confin'd.
 Yet let them only share the praises due ;
 If *few* their *wants*, their *pleasures* are but *few* ;
 For *every want* that stimulates the breast
 Becomes a *source* of *pleasure* when redrest.
 Whence from such lands each pleasing science flies,
 That first excites desire, and then supplies ;
 Unknown to them, when sensual pleasures cloy,
 To fill the languid pause with finer joy ;
 Unknown those powers that raise the soul to flame,
 Catch every nerve and vibrate through the frame.
 Their level life is but a mould'ring fire,
 Unquench'd by want, unfann'd by strong desire ;
 Unfit for raptures ; or, if raptures cheer
 On some high festival of once a year,
 In wild excess the vulgar breast takes fire,
 Till, buried in debauch, the bliss expire.

THERE is not, says Dr. John Brown, a *finer stimulus*, than the pleasurable feeling proceeding from a happy train or flow of thinking ; hence the delight that arises from a flight of *wit*, or from a pleasant vein

vein of *humour* ; hence all the fine feelings of the *belles lettres* ; hence in youth, the *enthusiasm*, so natural to the human feelings, to out-strip all others in every mental excellency. The arts, the sciences, every department of human knowledge, are all the effects of that intellectual propensity. How happy would it be for mankind were this noble stimulus duly cherished ! What benefits, which society is deprived of, would not accrue from a proper cultivation of it ! What must have been the delight of Pythagoras, when he found out the forty-seventh proposition ! He jumped about in an ecstasy, crying out *Eureka* ; and was so much more substantial than his other few brother discoverers, as to possess the means of offering a sacrifice of an hundred fat bullocks to the gods ! How delightful must the feelings of Milton have been, in whose works every page is an effort of the most beautiful, and of the most sublime, conceptions of human genius ! What were the lively sensations of Pope, Cowley, and Darwin, whose sportive imaginations called at will myriads of beautiful scenes ! How delightful the emotions of those orators, whose eloquence has saved their respective countries ; of those preachers, who have rooted out the malignant passions, and implanted in their room the most perfect philanthropy ; and lastly, of that physician from whose philosophy a NEW MEDICINE hath arisen with healing on her wings !

SECT. XXXVI.

THE PLEASURES OF SIR ISAAC NEWTON.

SHALL the great soul of NEWTON quit this earth,
 To mingle with *his stars*; and every muse,
 Astonish'd into silence, shun the weight
 Of honours due to his illustrious name?
 But what can *Man*? Ev'n now *The Sons of Light*,
 In strains high warbled to seraphic lyre
 Hail *his arrival* on the coast of bliss.
 Yet am not I deterr'd, though high the theme,
 And sung to harps of angels, for with you
 Ethereal Flames! ambitious, I aspire
 In NATURE'S *general symphony* to join.

Have ye not listen'd while HE bound the *suns*,
 And *planets*, to their spheres! th' unequal task
 Of human kind *till then*. Oft had they roll'd
 O'er erring man the year, and oft disgrac'd
 The pride of schools, before their course was known
 Full in its causes, and effects, to *him*
All-piercing sage! who sat not down and dream'd
 Romantic schemes, —————
 But, bidding his *amazing mind* attend,
 And with *heroic patience*, years on years,
 Deep-searching, saw at last THE SYSTEM dawn,
 And shine, of all his race, on HIM alone.

O, in-

O, ineffable magnificence divine !
 O, wisdom truly perfect ! thus to call
 From a *few causes* such a scheme of things,
 Effects of various, beautiful, and great,
 An *universe complete* ! And O belov'd
 Of heav'n ! whose well-purg'd, penetrating, eye,
 The mystic veil transpiercing, in'y scann'd
 The rising, moving, wide-establish'd frame,
 Who, while on this dim spot, where mortals toil
 Clouded in dust, from motion's *simple laws*
 Could trace *the secret band* of PROVIDENCE
Wide-working through this universal frame.

WHAT WERE HIS RAPTURES THEN ! HOW
 PURE ! HOW STRONG !

And what *the triumphs* of old Greece and Rome
 By *his* diminish'd, but the pride of boys
 In some small fray victorious ! when instead
 Of shatter'd parcels of this earth usurp'd
 By violence and blood, NATURE herself
 Stood, *all subdu'd by him*, and open laid
 Her every latent glory to *his* view.

HE first of men, with awful wing pursu'd
 The *comet* through the long elliptic curve,
 As round innumerable worlds he wings his way ;
 Till, to the forehead of our evening-sky
 Return'd the blazing wonder glares anew, .
 And o'er the trembling nations shakes dismay.

All intellectual eye, our solar round
 First gazing through, HE, by the blended power
 Of GRAVITATION and PROJECTION, saw
The whole in silent harmony revolve.

From unassisted vision hid, the *moons*
 To cheer remoter planets numerous form'd
 By HIM in all their mingled tracts were seen.

HE also fix'd our *wandering queen of night*,
 Whether she wanes into a scanty orb,
 Or, waxing broad, with her pale shadowy light,
 In a soft deluge overflows the sky.

Her every motion clear-discerning, HE,
 Adjusted to the billowy main, and taught
 Why now the mighty mass of water swells
 Resistless, heaving on the broken rocks,
 And the full river turning; till again
 The tide revertive, unattracted, leaves
 A yellow waste of idle sands behind.

Then breaking hence, HE took his ardent flight
 Through the blue infinite; and *every star*
 Which the clear concave of a winter's night
 Pours on the eye, or astronomic tube,
 Far-stretching, snatches from the dark abyss,
 Or such as farther in successive skies
 To fancy shine alone, at *his approach*
Blazed into SUNS, the *living center* each

Of

Of an *harmonious system* : all combin'd
 And rul'd unerring by that *single power*•
 Which draws the stone projected to the ground.

The heavens are all his own ; from the wild rule
 Of whirling vortices, and circling spheres,
 To their *first great simplicity* restor'd.

Th' aerial flow of *sound* was known to him,
 From whence it first in wavy circles breaks,
 Till the touch'd organ takes the message in.

Nor could the darting beam, *speed* immense,
 Escape his swift pursuit, and measuring eye.

Even *light* itself, which every thing displays,
 Shone undiscover'd till his brighter mind
Untwisted all the *shining robe* of *day* ;
 And, from the whitening undistinguish'd blaze,
 Collecting every ray into his kind,
 To the charm'd eye educ'd the gorgeous train
 Of parent colours. First the flaming *red*
 Sprung vivid forth ; the tawny *orange* next ;
 And next delicious *yellow* ; by whose side
 Fell the kind beams of all refreshing *green*,
 Then the pure *blue*, that swells autumnal skies,
 Ethereal play'd : and then, of sadder hue,
 Emerg'd the deepened *indico*, as when
 The heavy skirted evening droops with frost,

While

While the last gleamings of refracted light
Dy'd in the fainting *violet* away.

The noiseless tide of time, all bearing down
To vast eternity's unbounded sea,
He stemm'd alone : and to the source (involv'd
Deep in primeval gloom) ascending, rais'd
His vivid lights to pilot home the *deep*
Historian, wilder'd in his darksome way.

But who can *number* up his *labours* ? who
His high *discoveries* sing ? When but few
Of the deep-studying race can stretch their minds
To what he knew : in fancy's lighter thought,
How shall the muse *then* grasp the *mighty theme* ?

THOMSON,

SECT. XXXVII.

OF AMBITION.

Sweet is the concord of harmonious sounds,
 When the soft lute, or pealing organ strikes
 The well-attemper'd ear ; sweet is the breath
 Of honest love, when nymph and gentle swain
 Waft sighs alternate to each other's heart :
 But not the concord of harmonious sounds,
 When the soft lute, or pealing organ strikes
 The well attemper'd ear ; nor the sweet breath
 Of honest love, when nymph and gentle swain
 Waft sighs alternate to each others heart,
 So charm with ravishment the raptur'd sense,
As does the voice of well-deserv'd report
Strike with sweet melody the conscious soul !

ALTHOUGH *imitation* is one of the greatest instruments used by PROVIDENCE in bringing our nature towards its perfection, yet if men gave themselves up to *imitation* entirely, and each followed the other, and so on in an eternal circle, it is easy to see that there never could be any *improvement* amongst them. Men must remain as brutes do, the same at the end as they are at this day, and that they were in the beginning of the world. To prevent this,

GOD

GOD has planted in man a sense of *ambition*, and a satisfaction arising from the contemplation of his excelling his fellows in something deemed valuable amongst them. It is this passion that creates advantages we all derive in civilized life, and it is this passion also, ill directed, which often unfortunately hinders men from granting to *Genius* its due.

SECT. XXXVIII.

ON LIBERTY.

My soul is sick with ev'ry day's report
 Of wrong and outrage with which earth is fill'd.
 There is no yielding flesh in man's hard heart,
 It does not feel for man. The nat'ral bond
 Of brotherhood is sever'd as the flax
 That falls asunder at the touch of fire.

He finds his fellow *guilty* of a *skin*
 Not *colour'd* like *his own*; and having pow'r
 T' inforce the wrong, for such a *worthy cause*
 Dooms and devotes him as his lawful prey.
 Thus man devotes his brother;
 And worse than all, and most to be deplor'd,
 As human nature's broadest, foulest blot,
 Chains him, and tasks him, and exacts his sweat
 With stripes, that mercy with a bleeding heart
 Weeps when she sees inflicted on a *beast*.

Then what is man? And what man seeing this,
 And having human feelings, does not blush
 And hang his head, to think himself a man?
 I would not have a slave to till my ground,
 To carry me, to fan me while I sleep,
 And *tremble* when I wake, for all the wealth
 That sinews bought and sold have ever earn'd.

No:

No : dear as freedom is, and in my heart's
 Just estimation priz'd above all price,
 I had much rather be myself the slave,
 And wear the bonds, than fasten them on him.
 We have no slaves at home, then why abroad ?
 And they themselves, once ferried o'er the wave
 That parts us, are emancipate and loos'd.
 Slaves cannot breathe in England ; if their lungs
 Receive our air, that moment they are free ;—
 They touch our country, and their shackles fall.
 That's noble, and bespeaks a nation proud
 And jealous of the blessing. Spread it then,
 And let it circulate through every vein
 Of all your empire, that where Britain's power
 Is felt, mankind may feel her mercy too.

COWPER.

O *Liberty*, thou goddess heav'nly bright,
 Profuse of blifs, and pregnant with delight !
 Eternal pleasure in thy presence reign,
 And smiling plenty leads thy wanton train ;
 Eas'd of her load, subjection grows more light,
 And poverty looks cheerful in thy sight ;
 Thou mak'st the gloomy face of nature gay,
 Giv'st beauty to the sun, and pleasure to the day.
Thee, goddess, *thee* Britannia's isle adores ;
 How has she oft exhausted all her stores,
 How oft, in fields of death, thy presence sought,
 Nor thinks the mighty prize too dearly bought !

On foreign mountains, let the sun refine
 The grape's soft juice, and mellow it to wine ;
 With citron groves adorn a distant soil ;
 And the fat olive swell with floods of oil :
We envy not the warmer clime, that lies
 In ten degrees of more indulgent skies,
 Nor at the coarseness of our heav'n repine,
 Though o'er our heads the frozen pleiads shine ;
 'Tis *Liberty* that crowns Britannia's isle,
 That makes her barren rocks and bleakest moun-
 tains smile.

ADDISON.

SECT. XXXIX.

THE SAME SUBJECT CONTINUED.

Thee therefore, still blame-worthy as thou art,
 With all thy loss of empire, and though squeez'd
 By public exigence till annual food
 Fails for the craving hunger of the state,
Thee I account still *happy*, and the chief
 Among the nations, seeing thou art FREE!
My native nook of earth! thy clime is rude,
 Replete with vapours, and disposes much
 All hearts to sadness, and none more than mine;
 Thine unadulterate manners are less soft
 And plausible than social life requires,
 And thou hast need of discipline and art
 To give *thee* that which warmer climes receive
 From NATURE's bounty, *that humane address*
 And *sweetness*, without which *no pleasure* is
 In converse, either starv'd by cold reserve,
 Or flush'd with fierce dispute, a senseless brawl;
 Yet being FREE, I love *thee*. For the sake
 Of that ONE FEATURE, can be well content,
 Disgrac'd as *thou* hast been, poor as *thou* art,
 To seek no sublunary rest beside.
 But ONCE ENSLAVED, farewell! I could endure
 Chains no where patiently, and chains at home,
 Where I am FREE by birthright, not at all.
 ——— I should then with double pain
 Feel all the rigour of the fickle clime,
 And if I must bewail the blessing lost,
 For which our Hampdens and our Sidneys bled,

I would at least bewail it under skies
 Milder, among a people less austere,
 In scenes which, having never known me FREE,
 Would not reproach me with the loss I felt.

COWPER.

THERE are two great tyrannies, the tyranny of a despot, and that of a multitude. Of these the most dreadful is *republican tyranny*. The despot may receive the just blow, and fall from his high elevation, nothing is required but the arm of a Brutus: but the destruction of the many headed monster is an herculean labour. In despotic states, as well as in republics, the downfall of the ministers of government is usually effected by the death of the parties. In the former, they quietly yield up their breath; in the latter, the struggle is attended with a dreadful convulsion, and the superior faction gains the ascendancy after a mighty carnage.

Situated *between* the two stands, the MIXED FORM of GOVERNMENT, a GOVERNMENT *nicely poised between* THE EXTREMES OF TOO MUCH LIBERTY and TOO MUCH POWER, where an unsuccessful and improvident minister is displaced without the loss of life, and the murder of his friends, and where the several parts of the CONSTITUTION are so framed, that they serve as a check to each other; a CONSTITUTION, where the king is clothed with a power, that enables him to do all the good he has a mind to; and wants no degree of authority, but what a good prince would not, and an ill one ought

ought not to have: where he governs, though not absolutely, yet gloriously, because he governs men, and not slaves; and is obeyed by them cheerfully, because they know that, in obeying him, they obey those laws only which they themselves have had a share in contriving.

It is undoubtedly very natural for men to think *that form of government* the best, under which they draw their first breath, and to propose it as a model and standard for all others. But, if any people upon earth have a just title thus to boast, it is *we of this island*; who enjoy a CONSTITUTION, wisely moulded, out of all the different forms and kinds of civil government, into such an excellent and happy frame, as contains in it all the *advantages* of their several forms, without sharing in any of their *great inconveniences*. Our MIXED FORM of GOVERNMENT is authorised by lawyers, admired by strangers, recommended by divines, acknowledged by politicians, acquiesced in, nay passionately cherished, by *the people* in general; and all this during a period of at least a *hundred and eighty years*. This general consent surely, during so long a time, must be sufficient to render any constitution legal and valid: if the origin of all power be derived, as is alledged, from the people; here is *their consent* in the fullest and most ample terms that can be derived or imagined. We must be all sensible that the plan of liberty is settled; its happy effects are proved by experience; a long tract of time has given it

stability. We must be sensible, that public liberty with internal peace and order, has flourished almost without interruption: trade and manufactures, and agriculture, have increased: the arts and sciences, and philosophy, have been cultivated. Even religious parties have been necessitated to lay aside their mutual rancour: and the glory of the nation has spread itself all over Europe; derived equally from our progress in the arts of peace, and from our valour in war. *So long and so glorious a period no nation almost can boast of: nor is there another instance in the whole history of mankind, that so many millions of people have, during such a space of time, been held together, in a manner so free, so rational, and so suitable to the dignity of human nature.*

SECT. XL.

OF PATRIOTISM.

Dulce et decorum est pro patria mori.

Dear is the tie that links the anxious fire
 To the fond babe that prattles round his fire ;
 Dear is the love that prompts the generous youth,
 His fire's fond cares and drooping age to sooth ;
 Dear is the brother, sister, husband, wife,
 Dear all the charities of social life :—
 But not th' endearing springs that fondly move
 To filial duty or parental love ;
 Nor all the ties that kindred bosoms bind,
 Nor all the friendship's holy wreaths entwin'd,
 Are half so dear, so potent to controul
 The generous workings of the patriot soul,
 As is that *holy voice* that cancels all
Those ties, that bids him for his country fall.
At this high summons with undaunted zeal
He bares his breast ; invites the impending steel :
Smiles at the hand that deals the fatal blow,
Nor heaves one sigh for all he leaves below.

WHEN Edward the Third, disappointed of the
 throne of France by the brave resistance of the gar-
 rison

rison of Calais, resolved to take revenge, and demanded six of the principal inhabitants of that place to be led to him with halters about their necks, as a due atonement for the crime of resistance to their lawful sovereign, as he chose to style himself, the governor, Eustace Saint Pierre, first of all voluntarily and cheerfully gave himself up as a ransom for the city, and "*I doubt not,*" says he, "*there are many here as ready, nay, more zealous for this martyrdom than I can be, however modesty and the fear of imputed ostentation may withhold them from being foremost in exhibiting their merits.*"—"Yes, there are," exclaimed his son.—"*Ab, my child!*" cried St. Pierre, "*I am then twice sacrificed.—But no—I have rather begotten thee a second time.—Thy years are few, but full, my son; the victim of virtue has reached the utmost purpose and goal of mortality.*"—"Who next, my friends?—This is the hour of heroes."—"Your kinsman!" (cried James Wissant).—"Your kinsman!" (cried Peter Wissant).—"Ab!" (exclaimed Sir Walter Mauny, bursting into tears), "*Why was I not a citizen of Calais!*"

The sixth victim was still wanting, but was supplied by lot, from numbers who were emulous of so ennobling an example.

The keys of the city were then delivered to Sir Walter. He took the six prisoners into his custody. But before they departed, the citizens desired permission to take their last adieu of their deliverers.—What a parting! what a scene! They crowded with
 5 their

their wives and children about St. Pierre and his fellow prisoners. They embraced, they fell prostrate before them. They groaned; they wept aloud; and the clamour of their mourning passed the gates of the city, and was heard throughout the camp.

At length Saint Pierre and his fellow victims appeared under the conduct of Sir Walter and his guard. All the tents of the English were instantly emptied. The foldiers poured from all parts, and arranged themselves on each side, to admire this little band of *patriots* as they passed. They murmured their applause of that virtue which they could not but revere even in enemies; and they regarded those ropes which they had assumed about their necks, as ensigns of greater dignity than that of the British Garter.

As soon as they had reached the royal presence, "Mauny," (says the king) "*are these the principal inhabitants of Calais?*" "*They are,*" (says Mauny): "*they are not only the principal men of Calais; they are the principal men of France, my lord, if virtue has any share in the act of ennobling.*" "*Were they delivered peaceably?*" (says Edward); "*was there no resistance, no commotion among the people?*" "*Not in the least, my lord. They are self-delivered, self-devoted, and come to offer up their inestimable heads, as an ample equivalent for the ransom of thousands.*"

The king, who was incensed at the difficulties of
the

the siege, ordered them to be carried to *immediate execution*; nor could all the remonstrances of his courtiers divert him from his purpose.—But what neither a regard to his own interest and honour, the dictates of justice, nor the feelings of humanity, could effect, was accomplished by the influence of conjugal affection. The queen, who was then advanced in pregnancy, being informed of the particulars respecting the six victims, flew into her husband's presence, threw herself on her knees before him, and with tears in her eyes besought him not to stain his character with an indelible mark of infamy, by committing such a barbarous deed. Edward could refuse nothing to a wife whom he so tenderly loved, and especially in her situation; and the queen, not satisfied with having saved the lives of the six burghers, conducted them to her tent, where she applauded *their virtue*, regaled them plentifully, and having made them a present of money and clothes, sent them back to their fellow-citizens.

S E C T. XLI.

O F S Y M P A T H Y.

PLEASURE and PAIN, says Fontenelle, which are two sentiments so different in themselves, differ not much in their cause. From the instances of tickling, it appears, that the movement of *pleasure*, pushed a little too far, becomes *pain*; and that the movement of *pain* a little moderated becomes *pleasure*.

It is by *sympathy* that we enter into the concerns of others; that we are moved as they are moved, and are never suffered to be indifferent spectators of almost any thing which men can do or suffer. For *sympathy* must be considered as a sort of substitution, by which we are put into the place of another man, and affected in many respects as he is affected. It is by this principle chiefly that poetry, painting, and the other arts of peace, transfuse their passions from one breast to another, and are often capable of exciting a delight from wretchedness, misery, and even death itself. This taken as a fact, has been the cause of much reasoning. The satisfaction has been commonly attributed, first, to the comfort we receive in considering that so melancholy a story is no more than a *fiction*; and
next,

next, to the contemplation of *our own freedom* from the *evils* which we see represented. But I believe the nearer any tragedy approaches to reality, and the further it removes us from any idea of fiction, the more exquisite is the gratification. Do we not read the authentic histories of scenes of this nature with as much pleasure as romances or poems, where the incidents are fictitious? The prosperity of no empire, nor the grandeur of no king, can so agreeably affect in the reading, as the ruin of the state of Macedon, and the distress of its unhappy prince. Such a catastrophe touches us in history as much as the destruction of Troy does in fable. Our delight, in cases of this kind, is very greatly heightened, if the sufferer be some excellent person, who sinks under an unworthy fortune. Scipio and Cato are both virtuous characters; but we are more deeply affected by the violent death of the one, and the ruin of the great cause he adhered to, than with the deserved triumphs and uninterrupted prosperity of the other; for *every emotion of the mind produces delight*, except when the sensation presses upon us too close. Thus Lord Clarendon, when he approaches towards the catastrophe of the royal party, supposes that his narration must then become infinitely disagreeable; and he hurries over the beheading of King Charles, without giving us one circumstance of his death. He considers it as too horrid a scene to be contemplated with any satisfaction, or even without the utmost pain and aversion.

He

He himself, as well as the readers of that age, were too deeply^o concerned in the events, and felt a pain, which an historian and a reader of another age would regard as the most pathetic and interesting, and by consequence the most agreeable.

NATURE has formed us for *activity*, and the emotions of the soul are sources of delight, be the exciting causes what they will: for I am convinced, we have a degree of delight, and that no small one, in the real misfortunes and pains of others; for let the affection be what it will in appearance, if it does not make us fly from them, in this case I conceive we must have a delight or pleasure of some species or other. If this passion was simply painful, we should shun, with the greatest care, all persons and places that could excite such a sensation. But the case is widely different with the greater part of mankind; there is no spectacle we so eagerly pursue, as that of some uncommon and grievous calamity; so that whether this misfortune is before our eyes, or whether it be represented on the stage, it always touches with delight. The more real, the keener is the sensation. Choose the day, on which to represent the most sublime and affecting tragedy we have; appoint the most favourite actors; spare no cost upon the scenes and decorations; unite the greatest efforts of poetry, painting, and music; and when you have collected your audience, just at the moment when their minds are erect with expectation, let it be announced, that a *state criminal* of
high

high rank is on the point of being executed; in a moment the emptiness of the theatre would demonstrate the comparative weakness of the imitative arts, and proclaim the triumph of real sympathy: for our CREATOR has designed we should be united by the bond of sympathy, and hath strengthened that bond by a proportional delight; and there most, where our sympathy is most wanted: and HE hath also wisely ordained that this delight should, by pressing on us too strongly, finally give way to *real uneasiness*. The delight we have in such events hinders us from shunning scenes of misery; and the pain we afterwards feel, prompts us to relieve ourselves in relieving those who suffer; and all this antecedent to any reasoning by an instinct that works us to its own purposes without our concurrence.

S E C T. XLII.

A SINGULAR INSTANCE OF SYMPATHY.

O *Greece* ! thou sapient nurse of finer arts ;
 ————— whose every son,
 Even the last mechanic, the true taste possess'd,
 Thine was the meaning music of the heart ;
 Not the vain trill, that, void of passion, runs
 In giddy mazes, tickling idle ears ;—
 But that deep-searching voice, and artful hand,
 To which, respondent, shakes the varied soul.

THOMSON.

WHEN the appointed day arrived, the whole inhabitants of Athens, whether citizens or strangers, assembled early in the Piræus, to admire the greatest spectacle ever beheld in a Grecian harbour.

A hundred gallies were adorned with all the splendour of naval pomp: the troops destined to embark, vied with each other in the elegance of their dress, and the brightness of their arms: the alacrity painted in every face, and the magnificence displayed with profusion in every part of the equipage, represented a triumphal show, rather than the stern image of war. But the solidity and greatness of the armament proved that it was intended for use, and not ostentation.

Amidst this glare of external pageantry which ac-

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companied

compained the adventurous youth, their friends and kinsmen could not suppress a few parting tears, when they considered the dangers of the sea, and the uncertainty of beholding again the dearest pledges of their affection. But their partial expressions of grief were speedily interrupted by the animating sounds of the trumpet, which issued at once from an hundred ships, and provoked sympathetic acclamations from the shore.

The captains then offered solemn prayers to the gods, which were answered by corresponding vows from the spectators: the customary libations were poured out; and, after the triumphant Pæan had been sung in full chorus, the whole fleet at once set sail, and contended for the prize of naval skill and celerity, until they reached the lofty shores of Ægina, from whence they enjoyed a prosperous navigation to the rendezvous of their confederates at Corcyra.

There the commanders reviewed the strength of the armament, which consisted of an hundred and thirty-four ships of war, with a proportioned number of transports and tenders.

At a moderate computation, we may estimate the whole military and naval strength at twenty thousand men.

When the inhabitants of Syracuse heard the first rumours of the Athenian invasion, they despised them, as idle lies invented to amuse the populace. The hostile armament had arrived at Rhegium before they

they could be persuaded, by the wisdom of Hermocrates, to provide against a danger which their presumption painted as imaginary. But when they received undoubted intelligence that the enemy had reached the Italian coast; when they beheld their numerous fleet commanding the sea of Sicily, and ready to make a descent on their defenceless island, they were seized with a just degree of terror and alarm proportional to their false security. From the heights of presumption they plunged into the depths of despair, and their spirits were, with difficulty, restored by the animating voice of the brave and prudent Hermocrates.

Only a few days elapsed before the adverse armies prepared to engage. The Syracusan generals drew up their troops sixteen, and the Athenians only eight, deep; but the latter had, in their camp, a body of reserve, which was kept ready for action on the first signal.

The attack was begun with fury, and continued with perseverance for several hours. Both sides were animated with the utmost vigour of exertion, when a tempest suddenly arose, accompanied with unusual peals of thunder. This event, which inspired the Athenians with fresh courage, confounded the unexperienced credulity of the Syracusans, who were broken and put to flight.

Encouraged by success, the Athenians pushed the enemy with vigour. The populace of Syracuse clamoured, with their usual licentiousness, against the

incapacity or perfidy of their leaders, to whom alone they ascribed their misfortunes. New generals were named in the room of Hermocrates and his colleagues; and this injudicious alteration increased the calamities of the city, which at length prepared to capitulate.

While the assembly deliberated concerning the execution of a measure, which, however disgraceful, was declared to be necessary, a galley penetrated into the harbour, which announced a speedy and effectual relief to the besieged city.

The desponding citizens heard, with pleasing astonishment, that Gylippus, a Spartan general, had landed on the western coast of the island. This determined the wavering irresolution of the Syracusans. The most courageous sallied forth to meet this generous and powerful protector. A junction was happily effected; the ardour of the troops kindled into enthusiasm; and they distinguished that memorable day by a signal victory over the Athenians.

The Syracusans had scarcely time to rejoice at their victory, or Nicias to bewail his defeat, when a numerous and formidable armament appeared on the coast. The foremost gallies, their prows adorned with gaudy streamers, pursued a secure course towards the harbour of Syracuse. The emulation of the rowers was animated by the mingled sounds of the trumpet and clarion; and the regular decoration, the elegant splendor, which distinguished every part of the equipment, exhibited a pompous spectacle of
naval

naval triumph. Their appearance, even at a distance, announced the country to which they belonged; and both the joy of the besiegers, and the terror of the besieged, acknowledged that Athens was the only city in the world capable of sending to sea such a beautiful and magnificent contribution.

Nicias expected, by the valour of these fresh troops, which amounted to above twenty thousand, to obtain in one day the valuable reward of long and severe labour. He chose the first hour of a moon-light night to attack the enemy. The outposts were surprised; the guards put to the sword; and three separate encampments of the *Syracusans*, *Sicilians*, and *allies*, formed a feeble opposition to the *Athenian* ardour. As if their victory had already been complete, they urged on the pursuit with a rapidity that disordered their ranks. Meanwhile, the vigilant activity of Gylippus had assembled the whole force of Syracuse. The *Athenians* were decoyed within the intricate windings of the walls, and their irregular fury was first checked by the firmness of a *Spartan* phalanx.

A resistance so sudden and unexpected might alone have been decisive; but other circumstances were adverse to the *Athenians*: their ignorance of the ground, the alternate obscurity of the night, and the deceitful glare of the moon, which, shining in the front of this phalanx, illumined the splendour of their arms, and multiplied the terror of their numbers.

The foremost ranks of the pursuers were repelled; and as they retreated to the main body, they encountered part of their own army, who were advancing, and unfortunately they mistook them for enemies.

Fear, and then rage, seized the *Athenians*, who believing themselves encompassed on all sides, determined to force their way, and committed much bloodshed among their friends, before the mistake could be discovered.

To prevent the repetition of this dreadful error, their scattered bands were obliged at every moment to demand the watch-word, which was at length betrayed to their adversaries. The consequence of this was doubly fatal. At every rencounter the silent *Athenians* were slaughtered without mercy, while the enemy, who knew their watch-word, might at pleasure join, or decline, the battle, and easily oppress their weakness or elude their strength.

The terror and confusion increased; the rout became general; and Gylippus pursued in good order with his victorious troops. Many abandoned their arms, and explored the unknown paths of the neighbouring rocks. Others threw themselves from precipices, rather than await the pursuers. Several thousands were left dead or wounded on the scene of action, and in the morning the greater part of the stragglers were intercepted by the horse. .

This dreadful and unexpected disaster suspended the operation of the siege. The *Athenian* general
spent

spent the time in useless deliberations concerning their future measures, while the army was obliged to be encamped on the marshy and unhealthy banks of the Anapus.

The vicissitudes of an autumnal atmosphere, corrupted by the foul vapours of an unwholesome soil, made a severe impression on the *irritable fibres* of men exhausted by *fatigue*, dejected by *disgrace*, and deprived of *hope*. A general sickness broke out in the camp. Some of the commanders urged this calamity as a new reason for hastening their departure, while it was yet possible. But Nicias dissuaded from the design of leaving Sicily until they should be warranted to take this important step by the positive authority of the republic.

Meanwhile the prudence of Gylippus profited of the fame of his victory, to draw a powerful reinforcement from the *Sicilian* cities: and the transports, long expected from the Peloponnesus, finally arrived in the harbour of Ortygia.

The accession of such powerful auxiliaries to the besieged, and the force of the malady increasing, the *Athenians* were totally disconcerted. Even Nicias agreed to set sail.—When the fleet was ready for sea, he recalled the troops from the various ports and fortresses they occupied, and with a cheerful and magnanimous firmness, he removed the dejection of the *Athenians*, exhorting them, before they embarked, “to remember the vicissitudes of war, and the instability of fortune. Though hitherto unsuccessful, they had every thing to ex-

“ peft from the ftrength of their actual preparations ;
 “ nor ought men, who had tried and furmounted fo
 “ many dangers, to yield to the weak prejudices of
 “ inexperience and folly, and cloud the profpect of
 “ future victory, by the gloomy remembrance of
 “ paff defeat.”

When Gylippus and the *Syracufan* commanders were apprifed of the defign of the enemy, they haftened to prevent it. An engagement foon took place in the harbour ; and in this narrow fpace, more than two hundred gallies fought, during the greateft part of the day, with an obftinate and perfevering valour. The battle was not long confined to the fhock of adverfe prow, and to diftant hoftility of darts and arrows. The neareft veffels grappled, and clofed with each other, and their decks were foon deluged with blood. While the heavy armed troops boarded the enemy’s fhips, they left their own expofed to a fimilar misfortune ; the fleets were divided into mafive clufters of adhering gallies ; and the confufion of their mingled fhouts overpowered the voice of authority ; the *Athenians* exhorting, “ not to abandon an element on which their republic
 “ had ever acquired victory and glory, for the dangerous protection of an hoftile fhore ;” and the *Syracufans* encouraging each other “ not to fly
 “ from an enemy whose weaknefs or cowardice had
 “ long meditated a flight.”

The fingular and tremendous fpectacle of an engagement more fierce and obftinate than any that had

had ever been beheld in the Grecian seas, restrained the activity, and totally suspended the powers of the numerous and adverse battalions which encircled the coast. The spectators and actors were equally interested in the important scene; but the former, the current of whose sensibility was undiverted by any exertion of body, felt more deeply, and expressed more forcibly, the various emotions by which they were agitated. Hope, fear, the shouts of victory, the shrieks of despair, the anxious solicitude of doubtful success, animated the countenance, the voice, and the gesture of the *Athenians*, whose reliance centered in their fleet. When at length their gallies evidently gave way on every side, the contrast of alternate, and the rapid tumult of successive passions, subsided into a melancholy calm. This dreadful pause of astonishment and terror was followed by the disordered trepidation of flight and fear: and many escaped to the camp, which protected their landing.

In this well-fought battle, the vanquished had lost fifty, and the victors forty vessels. It was incumbent on the Athenians to recover the dead bodies of their friends, that they might be honoured with the sacred and indispensable rites of funeral. But they abandoned to insult and indignity the bodies of the slain; and when Nicias proposed to them to accomplish this necessary duty, which before under no circumstances they had ever neglected, yet did they decline to encounter again the armament of Syracuse.

Their

Their only desire was to escape by land, under cover of the night, from a foe whom they had not courage to oppose, and from a place where every object was offensive to their sight, and most painful to their reflections.

The day was far spent; the strength of the Syracusan sailors had been exhausted by a long continuance of unremitted labour: and both they and their companions on shore were more desirous to return to Syracuse to enjoy the fruits of victory, than to irritate the dangerous despair of the vanquished Athenians. The evening of the battle was the vigil of the feast of Hercules; and the still agitated combatants awakened, after a short and feverish repose, to celebrate the memory of their favourite hero, to whose propitious influence they probably ascribed the merit of the most splendid trophy that ever adorned the fame of Syracuse. The coincidence of a festival and a victory excited the utmost extravagance of licentious joy, and the excesses of sensual indulgence. Amidst these giddy transports, the Syracusans lost all remembrance of an enemy whom they despised; even the soldiers on guard joined the dissolute and frivolous amusements of their companions; and, during the greatest part of the night, Syracuse presented a mixed scene of secure gaiety, of thoughtless jollity, and of mad and dangerous disorder.

The camp of the *Athenians* was raised the next morning. Thirty thousand men, of whom many

were afflicted with wounds and disease, and all exhausted by fatigue, and dejected by calamity, presented on this occasion a most doleful sight. They had miserably fallen from the lofty expectations with which they sailed in triumph to the harbour of Syracuse.—They had abandoned their fleet, their transports, the hopes of victory, and the glory of the *Athenian* name; and these collective sufferings were enhanced and exasperated by the painful images which struck the eyes and the fancy of each unfortunate individual.—The mangled bodies of their companions and friends, deprived of the sacred rites of funeral, affected them with a sentiment of religious horror, on which the weakness of human nature is happily unable to dwell — They removed their attention from this dreadful sight; but they could not divert their compassion from a spectacle still more melancholy, the numerous crowds of sick and wounded, who followed them with enfeebled and unequal steps, intreating, in the accent and attitude of unutterable anguish, to be delivered from the rage of an exasperated foe. Amidst such affecting scenes, the heart of a stranger would have melted with tender sympathy; but how much more must it have afflicted the *Athenians*, to see their parents, brothers, and friends, involved in unexampled misery! to hear, without the possibility of relieving, their lamentable complaints! and reluctantly to throw the clinging victims from their wearied necks and arms! Yet the care of personal safety prevailed

over

over every other care; for the soldiers, were not only encumbered by their armour, but oppressed by the weight of their provisions.

The superior rank of Nicias entitled him to a pre-eminence of toil and woe; and he deserves the regard of posterity by his character and sufferings, and still more by the melancholy firmness of his conduct. The load of accumulated disasters did not sink him into inactive despondency. Though afflicted with the stone, he moved with a rapid pace around every part of the army, and the ardour of his mind re-animating the languor of his debilitated frame, he exclaimed, with a loud and distinct voice, "*Athenians and allies*, there is yet room for
 "hope. Many have escaped from still greater
 "evils; nor ought you rashly to accuse either for-
 "tune or yourselves. As to me, who in bodily
 "strength excel not the weakest among you, and
 "who in the happiness of private life, and the de-
 "ceitful gifts of prosperity, had long been distin-
 "guished above the most illustrious of my contem-
 "poraries, I am now confounded in affliction with
 "the meanest and most worthless. Yet am I un-
 "conscious of deserving such a fatal reverse of for-
 "tune. For this reason I am still animated with
 "confidence; calamities, unmerited by guilt, are
 "disarmed of their terrors. Our numbers, our re-
 "solutions, and even our misfortunes, still render
 "us formidable. There is not any army ready to
 "intercept our course; much less any capable of
 "expelling

"expelling us from the first friendly territory in
 "which we shall fix our camp. If we can secure,
 "therefore, our present safety, by a prudent, speedy,
 "and courageous retreat, we may afterwards
 "retrieve our lost honour, and restore the fallen
 "glory of Athens; since the chief ornament of a
 "state consists in brave and virtuous men, not in
 "empty ships and undefended walls."

The actions of Nicias fully corresponded with his words. He neglected none of the duties of a great general. The troops were divided into two bodies. Nicias led the van; Demosthenes conducted the rear; the baggage occupied the centre.

In this order of march they passed the river Anapus, and having proceeded beyond it five miles, they encamped in the evening on a rising ground, after being much harassed during the latter part of the journey by the Syracusan cavalry and archers, who galled them at a distance, intercepted the stragglers, and avoided, by a seasonable retreat, to commit the security of their own fortune with the dangerous despair of the Athenians.

The next day the Athenians had a desire to pass where the Syracusans were posted in great force. In vain the Athenians attempted, on three successive days, to force the passage. They were repelled with loss in every new attack, which became more feeble than the preceding. In the first and most desperate, an accidental storm of thunder increased the courage of the Syracusans and the terror of the Athenians.

Athenians. A similar event had, in the first engagement after the invasion of Sicily, produced an opposite effect on the contending nations. But the hopes and the fears of men change with their fortune.

They gave up at length the hopes of forcing this passage, and under the cover of the night they hoped to evade the enemy, and left their encampment in the same order they had before observed. But they had not proceeded far in this nocturnal expedition, when the obscurity of the skies, the deceitful tracts of an unknown and hostile country, filled the most timid or unfortunate with imaginary terrors, and Demosthenes, with above one half of his division, in this confusion, fatally mistook the road, and quitted, never more to rejoin, the rest of the army.

Nicias with the rest of the forces reached the banks of the river Assinaros. There Gylippus and the Syracusans assaulted them during the whole day with darts, arrows, and javelins. Their distress was most lamentable and incurable, yet hope did not totally forsake them; for, like men in the oppression and languor of a consuming disease, they still entertained a confused idea, that their sufferings would end, could they but reach the opposite banks of the river. The desire also of assuaging their thirst, encouraged this daring design. They rushed with frantic disorder into the rapidity of the stream; the pursuing Syracusans, who had occupied the rocky banks, destroying them with innumerable volleys

volleys of missile weapons. In the Assinaros they had a new enemy to contend with. The depth and force of the waters triumphed over their sngle, and shook their implicated strength. Many were borne down the stream. At length the weight of their numbers resisted the violence of the torrent ; but a new form of danger presented itself to the eyes of Nicias. His soldiers turned their fury against each other, disputing, with the point of the sword, the fordable parts of this turbid stream. This spectacle melted the firmness of his manly soul. He consented to ask quarter for the miserable remnant of his troops, who had not perished in the Assinaros, or been destroyed by the Syracusan archers and cavalry. His soldiers having laid down their arms were entitled to the pity and protection of Gylippus ; who, after sending proper detachments to intercept and collect the stragglers, returned in triumph to the city with the inestimable trophies of his valour and conduct.

The generals Nicias and Demosthenes were successively brought to Syracuse. Gylippus would have spared their lives, not from any motives of humanity and esteem, but that his joyous return to Sparta might have been graced by their presence. But the resentment of the Syracusans, and, above all, the suspicious jealousy of those perfidious traitors who had maintained a secret correspondence with Nicias, which they dreaded lest the accidents of his future life might discover, loudly demanded the

the immediate execution of the captive generals. The Athenians justly regretted the loss of Demosthenes, a gallant and enterprising commander; but posterity will for ever lament the fate of Nicias, the most pious, the most virtuous, and the most unfortunate man of the age in which he lived.

The other prisoners were condemned to labour in the mines and quarries of Sicily: their whole sustenance was bread and water: day and night they languished in this dreadful captivity, during which, the diseases incident to this manner of life were rendered infectious by the stench of the dead bodies, which corrupted the purity of the surrounding air. At length an eternal separation was made between those who should enjoy the *happier lot* of returning to their country, friends, and relatives, and those who were for ever to be confined to their dreadful dungeons. The Syracusans, who could punish their helpless captives with such unrelenting severity, had often melted into tears at the rehearsal of the affecting strains of Euripides, an Athenian poet, who had learned in the Socratic school to adorn the lessons of philosophy with the charms of fancy, and who was regarded by the taste of his contemporaries, as he still is by many enlightened judges, as the most tender and pathetic, the most philosophical and instructive, of all the ancient tragic writers*.

* The Greek play was sung, and every citizen had free admittance to these public entertainments. The ancient theatres contained from 20 to 30,000 people, who were admitted gratis.

The pleasure which the Syracusans had derived from his inimitable poetry, made them delight in hearing it sung by the flexible voices and harmonious pronunciation of the Athenians, so unlike, and so superior to the rudeness and asperity of their own doric dialect.

They desired those captives, who could sing, to rehearse those plaintive scenes of their favourite bard. The captives obeyed; and affecting to represent the woes of kings and heroes, they too faithfully expressed their own.

Their taste and sensibility endeared them to the Syracusans, who soon released their bonds; and, after treating them with all the honourable distinctions of ancient hospitality, restored them to their longing and afflicted country, as a small but precious wreck of the most formidable armament that had ever sailed from a Grecian harbour.

At their return to Athens, the grateful captives walked in solemn procession to the house of Euripides, whom they hailed as their deliverer from slavery and death*.

* Vide *The History of Greece* by Dr. Gillies, a work which exhibits throughout the deepest research, the most elegant narrative, and the soundest reflections.

THE PRINCIPLES OF MORAL PHILOSOPHY.

IN MEDIO STAT VIRTUS.

SECT. XLIII.

ON SELF-LOVE, AND SOCIAL AFFECTION.

On their own axis as the planets run,
Yet make at once their circle round the sun :
So *two consistent motions* actuate the soul ;
And one regards *itself*, and one the *whole*.

POPE.

THE original constitution of our nature with respect to the mixture of *selfish* and *social affection*, discovers in this, as in every other part of our frame, profound and admirable wisdom. Each individual is by his CREATOR committed particularly to himself and his own care. He knows and considers his own situation best, and has more opportunities of promoting his own happiness, than he can have
of

of advancing the happiness of any other person. It was therefore fit, it was necessary, that in each individual *self-love* should be the strongest and most active instinct.

This *self-love*, if he had been a being who stood solitary and alone, might have proved sufficient for the purpose both of his preservation and his welfare. But *such* was not intended to be the situation of man. He is mixed among multitudes of the same nature. In these multitudes, the *self-love* of one man, or attention to his own particular interest, encountering the *self-love* and the interest of another, could not but produce frequent opposition, and innumerable mischiefs. It was necessary, therefore, to provide a *counterbalance* to this part of his nature; which is accordingly done, by implanting in him those *social* and *benevolent instincts*, which lead him in some measure out of himself, to follow the interest of others.

The strength of these *social instincts*, is, in general, proportioned to their importance in human life. Thus, that *parental affection*, which the helpless state of infancy and childhood renders so needful, is made the strongest of them all. Next, come those ties of *blood*, which prompt mutual kindness among those who are intimately joined together by brotherhood, and other family connexions. To these succeeds that valuable instinct of *pity*, which impels us to assist the distressed wherever we behold them. Hence that degree of sensibility, which prompts us to weep with them that weep, is stronger than that

which prompts us to rejoice with them that rejoice; for this plain reason, that the unhappy stand more in need of our fellow feeling and assistance than the prosperous.

Still, however, it was requisite, that in each individual the quantity of *self-love* should remain in a large proportion, on account of its importance to the preservation of his life and well-being. But as the quantity requisite for this purpose is apt both to ingross his attention, and to carry him into criminal excesses, the perfection of his nature is measured by the *counterpoise* of those *social principles* which, tempering the force of the *selfish affection*, render man not only useful to himself, but to those about him.

SECT. XLIV.

OF PRIDE, AND THE LOVE OF PRAISE.

Meanwhile *opinion* gilds with varying rays
 Those painted clouds that beautify our days;
 Each want of happiness by hope supplied,
 And *each vacuity of sense* by PRIDE:
 These build as fast as knowledge can destroy;
 In folly's cups still laughs the bubble joy.
 One prospect lost, another still we gain,
 And not a VANITY is given *in vain*.

POPE.

AMIDST those inequalities of condition, which the state of human life requires, where it was necessary that some should be rich, and others poor, that some should be eminent and distinguished, and others obscure and mean, how seasonable is that *good opinion* which every one entertains of himself; that *self-complacency* with which he prefers himself to others;

Whate'er the passion, knowledge, fame, or pelf,
 Not one will *change his neighbour with himself*:

POPE.

and that fond hope, which is ever pleasing him with the prospect of future pleasures and advantages in
 T 3 life.

life. Without those *flattering sensations*, vain as they often are, how totally insupportable would this world become to many of its inhabitants. Whereas by means of them, PROVIDENCE hath wisely balanced the inequalities of condition among mankind. It hath contrived to diffuse pleasure through all ranks; and to bring the high and low nearer to a level with each other than might at first be supposed. It hath smoothed the most rugged tracts of human life; and hath gilded with rays of borrowed light its most dreary scenes.

We are also intended by PROVIDENCE to be connected with one another in *society*. By means of *society* our wants are supplied, and our lives rendered comfortable; our capacities are enlarged, and our virtuous affections called forth into proper exercise. In order to confirm our *mutual connexion*, it was necessary that some attracting power should pervade the human breast. Nothing could more happily fulfil this purpose, than our being so formed as to desire the good esteem of others. Had such a propensity been wanting, *society* must have proved an unharmonious and discordant state. Instead of mutual attraction, a repulsive power would have prevailed. Among men who had no regard to the *approbation* of one another, all intercourse would have been jarring and offensive. For the wisest ends, therefore, the desire of *praise* was made an original and powerful principle in the human breast.

To a variety of good purposes it is subservient, and on many occasions co-operates with the principle of virtue. It has given rise to most of the splendid, and to many of the useful, enterprises of men. It has animated the patriot, and fired the hero. It awakens us from sloth, invigorates activity, and stimulates our efforts to excel. The desire of *praise* is also connected with all the finer sensibilities of human nature.—But while the love of *praise* is admitted to be a natural, and, in so many respects, an useful principle of action, we are to observe, that it is entitled to no more than our secondary regard. *It has its boundaries set, by transgressing which, it is at once transformed from an innocent into a most dangerous passion.* More sacred and venerable principles claim the chief direction of human conduct. All the good effects which we have ascribed to the desire of *praise*, are produced by it when remaining in a subordinate station. But when passing its natural line, it becomes the ruling spring of conduct; when the regard which we pay to the opinions of men, encroaches on that reverence which we owe to the voice of conscience and the sense of duty; *the love of praise* having then gone out of its place, instead of *improving, corrupts*; instead of being a VIRTUE, it becomes a VICE.

SECT. XLV.

ON THE PASSIONS.

Passions, like elements, though born to fight,
 Yet mix'd and soften'd, in his work unite.
 LOVE, HOPE, JOY, fair pleasure's smiling train,
 HATE, FEAR, and GRIEF, the family of pain ;
These mix'd with art, and to DUE BOUNDS confin'd,
 Make and maintain the balance of the mind :
 The lights and shades, whose well-accorded strife
 Gives all the strength and colour of our life.

POPE.

PASSIONS are strong emotions of the mind, occasioned by the view of approaching good or evil. They are original parts of the constitution of our nature ; and therefore to extirpate them is a mistaken aim. When properly directed they are subservient to very useful ends. They rouse the dormant powers of the soul. They are even found to exalt them. They often raise a man above himself, and render him more penetrating, vigorous, and masterly, than he is in his calmer hours. Actuated by some high *passion*, he conceives great designs, and surmounts all difficulties in the execution. He is inspired with more lofty sentiments, and endowed with more persuasive utterance, than he pos-

fesses at any other time. *Passions* are the active forces of the soul. They are its highest powers brought into movement and exertion. RELIGION requires no more of us than to *moderate* and *rule them*. For necessary as their impulse is, to give activity in the mind, yet if they are not kept in subordination to REASON, they speedily throw all things into confusion. Like wind and fire, which are instrumental in carrying on many of the beneficent operations of nature; when they rise to undue violence, or deviate from their proper course, their path is marked with ruin; so are the *passions* either useful or destructive, according to their direction and degree. Ye *impetuous passions*, terrible whirlwinds, you excite those tempests that drown individuals in perdition; you change innocent pleasure into debauchery; the festive goblet into drunkenness; prudence into avarice; caution into cowardice: by you, fathers are induced to take up arms against their children, and children against their fathers; you drive to suicide; you change industry into rapine and robbery; it is you, in a word, that occasion all the disorder and confusion in this sublunary state.

SECT. XLVI.

ON ANGER.

When *reason*, like the skilful charioteer,
 Can break the FIERY PASSIONS to the bit,
 And, spite of their licentious fallies, keep
 The radiant track of glory ;—PASSIONS, then,
 Are *aids* and *ornament*.

YOUNG.

WE are, by no means, to imagine, that RELIGION tends to extinguish the sense of *honour*, or to suppress the exertion of a *manly spirit*. It is under a false apprehension of this kind, that *Christian patience* is sometimes stigmatised in discourse as no other than a different name for cowardice. On the contrary, every man of virtue ought to feel what is due to his character, and to support properly his own rights. *Resentment of wrong* is an useful principle in human nature ; and for the wisest purposes was implanted in our frame. It is the necessary guard of private rights ; and the great restraint on the insolence of the violent, who, if no resistance were made, would trample on the gentle and peaceable.

But in the fulness of self-estimation, we are too apt to forget what we are. We are rigorous to offences, as if we did not daily intreat heaven for
 7 mercy.

mercy. Nothing is in general so inconsistent as *anger*. The most inconsiderable point of interest, or honour, swells into a momentous object; and the slightest attack seems to threaten immediate ruin. It overpowers reason; confounds our ideas; distorts the appearances, and blackens the colour of every object. As it swells, it constantly justifies to our apprehensions the tumult which it creates, by means of a thousand false arguments which it forms, and brings to its aid. Beware, therefore, and suppress these moments of delusion. Suspend your violence, I beseech you, for an instant. Anticipate that period of coolness, which, of itself, will soon arrive. Allow yourself to think, how little you have any prospect of gaining by fierce contention; but how much of true happiness you are certain of throwing away. Wait until the fumes of *passion* be spent; until the mist which it hath raised is dissipated, when you shall see where truth and right lie; and reason shall, by degrees, resume the ascendant, Did you only preserve yourself composed for a moment, you would discover the insignificancy of most of those provocations which you magnify so highly. When a few suns more have rolled over your head, the storm will have, of itself, subsided; the cause of your present impatience and disturbance will be utterly forgotten. Can you not, then, anticipate this hour of calmness to yourself; and begin to enjoy the peace which it will certainly bring? If others have behaved improperly, leave them to their own folly,

folly, without becoming the victim of their caprice, and punishing yourself on their account. To prove that *passion* is exorbitant in its demands, what proportion, for instance, is there between the life of a man, and an affront received, or supposed to be given by some unguarded expression. How fantastic, then, how unjustifiable, are those supposed laws of modern honour, which for such an affront require no less reparation than the death of a fellow creature; and which, to obtain this reparation, requires a man to endanger his own life? Laws which, as they have no foundation in reason, never received the least sanction from any wise or polished nations of antiquity; but were devised in the darkest ages of the world, and are derived to us from the ferocious barbarity of Goths and Vandals. Who is there, were he to behold his enemy during that conflict which human nature must suffer at the last, but must feel relents at that animosity, which hath deprived another of existence.

“ There lies the man with whom I contended,
 “ silent and mute for ever! How poor is the ad-
 “ vantage which I now enjoy! He is fallen, and I
 “ am about to follow him. In a short time we shall
 “ be laid together! Had he not his virtues and good
 “ qualities as well as I? When we shall both appear
 “ before the judgment-seat of God, shall I be found
 “ innocent, and free of blame, for all the enmity I
 “ have borne to him?”

My friends, let the anticipation of such sentiments
 serve

serve now to cool the heat of anger, and allay the fierceness of resentment. Let us look upon this world as a state of trial. Elevated by such sentiments, our minds will become calm and sedate. We shall look down, as from a superior station, on the petty strifes of this world. They are the selfish, the sensual, and the vain, who are most subject to the undue influence of *passion*. They are linked so closely to the world; by so many sides they touch every object, and every person around them, that they are perpetually hurt, and perpetually hurting others. But the spirit of TRUE RELIGION removes us to a proper distance from the grating objects of worldly contention. It leaves us sufficiently connected with the world, for acting our part in it with propriety; but disengages us from it so far, as to weaken its power of disturbing our tranquillity. It inspires magnanimity; and magnanimity always breathes *gentleness*. It leads us to view the follies of men with pity, and not with rancour; and to treat, with the mildness of a superior nature, what in little minds would call forth all the bitterness of *passion*.

SECT. XLVII.

ON PLEASURE.

A pallid youth, beneath a shade,
 A melancholy scene display'd :
 His mangled face, and loathsome stains,
 Proclaim'd the poison in his veins ;
 He rais'd his eyes, he smote his breast,
 He wept aloud, and thus address'd :

*" Forbear the Harlot's false embrace,
 " Though lewdness wear an angel's face :
 " Be wise, by my experience taught ;
 " I die alas ! for want of thought."*

COTTON.

RELIGION is accused of insufferable severity, in prohibiting *enjoyment* ; and the old, when they offer their admonitions, are upbraided with having forgot that they once were young. And yet, my friends, to what do the restraints of *religion*, and the counsels of *age*, with respect to *pleasure*, amount ? They may be all comprised in a few words, " NOT TO " HURT YOURSELVES, AND NOT TO " HURT OTHERS," by your pursuit of *pleasure*. Within these bounds *pleasure* is *lawful* ; beyond them, it becomes *criminal*, because it is *ruinous*. Are these restraints any other, than those a wise man would choose to impose on himself ? *Religion* or *philosophy*

lofophy calls, you not to renounce *pleasure*, but teaches you how to enjoy it. Instead of abridging it, we exhort you to pursue it with safety. We propose measures for securing its possession, and for prolonging its duration. Though she may appear to contract the bounds of enjoyment, you will upon reflection find, that in truth she enlarges them: what is delightful in human enjoyment she readily allows, and not only allows, but heightens by that grateful relish which a good conscience gives to every pleasure, and not only heightens, but adds, when correcting the excess of some passions, she gives room for the growth of others. Amid the turbulence of riot and the fumes of intoxication, unknown are the *pleasures* of generous friendship, heart-felt love, and domestic society; unknown the *conscious satisfaction* which accompany honourable pursuits, and the justly acquired esteem of those who surround us.

To aim at a constant succession of high and vivid sensations of *pleasure*, is an idea of happiness altogether chimerical. Calm and temperate enjoyment is the utmost that is allotted to man. Beyond this, we struggle in vain to raise our state; and, in fact, depress our joys, by endeavouring to heighten them.

Instead of those fallacious hopes of perpetual festivity, with which the world would allure us, *religion* confers upon us a *cheerful tranquillity*. Instead of dazzling us with meteors of joy, which sparkle and expire, it sheds around us a *calm and steady light*.

Recollect

Recollect your own feelings. Inquire, on what occasions you have felt the *truest satisfaction*; whether days intermixed with *pleasure* and *business* have not left behind them a more agreeable remembrance, than whole nights of licentiousness and riot.

Look around you on the world; reflect on the different societies which have fallen under your observation; and think who among them enjoy life to most advantage; whether they who, encircled by gay companions, are constantly *fatiguing* themselves in quest of *pleasure*; or they to whom *pleasure* comes *unsought*, in the course of active, virtuous, and manly life.

It is an invariable law of our present condition, that every *pleasure* which is pursued to *excess*, converts itself to a *poison*. In all the pleasures of sense, it is apparent, that only when indulged *within certain limits*, they confer *satisfaction*. No sooner do we pass the line which temperance has drawn, than pernicious effects come forward and shew themselves. Could I lay open to your view the monuments of death, they would read a lecture on moderation, much more powerful than any that the most eloquent writers can give. You would behold the graves peopled with the victims of intemperance. You would behold those chambers of darkness hung round, on every side, with the trophies of luxury, drunkenness, and sensuality. So numerous, would you find those victims to iniquity, that it may be safely asserted, where war or pestilence have slain their

their thousands, *intemperate pleasure* has slain its ten thousands.—How long shall it be, ere the fate of your predecessors in the same course teach you wisdom? How long shall the experience of all ages continue to lift its voice to you in vain? Beholding the ocean on which you are embarked covered with wrecks, are not those fatal signals sufficient to admonish you of the hidden rock?

We all of us have experienced the effects which any indisposition of the body, even though slight, produces on external prosperity. Visit the gayest and most fortunate man on earth, only with sleepless nights; disorder any single organ of the senses; corrode but one of his smallest nerves; and you shall presently see all his *gaiety* vanish; and you shall hear him complain that he is a miserable creature, and express his envy of the peasant and the cottager.—And can you believe, that a disease in the soul is less fatal to *enjoyment* than a disease in the animal frame; or that a *sound mind* is not as essential as a *sound body* to the happiness of man? Let us rate sensual gratifications as high as we please, we shall be made to feel that the seat of enjoyment is in the soul. The man of moderation alone brings to all the natural and innocent pleasures, that sound uncorrupted relish, which gives him a much fuller enjoyment of them than the pallid and vitiated appetite of the voluptuary can allow him to know. He culls the flower of every allowable gratification, without dwelling upon it, until its sweetness be lost.

He stops at the point before enjoyment degenerates into disgust, and *pleasure* is converted into *pain*. Moderate and simple pleasure relish high with the temperate; whereas it is a great luck, if the voluptuary does not return disgusted even from a feast.— In the pleasures which are regulated by moderation, besides, there is always that dignity which goes along with innocence. No man needs to be ashamed of them. They are consistent with honour; with the favour of God, and of man. But the sensualist, who disdains all restraint in his pleasures, is odious in the public eye. His vices become gross; his character contemptible; and he ends in being a burden both to himself and to society.

By unhappy excesses, how many amiable dispositions have been corrupted or destroyed! how many rising capacities and powers have been suppressed! how many flattering hopes of parents and friends have been totally extinguished! Who but must drop a tear over human nature, when he beholds that morning which arose so bright, overcast with such untimely darkness; that good humour which once captivated all hearts, that vivacity which sparkled in every company, those abilities which were fitted for adorning the highest station, all sacrificed at the shrine of low sensuality; and one who was formed for running the fair career of life in the midst of public esteem, cut off by his vices at the beginning of his course, or sunk, for the whole of it, into insignificance

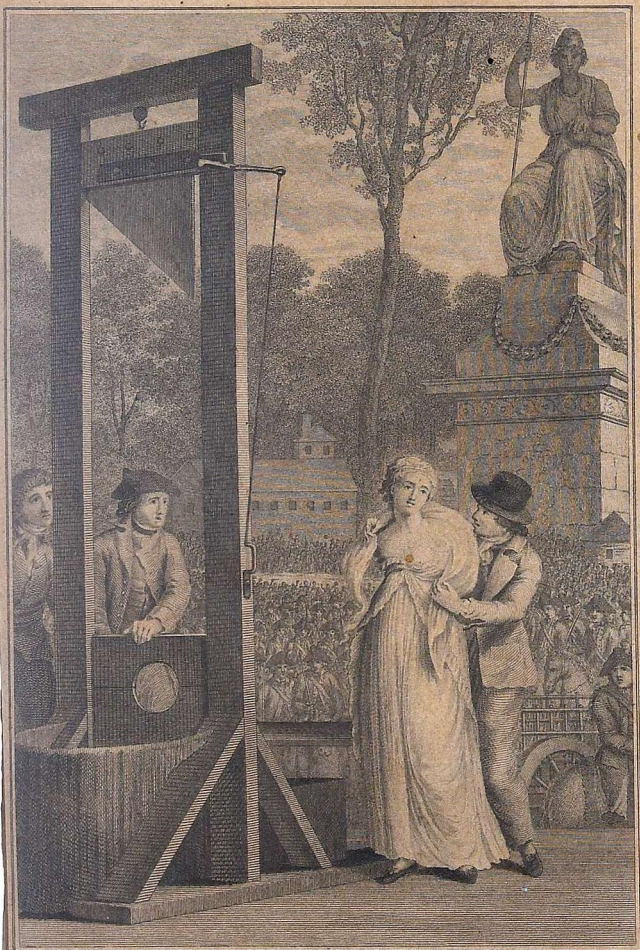
nificancy and contempt!—These, O sinful Pleasure, are *thy* trophies!

Retreat, then, from your dishonourable courses, ye who by licentiousness, extravagance, and vice, are abusers of the world! You are degrading, you are ruining yourselves. You are grossly misemploying the gifts of GOD; and mistake your true interest. Awake then to the pursuit of men of virtue and honour. Break loose from that magic circle, within which you are at present held. Reject the poisoned cup which the enchantress Pleasure holds up to your lips. Draw aside the veil which she throws over your eyes. You will then see other objects than you now behold. You will see an abyss opening below your feet. You will see *virtue* and *temperance* marking out the road, which conducts to *true felicity*. You will be enabled to discern, that the world is enjoyed to advantage, by none but such as follow those divine guides; and who consider “*pleasure as the seasoning, but not as the business of life.*”

SECT. XLVIII.

ON FORTITUDE.

CHARLOTTE CORDAY was tall and well shaped, of the most graceful manners and modest demeanour: there was in her countenance, which was beautiful and engaging, and in all her movements, a mixture of *softness* and *dignity*, which were evident indications of a heavenly mind. She came to Paris, and under a feigned pretext gained admission to that chief of republican tyrants, Marat, in whose breast she plunged a dagger, acknowledged the deed, and justified it by asserting that it was a duty she owed her country and mankind to rid the world of a monster. Her deportment during the trial was *modest* and *dignified*. There was so engaging a *softness* in her countenance, that it was difficult to conceive how she could have armed herself with sufficient intrepidity to execute the deed. Her answers to the questions of the tribunal were full of *point* and *energy*. She sometimes surprised the audience by her *wit*, and excited their admiration by *her eloquence*. Her face sometimes beamed with *sublimity*, and was sometimes covered with *smiles*. She retired while the jury deliberated on their verdict; and when she again entered the tribunal there was a *majestic solemnity* in her demeanour which perfectly became her situation. She heard her sentence with attention and composure; and left the court with *serenity*, her mind being long before prepared even for the last scene. It is difficult to conceive the *heroism* which she displayed in the way to execution. There was such an air of chastened exultation thrown over her countenance, that she inspired sentiments of love rather than pity. The spectators as she passed, uncovered



C.B. Nolan Del.

J. Caldwell Sculp.

DEATH OF CHARLOTTE CORDAY.

covered their heads before her, and others gave loud tokens of applause. She ascended the scaffold with undaunted firmness. When the executioner informed her that her feet must be tied to the fatal plank she submitted with a *smile*. When he took off her handkerchief, the moment before she bent under the fatal stroke, she *blushed deeply*; and her head, which was held up to the multitude the moment after, exhibited this last impression of offended modesty. A young man of the name of Lux, a commissary for Mayence, published a few days after a pamphlet, in which he proposed raising a statue to her honour, and inscribing on the pedestal, "GREATER THAN BRUTUS." He was confined the next day in prison, where he did nothing but talk of the example given by Charlotte Corday, and transforming the *guillotine* into an altar, he was only solicitous to receive death from the same instrument by which she had perished. As he was leading to execution, he is said to have exclaimed,

Look abroad through nature, to the utmost range
Of planets, suns, and adamantine spheres,
Wheeling unshaken through the void immense;
And speak, O man! does this capacious scene
With half that kindling majesty dilate
Thy strong conception, as when BRUTUS rose
Refulgent from the stroke of CÆSAR's fate,
Amid the crowd of patriots; and his arm
Aloft extending, like eternal Jove
When guilt brings down the thunder, call'd aloud
On Tully's name, and shook his crimson steel,
And bade the father of his country hail!
For lo!—*the tyrant prostrate on the dust,*
And Rome again is free!

PERSONS of a *mild character* are not qualified for discharging aright many duties, to which their situ-

ation may call them. When all is calm and smooth around them; when nothing occurs to agitate the mind, or to disturb the tenor of placid life, they behave with abundance of propriety. They are beloved, and they are useful. They promote the comfort of human society; and, by gentleness, and courtesy of manners, serve to cement men together in agreeable union. But to sail on the tranquil surface of an unruffled lake, and to steer a safe course through a troubled and stormy ocean, require *different talents*: and, alas! human life oftener resembles the stormy ocean, than the unruffled lake. We shall not have long embarked, without finding the resemblance to hold too closely. The present state of man is a mixed state, of comfort and sorrow, of prosperity and adversity; neither brightened by uninterrupted sunshine, nor overcast with perpetual shade; but subject to alternate successions of the one, and the other. Amidst the bustle of the world, amidst the open contentions, and secret enmities, which prevail in every society, *mildness* and *gentleness* alone are not sufficient to carry us, with honour, through the duties of our different stations. Trials arise, which demand vigorous exertions of all the moral powers; of patience, vigilance, and self-denial; of constancy and fortitude, to support us under danger and reproach; of temperance, to restrain us from being carried away by pleasure; of firm and determined principles, to support us under the different and trying circumstances of life. Unless we
be

be thus armed and fortified, whatever good intentions have been in our heart, they are likely to be frustrated in action. *Good nature*, for instance, is in danger of running into that unlimited complaisance, which assimilates men to the loose manners of those whom they find around them. Pliant, and yielding in temper, they have not force to stand by the decisions of their own minds, with regard to right and wrong. Through innocent, but unguarded weakness, and from want of the *severer virtues*, they are, in process of time, betrayed into downright crimes. They were equipped for the season of sunshine and serenity; but when the sky is overcast, and the days of darkness come, their feeble minds are destitute of shelter, and ill provided for defence. Then is the time, when more *hardy qualities* are required; when courage must face danger, constancy support pain, patience possess itself in the midst of discouragements, and magnanimity display its contempt of threatenings. If those *high virtues* be altogether strangers to the mind, the *mild and gentle* will certainly sink under the torrent of disasters.

Such are the feelings incident to persons of mixed and imperfect goodness: such are the defects of a character formed merely of the *amiable*, without the *estimable qualities* of man.

It becomes us therefore to guard against either *too great severity*, or *too great facility* of manners. These are *extremes*, of which we every day behold instances in the world.

He who leans on the side of *severity*, is harsh in his censures and narrow in his opinions. He cannot condescend to others in things indifferent. He makes no allowance for human frailty; nor believes that

Virtuous and vitious every man must be,
 Few in the extreme, but all in the degree.
 The rogue and fool by fits are fair and wise,
 And ev'n *the best*, by fits, what *they despise*.

POPE.

With him, all *gaiety* is sinful *levity*; and every *amusement* is a *crime*. To *this extreme* the admonition of Solomon seems to belong,

BE NOT RIGHTEOUS OVERMUCH.

Nothing, it must be confessed, in moral conduct, is more difficult, than to avoid turning either to the *right hand* or the *left*.

One of the greatest trials both of wisdom and virtue is, to preserve a JUST MEDIUM between that *harshness* of *austerity*, which disgusts and alienates mankind, and that *weakness* of *good-nature*, which opens the door to sin.

One who is of the *former character*, studies too little to be agreeable, in order to render himself useful. He who is of the *latter*, by studying too much to be agreeable, forfeits his innocence. If the *one* hurts religion, by clothing it in the garb of unnecessary

fary strictness; the *other*, by unwarrantable compliance, strengthens the power of corruption in the world. *True religion* enjoins us to stand at an *equal distance* from *both*; and to pursue the *difficult*, but *honourable*, aim of uniting *good-nature* with *fixed principles*, and *affable manners* with *untainted virtue*.

SECT. XLIX.

ON CHEERFULNESS.

What blessings ~~thy~~ free bounty gives
 Let me not cast away ;
 For God is paid when man receives,
 T' enjoy is to obey.

POPE.

As I was betwixt sleeping and waking, methought on a sudden I perceived one of the most shocking figures imagination can frame advancing towards me. She was drest in black, her skin was contracted into a thousand wrinkles, her eyes deep sunk in her head, and her complexion pale and livid as the countenance of death. Her looks were filled with terror and unrelenting severity, and her hands armed with whips and scorpions. As soon as she came near, with a horrid frown, and a voice that chilled my very blood, she bid me follow her. I obeyed, and she led me through rugged paths, beset with briars and thorns, into a deep solitary valley. Wherever she passed the fading verdure withered beneath her steps; her pestilential breath infected the air with malignant vapours, obscured the lustre of the sun, and involved the fair face of heaven in universal gloom. Dismal howlings resounded through the

the forest, "from every baleful tree the night-raven croaked his dreadful note, and the prospect was filled with desolation and horror. In the midst of this tremendous scene she addressed me in the following manner :

" Retire with me, O rash unthinking mortal,
 " from the vain allurements of a deceitful world,
 " and learn that *pleasure* was not designed the por-
 " tion of human life. Man was born to *mourn* and
 " to be *wretched* ; this is the condition of all below
 " the stars, and whoever endeavours to oppose it,
 " acts in contradiction to the will of heaven. Fly
 " then from the fatal enchantments of youth and
 " social delight, and here consecrate the solitary
 " hours to lamentation and woe. *Misery* is the duty
 " of all sublunary beings, and every *enjoyment* is an
 " *offence* to the DEITY, who is to be worshipped
 " only by the mortification of every sense of plea-
 " sure, and the everlasting exercise of sighs and
 " tears."

This melancholy picture of life quite sunk my spirits, and seemed to annihilate every principle of happiness within me. I threw myself beneath a blasted yew, where the winds blew cold and dismal round my head, and dreadful apprehensions chilled my heart. Here I resolved to lie till the hand of death, which I impatiently invoked, should put an end to the miseries of a life so deplorably wretched. In this sad situation I spied on one hand of me a deep muddy river, whose heavy waves rolled

on in flow and fullen murmurs, when I found myself suddenly surpris'd by the sight of the loveliest object I ever beheld. The most engaging charms of youth and beauty appeared in all her form ; effulgent glories sparkled in her eyes, and their awful splendours were softened by the gentlest looks of compassion and peace. At her approach, the frightful spectre, who had before tormented me, vanished away, and with her all the horrors she had caused. The gloomy clouds brightened into cheerful sun-shine, the groves recovered their verdure, and the whole region looked gay and blooming as the garden of Eden. I was quite transported at this unexpected change, and reviving hope began to glad my thoughts, when, with a look of inexpressible sweetness, my beauteous deliverer thus uttered her divine instructions :

“ My name is RELIGION. I am the offspring
 “ of TRUTH and LOVE, and the parent of BENEVO-
 “ LENCE, HOPE, and JOY. That monster from
 “ whose power I have freed you is called SUPER-
 “ STITION ; she is the child of DISCONTENT, and
 “ her followers are FEAR and SORROW. Thus, dif-
 “ ferent as we are, she has often the insolence to
 “ assume *my name* and *character*, and seduces un-
 “ happy mortals to think us the *same*, till she at
 “ length drives them to the borders of despair, that
 “ dreadful abyss into which you were just going to
 “ sink.

“ Look around and survey the various beauties of
 “ the

" the globe, which heaven has destined for the seat
 " of the human race, and consider whether a world
 " thus exquisitely framed could be meant for the
 " abode of misery and pain. For what end has the
 " lavish hand of PROVIDENCE diffused such innumerable
 " objects of delight, but that all might
 " *rejoice* in the privilege of existence, and be filled
 " with gratitude to the beneficent Author of it?
 " Thus to enjoy the blessings he has sent, is virtue
 " and obedience; and to reject them merely as
 " means of pleasure, is pitiable ignorance, or absurd
 " perverseness. Infinite goodness is the source of
 " created existence; the proper tendency of every
 " rational being, from the highest order of raptured
 " seraphs, to the meanest rank of men, is to rise
 " incessantly from lower degrees of happiness to
 " higher. They have each faculties assigned them
 " for various orders of delights."

" What," cried I, " is this the language of RELIGION? Does she lead her votaries through
 " flowery paths, and bid them pass an unlaborious
 " life? The *true enjoyments* of a reasonable being,"
 answered she mildly, " do not consist in *unbounded*
 " *indulgence*, or *luxurious ease*, in the *tumult* of *passions*,
 " the *languor* of *indulgence*, or the *flutter* of
 " *light amusements*. Those are often raised into the
 " *greatest transports* of *joy* who are subject to the
 " *greatest depressions* of *melancholy*: on the contrary,
 " CHEERFULNESS, though it does not give the
 " mind such an exquisite gladness, prevents us from
 " falling into any depths of sorrow. MIRTH is like
 " a flash

“ a flash of lightning, that breaks through a gloom
 “ of clouds, and glitters for a moment ; CHEERFUL-
 “ NESS keeps up a kind of day-light in the mind,
 “ and fills it with a steady and perpetual serenity.

“ If we consider cheerfulness in three lights,

“ 1. *With regard to ourselves,*

“ 2. *To those we converse with, And*

“ 3. *To the great Author of our being,*

“ it will not a little recommend itself on each of
 “ these accounts.

1. “ The man who is possessed of *this excellent*
 “ *frame of mind* is not only easy in his thoughts, but
 “ a perfect master of all the powers and faculties of
 “ the soul : his imagination is always clear, and his
 “ judgment undisturbed : his temper is even and
 “ unruffled, whether in action or solitude. He
 “ comes with a relish to all those goods which
 “ nature has provided for him, tastes all the plea-
 “ sures of the creation which are poured about him,
 “ and does not feel the full weight of those ac-
 “ cidental evils which may befall him.

2. “ If we consider him *in relation to the persons*
 “ *whom he converses with*, it naturally produces love
 “ and good-will towards him. A CHEERFUL MIND
 “ is not only disposed to be affable and obliging,
 “ but raises the same good humour in those who
 “ come within its influence. A man finds himself
 “ pleased, he does not know why, with the cheer-
 “ fulness of his companion : it is like a sudden sun-
 “ shine, that awakens a secret delight in the mind,

“ without

“ without her attending to it. The heart rejoices of
 “ its own accord, and naturally flows out into friend-
 “ ship and benevolence towards the person who has
 “ so kindly an effect upon it.

3. “ When I consider this CHEERFUL STATE OF
 “ MIND in its third relation, I cannot but look upon
 “ it as a *constant habitual gratitude* to the great AU-
 “ THOR OF NATURE. An *inward cheerfulness* is an
 “ implicit praise and thanksgiving to PROVIDENCE
 “ under all its dispensations. It is a kind of ac-
 “ quiescence in the state wherein we are placed, and
 “ a secret approbation of the *Divine Will* in his con-
 “ duct towards man.”

Such considerations as these we should per-
 petually cherish in our thoughts; they will banish
 from us all that secret heaviness of heart which un-
 thinking men are subject to when they lie under
 no real affliction, all that anguish which we may
 feel from any evil that actually oppresses us, to
 which I may likewise add those little cracklings of
 mirth and folly, that are apter to betray virtue than
 support it; and establish in us such an EVEN and
 CHEERFUL TEMPER, as makes us pleasing—to *our-*
selves—to *those* with whom we converse, and—to
him whom we are made to please.

CHEERFULNESS is in the next place the best pro-
 moter of *health*. Repinings and secret murmurs of
 heart give imperceptible strokes to those delicate
 fibres of which we are composed, and wear out the
 machine insensibly; not to mention the injury they
 do

do the blood, and those irregular disturbed motions which they raise in the vital functions. I scarce remember in my own observation, to have met with many old men, or with such, who (to use our English phrase) wear well, that had not at least a certain calmness in their humour, if not a more than ordinary gaiety and cheerfulness of heart.

CHEERFULNESS bears the same friendly regard to the *mind* as to the *body*; it banishes all anxious care and discontent, soothes and composes the passions, and keeps the soul in a perpetual calm.

There are writers of great distinction who have made it an argument for PROVIDENCE, that the whole earth is covered with *green* rather than with any other colour, as being such a right mixture of light and shade, that it comforts and strengthens the eye instead of weakening or grieving it. For this reason several painters have a green cloth hanging near them to ease the eye upon, after too great an application to their colouring. A famous modern philosopher accounts for it in the following manner :

*“ All colours that are more luminous, overpower and
 “ dissipate the animal spirits which are employed in
 “ sight :—on the contrary, those that are more obscure
 “ do not give the animal spirits a sufficient exercise ;
 “ whereas the rays that produce in us the idea
 “ of green, fall upon the eye in such a due proportion,
 “ that they give the animal spirits their proper play,
 “ and, by keeping up the struggle in a just balance, excite
 “ a very pleasing and agreeable sensation.”* Let the

cause be what it will, the effect is certain; for which reason the poets ascribe to this particular colour the epithet of *cheerful*.

To consider further this double end in the works of NATURE, and how they are, at the same time, both useful and entertaining, we find that the most *important* parts in the vegetable world are those which are the most *beautiful*. These are the seeds by which the several races of plants are propagated and continued, and which are always lodged in flowers or blossoms. NATURE seems to hide her principal design, and to be industrious in making the earth gay and delightful, while she is carrying on her great work, and intent upon her own preservation. The husbandman, after the same manner, is employed in laying out the whole country into a kind of garden or landscape, and making every thing smile about him, whilst in reality he thinks of nothing but of the harvest, and increase which is to arise from it.

We may further observe how PROVIDENCE has taken care to keep up this *cheerfulness* in the mind of man, by having formed it after such a manner as to make it capable of conceiving delight from several objects which seem to have very little use in them, as from the wildness of rocks and deserts, and the like grotesque parts of nature. In short, the whole universe is a kind of theatre filled with objects that either raise in us pleasure, amusement, or admiration.

The reader's own thoughts will suggest to him the vicissitude of day and night, the change of seasons, with all that variety of scenes which diversify the face of nature, and fill the mind with a perpetual succession of beautiful and pleasing images. I shall omit to mention the several entertainments of *art*, with the pleasures of *friendship*, *books*, *conversation*, and other *accidental diversions* of life, because I would only take notice of such incitements to a *cheerful temper*, as offer themselves to persons of *all ranks* and *conditions*, and which may *sufficiently shew us*, that PROVIDENCE did not design *this world* should be filled with *murmurs* and *repinings*, and that the heart of man should be involved in perpetual *gloom* and *melancholy*.

S E C T. L.

THE REWARD OF ATTENTION TO THE LAWS OF
THE ANIMAL OECONOMY.

THE man who is attentive to the maxims of health, which we have before delivered,

Will prosper like the slender reed,
Whose top waves gently o'er the mead;
And move, such blessings virtue follow,
In *Health*, and Beauty, an Apollo.

Like dew drops from the crystal stream,
Will his eyes with pearly lustre beam;
And with marks of firm health o'erspread,
His cheeks surpass the morning's red.

The fairest of the female train
For him shall bloom, nor bloom in vain:
O happy she, whose lips he presses!
O happy she, whom he caresses!

P A T H O L O G Y

P A T H O L O G Y.

PRACICAL OBSERVATIONS

SECT. II.

OF THE SYMPTOMS DENOTING DISEASE

It is now fully known, what it is that constitutes health, we now proceed to inquire, of that part of physics which relates to the morbid state of the human body.

If we attend to the nature of diseases, we shall find that they always consist of different kinds of affections or imbalances; for as we examine any person who is ill, it matters not at what different, and we shall constantly perceive that there is more than one complaint.

These complaints, when regarded singly, are all ranged in the medical language, under different names. These we may understand what the author means, when they tell us that a disease is an assemblage or combination of symptoms.

As the analytic method, which begins by reducing things, as far as may be, into their constituent parts, and then examining these in the separate state, is the way that has led to the most important discoveries

PRACTICAL OBSERVATIONS.

SECT. LI.

OF THE SYMPTOMS DENOTING DISEASE.

HAVING fully shewn what it is that constitutes health, we now proceed to *pathology*, or that part of physic which treats of the morbid state of the human body.

If we attend to the nature of diseases, we shall find that they always consist of different kinds of distress or inability; for let us examine any person who is ill, it matters not of what distemper, and we shall constantly perceive that there is more than one complaint.

These complaints, when regarded singly, are all termed in the medical language *symptoms*.

Hence we may understand what the authors mean, when they tell us that a disease is an assemblage or combination of symptoms.

As the analytic method, which begins by resolving things, as far as may be, into their constituent parts, and then examining these in the separate state, is the way that has led to the most important disco-

veries which have been made in natural philosophy, let us adopt it, in order, if possible, to find out the true nature of diseases; and since symptoms are the component parts of diseases, let us first attempt to investigate them.

We shall readily ascertain the number of general symptoms, by first observing the several conditions which result from the general regularity of the animal œconomy, and then by considering the deviations from, or the opposites to, these conditions.

Signs of Health.

I. *When the degree of animal heat is such, that it neither falls below nor rises above what gives a pleasant and agreeable sensation.*

II. *When the appetite relishes its objects, and returns in moderation at the proper seasons and intervals.*

Symptoms of Disease.

The two extremes of the mean, or a pleasant moderate warmth, is an uneasy sensation of excessive heat, or great coldness: hence arise two marking symptoms,

- { 1st. *A sense of heat.*
- { 2d. *A sense of cold.*

The deviation from, or the opposites to, a natural appetite, is a disrelish or loathing of the proper objects: whence arise a third, fourth, and fifth, viz.

- { 3d. *A loathing of certain foods, or absolute sickness.*
- { 4th. *Thirst.*
- { 5th. *An insatiable appetite.*

III. *When*

Signs of Health.

III. *When there is no pain, or feel as if we were composed of different organs or parts.*

IV. *When sleep is natural and refreshing.*

V. *When there is no sense of straitness or oppression in the action of breathing.*

VI. *When the voluntary motions depending upon the exertion of the muscles can be performed agreeably to the will, with ease, readiness, and a due degree of force.*

VII. *When the feeling is natural, and the several organs of external sense receive and transmit the different impressions to which they are peculiarly adapted, in the just degree.*

Symptoms of Disease.

6th. *Uneasy sensation, or actual pain, calling the attention of the mind to some one part.*

{ 7th. *Restlessness, or inability to sleep.*
8th. *A propensity to be ever dropping asleep.*

{ 9th. *A sense of oppression about the chest, producing anxiety,*
10th. *Breathing oppressed, or*
11th. *Painful.*

{ 12th. *Weakness, or muscular debility.*
13th. *Spasm, or convulsion.*

{ 14th. *Insensibility to external objects.*
15th. *A too high degree of sensibility.*

VIII. *And,*

Signs of Health.

VIII. *And, lastly, when the organs of internal sense are all in that natural state which enables the mind to perceive clearly, and judge truly concerning the impressions which are made, or of the ideas which arise in consequence of the powers of memory and imagination.*

Symptoms of Disease.

{ 16th. *A disorder of the internal senses.*

This happens when the faculties of the mind cannot be properly exercised, and the several powers of memory, imagination, and judgment, are weakened, confused, or perverted.

Each of these sixteen species of morbid distress or affection, may be considered in the abstract as capable of existing, one independent of another; but whenever they do exist, they affect the whole frame, and disturb the general regularity of the animal œconomy; hence we have called them general symptoms, in order to distinguish them from those slight affections which are only transient, and spring from some trifling disorder of the body. As, for example, the lungs may be disturbed in their action by a cough, raised by the irritation of somewhat either about the larynx, or lower down in the trachea; or the little ducts and orifices, which are naturally destined to ooze out lymph and mucus, to lubricate the intestines, may be irritated so as to pour out an unusual quantity of these humours, and thus give rise to a looseness: but this cough, unless it be accompanied with other symptoms, such as pain, difficulty of breathing, restlessness, or loss of appetite, will

will not deserve the name of disease, and the person affected will scarcely apply for medical assistance; neither would the slight diarrhœa or looseness be reckoned a disease, unless it were attended with some one or more of the sixteen general symptoms, since we know for certain that so long as every one of these sixteen complaints can be kept off, so long will the body remain free from any very important disorder *.

* The great Dr. Darwin has thought fit to deviate from this rule, and has made every aberration from common or natural action a species of disease. Hence we find among the catalogue of his diseases, drunkenness, febrile heat, warm sweats, sweat from labour, sweat from sitting near a large fire, the discharge from a blister, even the healing of ulcers, surprise, coldness of fever, grey hairs, hunger, deglutition, respiration, sneezing, panting, delirium of fever, dreams, blush from heat, from joy, distention of the nipples, folly from insensibility, want of appetite, restlessness, febrile trembling, reverie, sentimental love, vanity, pride of family, anger, rage, pity, heroic education, fatigue, sleep, credulity, flushing of the face after dinner, sweat from covering the face in bed, cure of sickness by stimulating the skin, tooth-edge, biting the nails, life of an egg, life of winter-sleepers, electric shock through the arm, oxygenation of the blood, soft pulse in vomiting, trembling from anger, redness from anger, blush of guilt, slowness of old age, periods of sleep, diabetes from fear, nausea from ideas, vomiting from tickling the throat, &c. a plan which we have not adopted for the reasons above assigned, but when differing from such high authority, we beg leave at the same time to confess the ingenuity of the plan, and to refer the reader for an explanation of many of the phænomena attendant upon life to the *Zoonomia*, or its laws.

As

As certain symptoms, both general and local, are usually observed to combine, and accompany each other (because they flow from similar changes in the state of the animal motions); these *assemblages* are distinguished by different names, such as fever, pleurisy, dysentery, and so forth, thus making up the entire catalogue of diseases.

The knowing how to distinguish these *combinations*, and the *sources* from whence they spring, is the true foundation of *rational practice*; because, in our attempts to relieve sick people, we seldom regard particular symptoms, or any single species of the distress, but rather, having found out the source of the whole assemblage, strike at the root, and endeavour to rectify what is amiss with respect to the animal motions.

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PRACTICAL OBSERVATIONS.

S E C T. LII.

OF THE CLASSIFICATION OF DISEASE.

NosOLOGISTS erect imaginary boundaries between things which are of an homogeneous nature. They degrade the human understanding, by substituting simple perceptions, to its more dignified operations of judgment and reasoning. They gratify indolence in a physician, by fixing his attention upon the name of a disease, and thereby leading him to neglect the varying state of the system. They moreover lay a foundation for disputes among physicians, by diverting their attention from the simple predisposing and proximate, to the numerous, remote, and exciting causes of diseases, or to their more numerous and complicated effects. The whole materia medica is infected with the baneful consequences of the nomenclature of diseases; for every article in it is pointed only against their names, and hence the origin of the numerous contradictions among authors who describe the virtues and doses of the same medicines. By the rejection of the artificial arrangement of diseases, a revolution must follow in medicine. Observation and judgment will take the place of reading
and

and memory, and prescriptions will be conformed to existing circumstances. The road to knowledge in medicine by this means will likewise be shortened; so that a young man will be able to qualify himself to practise physic at as much less expense of time and labour than formerly, as a child would learn to read and write by the help of the Roman alphabet, instead of Chinese characters.

Medicine has certainly much to deplore from this multiplication of diseases. It is as repugnant to truth in medicine, says Rush, as polytheism is to truth in religion. The physician who considers every different affection of the different systems in the body, or every affection of different parts of the same system, as distinct diseases, when they arise from one cause, resembles the Indian or African savage, who considers water, dew, ice, frost, and snow, as distinct essences: while the physician who considers the morbid affections of every part of the body, (however diversified they may be in their form or degrees) as derived from one cause, resembles the philosopher, who considers dew, ice, frost, and snow, as different modifications of water, and as derived simply from the absence of heat.

If the immediate causes of the sixteen general symptoms were not so few, the number of diseases which might result from their possible combination with each other, would amount to somewhat beyond the reach of common apprehension; but since intenseness or remissness, irregularity or suspension, of
the

the motions in either nervous or vascular system, give rise to every one of the symptoms which are found, more or less, in all diseases whatever, some of the sixteen, as depending on similar circumstances, must unavoidably concur, and always run together in the same assemblage; and hence it is, that all the diseases which afflict the human body, can be reduced to a moderate number of classes.

As to distinctions into genera, species, and varieties, they may be extended to many hundreds; but, as will hereafter appear, so many subdivisions are not absolutely necessary for practice, though they are indispensably so, whenever it is attempted to write histories of diseases*.

In thus rejecting the nosologies of the schools, I do not, however, wish to see them banished from the libraries of physicians.

To all those who wish to become acquainted with the arrangement of diseases by the illustrious Dr. Cullen, and the method of scientific teaching of physic, by treating specifically of each disease, dividing them into their classes, orders, genera, species, and varieties, with the remote, predisponent, occasional, and proximate causes of each disease, and the indications of cure, we would strongly recommend the *Elements of Therapeutics, or Guide to Health*, by the Rev. Mr. Townsend.

* Those who wish to acquire this minute knowledge, we refer to the inimitable work of the illustrious Sauvage.

We have, however, followed Dr. BROWN's method with some variations, considering it as most simple; since by bringing those diseases together which demand similar remedies *, it proves that however nosologists have multiplied names, there is truly speaking but two diseases, or opposite states of the constitution, each of which requires its own treatment.

In our work we, therefore, propose marshalling out diseases into three grand classes, or divisions, viz.

I. STHENIC DISEASES †.

II. ASTHENIC DISEASES ‡.

III. ANIMAL AND VEGETABLE POISONS §.

* The defect of Cullen's system is the classing together the most opposite diseases; thus simple inflammatory fever is placed together with typhus, or putrid fever, as species of the same genus, as is also the common quinsy, with the malignant sore throat; catarrh is companion with dysentery, and hydrophobia with colic, and hydrothorax with rickets, and scrophula with chlorosis, jaundice, and syphilis, and pfora, the itch, with a fracture of a bone, &c. How different this arrangement from the simple method we have adopted, and how confounding must it be to the medical writer, who is obliged to treat separately of each disease!

† Or, diseases of strength, from *σθένος*, force.

‡ Or, diseases of weakness, from *ασθένεια*, weakness. This was the two-fold division of Brown.

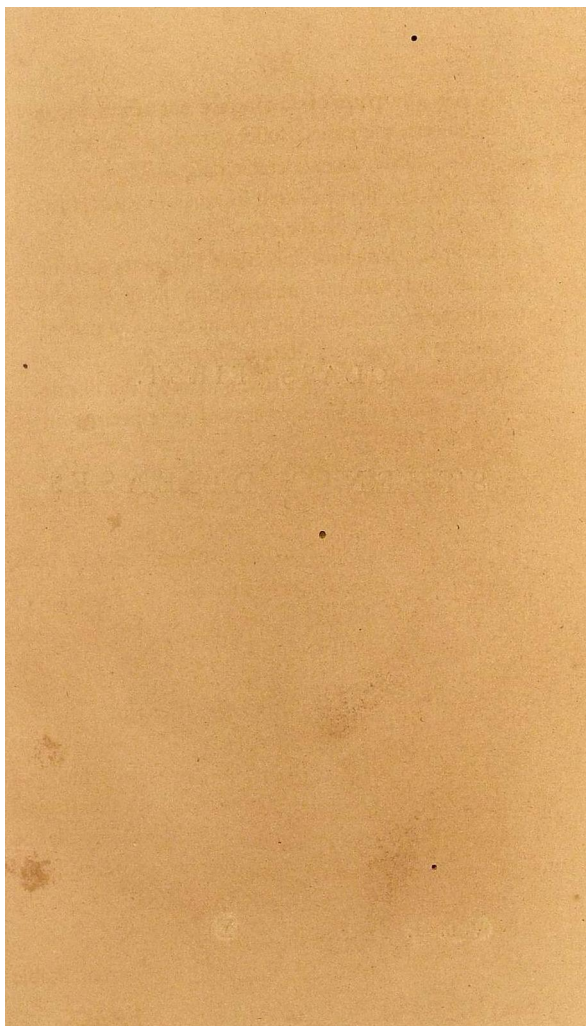
§ Including mostly infectious disorders, separated from the rest chiefly on the ground of *Pneumatic Philosophy*.

CLASS FIRST.

STHENIC DISEASES.

VOL. II.

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PRACTICAL OBSERVATIONS.

S E C T. LIII.

PHRENITIS *;

OR,

INFLAMMATION OF THE BRAIN.

THE distinguishing signs of this disease are,

1. A furious delirium.
2. Redness and turgescence of the face and eyes.
3. Impatience of light and noise.
4. A quick, hard, and generally steady pulse, sometimes however very full.
5. The fever very high.
6. Constant wakefulness.
7. Restlessness.
8. Great increase of muscular strength.
9. Head-ach, violent.

We are not to confound the delirium, which is a common symptom in many fevers, with the original inflammation of the brain, which will readily be distinguished by observing, that in the phrenitis the delirium is evident, and violent, before there be any

* From φρεν, the mind.

remarkable degree of fever; whereas, in the common febrile delirium, the disease is always of some days continuance before the delirium is observable, and the degree of raving is correspondent to the degree of fever: but in the true phrensy the degree of fever is never correspondent to the delirious fury, which is equal to what we meet with in real madness, from which the inflammation of the meninges is hardly to be distinguished but by the shortness of its duration; for it must terminate either in recovery or death, in the space of a very few days.

The original or true phrensy is not a common disease in these temperate climates; but in the hot countries, where people are often exposed to the sun, and incautious of defending the head from the scorching heat, the vessels in that part are frequently so weakened and irritated, that they give way to the force of the fluids, and become the seat of an inflammation, which very seldom admits of a favourable crisis, as one may readily conceive, from considering the delicacy of the affected vessels, and their importance in the animal œconomy.

Sauvage, by dividing inflammations into *membranaceæ* and *parenchymatosæ*, was here under the necessity of making two distinct genera, *phrenitis* and *cephalitis*; and he splits these into no less than twenty-four species; intending, by the first, those cases wherein only the meninges is inflamed; and, by the second, those wherein the substance of the brain and cerebellum become the seat of the disease.

These

These distinctions, with respect to practice, are totally superfluous, as being only different stages of the same disease; for the phrenitis, before the patient dies, will generally run on till it becomes a cephalitis.

The termination of phrenitis, if it does not soon resolve itself, is an incurable mania, or idiotism.

PRACTICAL OBSERVATIONS.

SECT. LIV.

A P O P L É X I A *;

OR,

A P O P L E X Y.

THIS disorder is marked,

1. By a sudden privation of all the powers of sense and voluntary motion.
2. The joints remain flexible, and the muscles flaccid.
3. The person affected seems to be in a most profound sleep, with a sonorous breathing, or snoring.

We may distinguish a fit of apoplexy from that of swooning by observing the pulse and respiration. In apoplectic cases,

4. The pulse is always strong and full.
5. The countenance is flushed for the most part, and always looks full and feels warm.

Whereas in syncope,

1. The pulse is either greatly weakened, or not to be felt at all.

* From ἀποπληξείν, to strike down.

2. The

2. The breathing is not observable.
3. The countenance falls.
4. Redness forsakes the lips, and
5. The flesh feels cold.

In general, apoplexy seizes people who are inclined to be corpulent, have a florid complexion, are full of blood, with short necks, and who indulge too freely in the pleasures of the table, without taking proper exercise. And what makes me more especially place this disease among the sthenic is, that there is always reason to suspect an oppressed brain, and the rupture of a vessel is the usual consequence, or the suffusion of serum, which produces palsy of the nervous system *.

The reader will please to observe that all sthenic diseases in their sequel become asthenic, hence the puzzlings they have created to systematic nosologists, and the error which nosology introduces into practice. In our method we avoid all this, and follow the path of nature. We shall trace here in their order sthenic diseases, commencing from the head, and so going downwards, until we arrive at the extremities, remarking the sequels of each.

* John Hunter, who paid much attention to this subject, in all the cases he dissected at St. George's hospital, found a coagulum of blood, or suffused serum. Vide Dr. Bayley's *Morbid Anatomy*.

PRACTICAL OBSERVATIONS.

SECT. LV.

HYDROCÉPHALUS;

OR,

DROPSY OF THE BRAIN.

HAVING, says Dr. Rush, for many years been unsuccessful in all the cases, except two, of internal dropsy of the brain, which came under my care; I began to entertain doubts of the common theory of this disorder, and to suspect that the effusion of water should be considered only as the effect of a primary inflammation, or congestion of blood in the brain.

I mentioned this opinion to my colleague Dr. Wistar in the month of June 1788, and delivered it the winter following in my lectures. The year afterwards I was confirmed in it by hearing that the same idea had occurred to Dr. Quin. I have since read Dr. Quin's treatise on the dropsy of the brain with great pleasure, and consider it as the first dawn of light which has been shed upon the theory of this disorder. In pursuing this subject, therefore, I shall avail myself of Dr. Quin's discoveries, and endeavour to arrange the facts and observations I have collected

collected in such a manner, and to form a connected theory from them, which I hope will lead to a new and more successful mode of treating this disease.

I shall begin this inquiry by delivering a few general propositions.

1. The internal dropsy of the brain is a disorder confined chiefly to children.

2. In children the brain is larger in proportion to other parts of the body, than it is in adults; and of course a greater proportion of blood is sent to it in childhood than in the subsequent periods of life.—The effects of this determination of blood to the brain appear in the mucous discharge from the nose, and in the sores on the head and behind the ears, which are so common in childhood.

3. In all febrile diseases there is a preternatural determination of blood to the brain. This occurs in a more especial manner in children; hence the reason why they are so apt to be affected by convulsions in the eruptive fever of the small-pox, in dentition, in the diseases from worms, and in the first paroxysm of intermitting fevers.

4. In fevers of every kind, and in every stage of life, there is a disposition to effusion in that part to which there is the greatest determination. Thus in inflammatory fever, effusions take place in the lungs and in the joints. In the bilious fever they occur in the liver, and in the gout in every part of the body. The matter effused is always influenced by the structure of the part in which it takes place.

These

These propositions being premised, I should have proceeded to mention the remote causes of this disorder; but as this inquiry may possibly fall into the hands of some gentlemen who may not have access to the description of it as given by Dr. Whytt, Dr. Fothergill, and Dr. Quin, I shall introduce a history of its symptoms taken from the last of those authors. I prefer it to the histories by Dr. Whytt and Dr. Fothergill, as it accords most with the ordinary phenomena of this disorder.

1. In general the patient is at first inactive.
2. Often drowsy and peevish.
3. The skin is observed to be hot and dry towards the evening.
4. There is a sharp head-ach chiefly in the forehead, or, if not there, generally in the crown of the head, or one side.
5. The head is often inclined to the side affected.
6. The patient at this period dislikes light.
7. Whines much.
8. Sleeps uneasy.

When the symptoms abovementioned have continued for a few days,

9. The axis of one eye is generally found to be turned in towards the nose.
10. The pupil on this side is rather more dilated than the other.
11. If both eyes are similarly affected the pupils are enlarged.
12. The head-ach becomes more excruciating.

13. Pyrexia

13. Pyrexia now increases, the pulse is frequent, breathing quick, exacerbations of the fever take place towards evening, and the face is occasionally flushed; usually one cheek is much more affected than the other.
14. Temporary perspirations break out bringing no relief.
15. Delirium, and that of the most violent kind, particularly if the patient has arrived at the age of puberty, now takes place.

The disease, if not resolved, then undergoes that remarkable change, which sometimes suddenly points out the commencement of what has been called its second stage: the pulse becomes slow but unequal, both as to its strength, and the intervals between the pulsations; the pain of the head, or of whatever part had previously been affected, seems to abate, or at least the patient becomes apparently less sensible of it; the interrupted slumbers, or perpetual restlessness which prevailed during the earlier periods of the disorder, are now succeeded by an almost lethargic torpor, the strabismus, and dilatation of the pupil increase, the patient lies with one, or both eyes half closed, which, when minutely examined, are often found to be completely insensible to light; the vomiting ceases; whatever food or medicine is offered is usually swallowed with apparent voracity; the bowels at this period generally remain obstinately costive.

If

If every effort made by art fails to excite the sinking powers of life, the symptoms of what has been called the second stage are soon succeeded by others, which more certainly announce the approach of death.—The pulse again becomes equal, but so weak and quick, that it is almost impossible to count it; a difficulty of breathing, nearly resembling the *Stertor Apoplectic*, is often observed; sometimes the eyes are suffused with blood, the flushing of the face is more frequent than before, but of shorter duration, and followed by a deadly paleness; red spots, or blotches, sometimes appear on the body and limbs; deglutition becomes difficult, and convulsions generally close the scene. In one case, I may observe, the jaws of a child of four years of age were so firmly locked for more than a day before death, that it was impossible to introduce either food or medicine into his mouth; and in another case, an hæmiplegia, attended with some remarkable circumstances, occurred during the two days preceding dissolution.

PRACTICAL OBSERVATIONS.

S E C T. LVI.

OPHTHÁLMIA *;

OR,

INFLAMMATION OF THE EYES.

THIS disease is seated generally in the adnata, or whites of the eye.

1. The vessels which before only allowed the passage of serum now admit of red globules.
2. There is great pain, especially upon moving the balls of the eye.
3. There is a frequent effusion of tears.

When the affection of the adnata is considerable, the inflammation is not unfrequently communicated to the subjacent membranes of the eye, and even to the retina itself, which acquires so great a sensibility, that

4. The slightest impression of light becomes intolerable.

Oculists have multiplied diseases of the eye and parts surrounding, without end. Dr. Rowley has

* From οφθαλμος, the eye.

lately published a work, giving names and remedies for one hundred and eighteen principal diseases in the eyes and eyelids; but however one may admire his ingenuity, we shall not follow him in splitting of hairs, for, as Cullen justly observes, such divisions are idle, if not hurtful; for all cases of inflammation of the membranes differ only in their intensity, as blue varies from azure to indigo, and are to be cured by remedies of the same kind more or less employed.

The inflammation of the eye sometimes produces a thickening of the thin membrane covering the eye, general or partial, creating blindness from the opacity of the cornea, and when the suffusion of lymph is internal, coating the retina, and obstructing the impulse of light on it; and the crystalline lens is sometimes rendered obscure from the same cause, and at times the ball of the eye itself suppurates, and, corroding every part, obliterates the whole, leaving only an empty socket.

PRACTICAL OBSERVATIONS,

S E C T. LVII.

ERÝSIPELAS *;

OR,

SAINT ANTHONY'S FIRE.

THE Erysipelas of the face comes on,

1. With a cold shivering, after which succeeds,
2. The hot stage, which is frequently attended,
3. With confusion of the head, or delirium.
4. Drowsiness, sometimes,
5. Coma.
6. Pulse frequent, commonly full and hard.

When these symptoms have continued for one, two, or at most three days, there appears

7. A redness covering the face, not very vivid, readily disappearing upon pressure, but quickly returning again.
8. This redness gradually spreads from the part it first occupied to the other parts of the face,

* From *ερεειν*, to draw, and *πελας*, near, because it affects the neighbouring parts.

commonly

- commonly till it spreads over the hairy scalp, or descends upon some part of the neck.
9. As the redness spreads with a pain like that from burning, it commonly disappears, or at least decreases in the parts it had before occupied.
 10. All the parts upon which the redness appears are at the same time affected with some swelling, which continues for a time after the redness has abated.
 11. The whole face becomes considerably turgid.
 12. The inflammation coming upon the face does not produce any remission of the fever which had before prevailed; and sometimes the fever increases with the increasing and spreading inflammation.
 13. The inflammation usually continues eight or ten days; and, for the same time, the fever and symptoms attending it also continue.
 14. When the redness and swelling have proceeded for some time, there commonly arise, sooner or later, blisters of a larger or smaller size, on several parts of the face, containing a thin yellowish, or almost colourless liquor.
 15. The surface of the skin, in the blistered places, sometimes becomes *livid* and *blackish*; but this *livor* seldom goes deeper than the surface, or discovers any degree of gangrene affecting the skin.

16. On

16. On the parts of the surface not affected with blisters, the cuticle suffers, towards the end of the disease, a considerable desquamation.
17. The eye-lids are often so much swelled as entirely to shut up the eyes.

Erysipelas sometimes occasions suppuration of the eye-lids, but with the inflammation the fever commonly ceases; and without evident crisis, the patient returns to his ordinary state of health.

Persons who have once laboured under this disease are very liable to have returns of it, especially in spring and fall.

PRACTICAL OBSERVATIONS.

S E C T. LVIII.

O T Í T I S *;

OR,

INFLAMMATION OF THE EAR.

THIS is marked by so excruciating a pain in the ear, as often to render the patient almost delirious.

It often ends in suppuration, and produces incurable deafness.

S E C T. LIX.

C O R Ý Z A †;

OR,

DEFLUXION OF THE NOSE.

THIS is rarely an idiopathic disease, but generally the first symptom of cold, or indication of an approaching asthma, or measles; it is usually accompanied with sneezing.

* From *ος*, the ear.

† From *καφα*, the head, and *ζευ*, to flow.

PRACTICAL

PRACTICAL OBSERVATIONS.

SECT. LX.

CYNANCHE TONSILLÁRIS*;

OR,

QUINSY.

THIS is an inflammation of the mucous membrane of the fauces, affecting especially that congeries of mucous follicles which form the tonsils, and spreading from thence along the velum and uvula, so as frequently to affect every part of the mucous membrane.

The symptoms of this disease are,

1. Pain in swallowing.
2. Tumour sometimes considerable, being at first one of the tonsils enlarged.
3. Inflammation surrounding the tonsil.
4. Deglutition difficult and accompanied with considerable pain.
5. Frequently this disease passes over to the other

* From *κυνω*, a dog, and *αγγειν*, to strangle, and *tonsillæ*, the tonsils.

tonsil, and then deglutition is almost impossible, producing a sense of almost immediate suffocation.

6. A troublesome clamminess of the mouth and throat.
7. A frequent but difficult excretion of mucus.
8. The neck is sometimes puffed up, and this is reckoned not an unfavourable circumstance, as it denotes less danger of suffocation.
9. There is often a pain of the internal ear, from the inflammation extending to the Eustachian tube.
10. Pulse often an hundred, full, strong, and hard.

It is not unusual in this disease to see patients able to swallow solids with less difficulty than liquids, because the swallowing of liquids requires the action of more of the muscular fasciculi subservient to deglutition, than that of solids; the spittle, on account of its viscosity, being more difficult to swallow than even the liquids used for drink, the patient suffers it to accumulate in the fauces, and hence the continual hawking, which increases the pain of the parts affected, and prevents sleep.

The cynanche tonsillaris terminates by resolution, that is dispersion, or subsiding of the tumour and inflammation; or by suppuration.

PRACTICAL OBSERVATIONS.

S E C T. LXI.

CYNANCHE TRACHEÁLIS*;

OR,

C R O U P.

THE seat of this disease is the membrane lining the upper part of the trachea.

The symptoms characteristic of it are the following:

1. A hoarseness, with some shrillness and ringing sound, both in speaking and coughing, as if the noise came from a brazen tube.
2. Difficult respiration, shewn by a whizzing noise in inspiration, as if the passage of the air was straitened.
3. A dry cough.
4. Pulse frequent and full.
5. An uneasy sensation of heat.
6. Pain situated about the larynx.
7. Sometimes a redness and swelling about the fauces.

* From *τραχεια*, the wind-pipe.

In this disorder, so quick and fatal to children, the sequel of the inflammation, if not resolved, is an exudation analogous to that found on the surface of inflamed viscera, appearing partly in a membranous crust, and partly in a fluid somewhat resembling pus; hence,

8. If any thing is spit up, it is purulent matter, sometimes containing films resembling portions of a membrane; hence,
9. A sense of suffocation, which actually happens from the obstruction of the trachea, often extending along its ramifications, or bronchia.

In Dr. Hunter's Museum you may see a beautiful specimen of this membrane.

PRACTICAL OBSERVATIONS.

S E C T. LXII.

CARDÍTIS*;

OR,

INFLAMMATION OF THE HEART.

THE membranes which line and divide the chest are extremely liable to become the seat of active inflammation, as well as the lungs. The heart also, and pericardium are also subject to the same inflammation (though the examples are rare), as may be discovered from the inspection of dead bodies after death, wherein the heart has sometimes been found in a state of suppuration, and crusted over with purulent matter. The characters of Carditis, however, are dubious and equivocal, resembling those of the other thoracic inflammations, whose general characters, however, are:

1. Fever, ushered in with rigour.
2. Difficult breathing.
3. Head-ache.
4. Pain in the region of the heart.

* From καρδια, the heart.

5. The pulse, frequent, and irregular, hard, and quick.
6. Increase of symptoms, when lying on the left side.
7. Palpitation.
8. The greatest anxiety and distress.
9. Syncope, or faintings.

PRACTICAL OBSERVATIONS.

S E C T. LXIII.

P L E U R Í T I S *;

OR,
P L E U R I S Y.

THE characters of this disease are,

1. Fever.
2. A hard tense pulse, usually full.
3. Acute pain, or stitch in the right side, seated under the sixth or seventh rib, near the fleshy part of the breast. This does not commence until some hours after the fever, and often is not felt until the third or fourth day.
4. A teasing, dry cough, and
5. A straitness, or oppression, of the chest.
6. The blood cupped and covered with a buff coat.

But, as Cullen justly observes, this inflammation, local at first, commonly communicates to the contiguous parts, and extends not only over that part covering the ribs, but also over the mediastinum,

* From πλευρα, the membrane investing the thorax:

and

and the whole surface of the lungs, for upon dissection it has been shewn, in a hundred of instances, that the pleura, in its contracted sense, is hardly ever affected alone, the inflammation being generally extended over the mediastinum and the whole membranous body of the lungs, in which case we have a peripneumony.

PRACTICAL OBSERVATIONS.

S E C T. LXIV.

PERIPNEUMÓNIA*;

OR,

INFLAMMATION OF THE LUNGS.

WE have before seen, that peripneumony is only a more general inflammation of the membrane which lines the chest, as well as the lungs, both external and internal, and it is contra-distinguished by authors from pleurisy by,

1. A moist cough, the matter spit up being frequently streaked with blood.
2. The pain is situated sometimes under the sternum, sometimes in the back, betwixt the shoulders; and when in the sides, its place has been higher, or lower, more forward, or backward, than in the true pleurisy.
3. The pain is generally dull and obtuse, rather an expression of disease, than an acute pain.
4. The breathing is much more laborious.

* From *περι*, about, and *πνευμων*, the lungs.

5. Great pain upon inspiration. .
6. Pulse less full and hard than in pleurisy, often thready.

Sauvage has made two distinct genera of the pleuritis and peripneumonia, and has subdivided them into no less than thirty-two species; twenty of pleurisy, and twelve of peripneumony. Though these minute distinctions are extremely satisfactory, considered as histories of the disease, and the industry and accuracy of the observer are greatly to be admired, and commended, yet they are of no use taken on the great scale of things, and cannot assist the practitioner in his indications of cure. Perhaps it would have been better to have considered pleurisy and peripneumony as one disease.

The pneumonic, like other inflammations, may terminate by resolution, the excitability being worn down by the disease, when the cough gradually ceases, and the patient by degrees recovers his former health.

But in cases where the patients have not been properly treated at first, the pneumonic, like other inflammations, may terminate in suppuration, sometimes producing the deposition of coagulable lymph on the surface of the pleura, which form numberless *adhesions*, joining the convex surface of the lungs to the ribs, or a *vomica* may be formed in the lungs, which very frequently is a considerable time before it bursts; and in some cases where there happens to be but little pressure on any of the
larger

larger trunks of the pulmonary vessels, and the cyst is of a compact texture, these abscesses will occasion no great distress, nor much hectic fever; for, if there be little or no absorption, we shall have little or no hectic fever; but whenever the vomica breaks, and the purulent matter is taken up by the absorbents, and carried into the circulation, then the patient will be seized with alternate cold and hot fits, which will bring on profuse sweats, and in the end destroy life, unless it should so happen, that the purulent matter shall be discharged by expectoration.

We may know that a vomica is formed, if after fourteen days the symptoms, though abated in violence, shall still appear far from being removed; the cough, difficulty of breathing, and oppression continuing, though the pain has ceased; the pulse still quick, though weaker and softer; and if, joined to these, the patient shall feel a slight shivering, and this be succeeded by heat, we may be certain that a suppuration has taken place: and when we find these symptoms grow every day more and more distressing, that the cough is exasperated upon the least motion, and the patient can only lie on the affected side, or perhaps cannot lie down at all, while weakness and wasting are daily more evident, then we may be assured that there is a formed collection of matter, from which the patient will have little or no prospect of escaping, unless the abscess should happen to burst into the branches of the trachea,

trachea, in such a gradual manner as not to occasion suffocation, but allow the purulent matter to be coughed up, and expectorated by degrees.

This disease, then, has also a termination peculiar to itself, which is a rupture of a vessel, and suffusion, which often brings on the fatal catastrophe, or is the foundation of a true phthisis, or consumption.

From the debility in the absorbents, occasioned by a long protracted pneumonia, the effused serum exhaled to lubricate every part is not taken up as quick as deposited; hence the frequent sequel of pneumonia, hydrothorax, or water in the chest.

PRACTICAL OBSERVATIONS.

SECT. LXV.

CATARRHUS*;

OR,

CATARRH.

INFLAMMATION was before explained, when speaking of the manner in which rheums in the head, creaks in the neck, inflammation of the eyes, colds, and rheumatic pains were produced, vide Vol. III. Sect. XI. to depend upon an increased irritability arising from an exposure to partial cold, and subsequent stimuli.

We will here enter more particularly into the symptoms of catarrh.

- I. It is not till the next day, or perhaps the second or third day, that the person who has caught cold begins to complain and recollects his exposure to cold, either partial (as is most common) or general.

This frequent, but curious fact, is similar to

* From *καταρσιν*, to flow down.

what

what happens in the operations of the causes of other febrile diseases. From the commencement of their action on the body, some time must elapse before the system in general can be affected by them, so as to produce the disease corresponding to the nature of the cause. The symptomatic fever, in consequence of wounds, amputations, and other surgical operations on the body, is seldom considerable till the third day after they have been performed. So with blisters it is some hours before the action commences. This cause will go on slowly, acting imperceptibly, until the system in general is affected, exciting,

2. More or less of fever, or that disagreeable sensation over the body which generally precedes the accession of fever.
3. The least cold produces uneasiness even in warm weather.
4. The membranes of the nose become first affected, and there is a dryness, and afterward defluxion of that part.
5. Often the amygdalæ, and other glands about the throat, mark the first stage of this disorder.
6. There is frequently considerable hoarseness, especially towards night.
7. In a few days the trachea, or windpipe, becomes affected, when the throat appears husky.
8. After which the natural secretion is increased, and altered, and there is a considerable discharge

charge of a thin sharp rheum from the glands of the throat and fauces.

9. The secretion from the upper parts decreases, and it is now said to fall upon the breast, which feels tight.
10. At first there is only a tickling uneasy cough, expectoration comes on, which is thin at first, gradually becomes thicker,
11. And diminishes in quantity until the morbid secretion ceases with the recovery of the patient.

Unfortunately for the unthinking part of the human race, colds so often resolve themselves under every treatment, and being unaccompanied with sickness or pain, are therefore foolishly neglected. It is only a cold, and hence little heeded. So the man goes to battle and escapes; but will the same good luck always await him? The pitcher that is often taken to the well comes home at last broken. Persons who have colds on them are too often tempted, on account of business or pleasure, to expose themselves to vicissitudes of cold and heat, by which means that preternatural irritability brought on the internal membrane of the bronchia is kept up, and the increased secretion and cough are often protracted for a considerable time. For, when the system is once morbidly affected, or even after the patient has apparently recovered from his indisposition, causes of the same kind, though greatly inferior to

what was at first necessary for the production of the disease, will exasperate it, or subject the person to a relapse often more severe than the first attack.

From these repeated attacks spitting of blood often arises, and very frequently obstructions are formed, called tubercles.

It is highly probable, that a gradual resolution of such obstructions takes place, especially if the person escapes a return of the same disorder for any considerable time. But if, from repeated colds, these obstructions increase in number and obstinacy, they become at last irresolveable, and lay the foundation of what are called tubercles in the lungs, which are sometimes attended with difficulty of breathing on any brisk or violent exercise, and are often the cause of a chronic dry cough. But, as these complaints are temporary, and not accompanied with pain, the danger of the disorder is frequently overlooked, till, by some future catarrh, they are irritated into a state of inflammation, and afterwards suppurating, bring on a phthisis pulmonalis, the most treacherous and mortal of all diseases.

Also every one who has been afflicted with a severe catarrh, ending in a troublesome cough of long duration, becomes more liable to returns of it, on catching cold, than he was before the first attack of that disorder. Such a person comes, by degrees, to have larger secretions of phlegm in his

lungs than formerly, and, in consequence of it, frequent fits of coughing, without any accession of cold, especially in the winter or cold weather, partly from a diminution of perspiration, but chiefly from the general operation of cold on the body. This gradually increases as age advances, and often proves not only the cause of habitual coughs, but of the humoral asthma.

PRACTICAL OBSERVATIONS.

SECT. LXVI.

FEBRIS CATARRHĀLIS;

OR,

A CATARRHAL FEVER.

THIS disease commonly comes on with the same symptoms as other febrile diseases, that is,

1. With alternate chills and heats, often there is no pyrexia.
2. The cough comes on almost at first.
3. Accompanied with some expectoration, generally of a thick ropy mucus.
4. The face is swelled and flushed.
5. Some giddiness and drowsiness accompanies the disease.
6. There is a sense of lassitude over the whole body.
7. There is a difficulty of breathing.
8. A sense of oppression, and straitness of the chest.
9. With some obscure pain there.

10. The

10. The cough is frequent and violent.
11. Sometimes it excites even vomiting.
12. Frequently a rending head-ach accompanies this disease.
13. The blood drawn shews a buffy surface.

This disease has often the appearance only of a more violent catarrh, and after the employment of some remedies is entirely relieved by a free and copious expectoration. In other cases, however, the feverish and catarrhal symptoms are at first very moderate, and even slight; but after a few days, these symptoms suddenly become considerable, and put an end to the patient's life when the indications of danger were before very little evident.

From the different circumstances in which this disease appears, the pathology of it is difficult. It is certainly often no other at first than a *catarrhal affection*, which, in elderly persons, is frequently attended with a large afflux of mucus to the lungs; and it was on this footing that Sydenham considered it as only differing in degree from his *Febris Hyemalis*. A catarrh, however, is strictly an affection of the mucous membrane and follicles of the bronchiæ alone: but it may readily have, and frequently has, a degree of pneumonic inflammation joined to it; and in that case may prove more properly the peculiar disease we treat of here. But, further, as pneumonic inflammation very often produces an effusion of serum into the bronchiæ, so this, in elderly persons, may occur in consequence of a

flight degree of inflammation; and when it does happen, will give the exquisite and fatal cases of the peripneumonia notha, or bastard pleurisy, called such when there is a suffusion of sputa, or lymph, thrown out into the cellular texture of the lungs.

PRACTICAL OBSERVATIONS.

S E C T. LXVII.

CONTAGEOUS CATARRH;

OR,

INFLUENZA.

As contagious diseases demand the popular attention, being such as generally exclude the advice of physicians, who, provided they escape, are too much employed to attend every one who is seized, I shall be as explicit on this disease as possible.

Whilst it was the general opinion of philosophers, that all things upon earth were governed by the heavens, physicians imputed the epidemical catarrhus semipestilential fever to the influence of the stars; whence the Italians gave it the name of influenza. From Hippocrates to Sydenham, it was known and is mentioned by the name of *febris catarrhalis epidemica*: but Sydenham chiefly calls it *tussis epidemica*. Since Sydenham's time it has been variously named, but is now generally known by the name of *influenza*.

Dr. Fothergill's account of this disease, as approaching more nearly to our own times, deserves the highest attention.

About the beginning of the last month, the end of the year 1775, it was mentioned to me, says the benevolent Dr. Fothergill, that in many families most of the servants were sick; that they had colds, coughs, fore-throats, and other pulmonic complaints.

In the space of a week these complaints became more general; few servants escaped them, especially the men, who were most abroad; many of the other sex, likewise, and people of higher conditions, were attacked: nor were children exempted.

The disease, which had hitherto been either left entirely to itself, or had been treated with the usual domestic medicines appropriated to colds, now claimed the attention of the faculty, and, for the space of near three weeks, kept them universally employed.

Most of those whom I saw were seized (and often so suddenly as to be sensible of the attack)

1. With a swimming, or slight pain in the head.
2. A foreness of the throat.
3. Pains wandering over the body, with a sense of coldness, particularly in the extremities.
4. A cough, soon followed by
5. A running of the nose.
6. Watery eyes.
7. Slight nausea.

8. More

8. More or less feverish heat.
9. Inquietude.
10. Pain about the breast.
11. The tongue was always moist.
12. The skin seldom hot and dry.
13. The pulse often full, quick, and hard.

In a few days every complaint abated, except the cough, which continued after the subsiding of the other symptoms, which in the fore part of the night was exceedingly troublesome and vexatious, and towards morning there generally came on a sweat and easy perspiration.

Many who neglected themselves, and went abroad with the distemper upon them, frequently got additional colds, and brought on a fever of the most dangerous kind; a few died phrenetic.

Old asthmatic persons were likewise great sufferers for the most part: a peripneumonic fever came gradually on, which often terminated fatally. And of those who did recover, their amendment was slow, and treatment difficult.

And indeed it appeared that very few persons wholly escaped the influence of this morbid constitution: for it seemed to aggravate every present malady.

It proved fatal likewise to several very young children, disposing them to violent coughs or diarrhoeas.

During this time, horses and hogs were much affected; those especially that were well kept. The
horses

horses had severe coughs, were hot, forbore eating, and were long in recovering. Not many of them died, that I heard of; but several dogs.

To the consideration of the faculty in this city, is this sketch of the late epidemic submitted, with all due deference; and with a request, that if the observations they have made do not correspond with this recital, they will be pleased to communicate their remarks while the remembrance of the facts are recent; in order that as exact an account of this disease as possible may be transmitted to our successors.

If those physicians in the country, into whose hands this essay may come, will be so obliging as to mention the time when this epidemic made its appearance in their neighbourhood, and wherein it differed from the preceding sketch, either in the symptoms or the method of cure, they will likewise contribute to the same good purpose. *The united observations of the faculty at large must greatly exceed the utmost efforts of any individual, however warmly he may be disposed to promote the utility of his profession.*

JOHN FOTHERGILL.

London, 6th Dec. 1775.

In consequence of this circular letter Dr. Fothergill received the following answers. First from

SIR

SIR JOHN PRINGLE, BART.

President of the Royal College of Physicians.

1. THE species that I had of the influenza was a sore throat, with fever and shooting pains through the back part of my head; but these symptoms were never followed by a cough. I heard of several others who, like me, had never been troubled with a cough, and only with this inflammatory angina.

2. I think you do well to record the state of the weather; but I think the conclusion ought to be, that the sensible qualities of the air had most probably no share in producing this epidemic, I should be tempted to say, that they had evidently no part; for we hear of the same distemper having been in Italy, France, and in the Low Countries; and, I doubt not, in other parts of Europe, had we inquired. But it cannot be supposed that the state of the atmosphere, either as to weight, heat, or moisture, was the same every where. And in the same country have we not seen it rage in one district, or city, whilst others, at no great distance, were totally free? Yet between the sound and the sickly there could be no considerable meteorological difference. My conclusion, therefore, should be, that such epidemics (of which there have been four in my remembrance) do not depend on any principles we
are

are yet acquainted with, but upon some others, to be investigated, and by such means as Dr. Fothergill very properly and most commendably proposes to be done by the united inquiries of his brethren.

DR. HEBERDEN.

December 16, 1775.

THE 28th of October was the first day on which the late epidemic cold seized upon any one whom I had an opportunity of observing; and at the end of three weeks the cause, whatever it was, of this distemper was so far weakened, as to be incapable of infecting those who had escaped it until that time; though many, who had suffered by it before, continued to complain of the cough and hoarseness much longer. The violence of this distemper usually began to abate in five or six days.

In some it began with a sickness and perpetual vomiting, which were the forerunners of a severe degree of this illness; in others the first symptoms were sneezing, and a copious defluxion from the nose and eyes, and these suffered much less, and were sooner recovered. Many complained of a hoarseness and sore throat, and of a tightness, oppression,

pression, and heat of their breasts, and of feeling pains in various parts, particularly in their heads, sides, and backs. Almost every one of these patients was afflicted with a racking cough; with a sense of coldness frequently returning upon them; with a failure of appetite and of sleep; and with a languor and weakness much greater than might have been expected from the effects of any of the other symptoms. The degree of fever was seldom great. I saw two persons in this distemper who had eruptions upon their skins resembling that of a scarlet fever. In two or three young men this disorder was increased to a dangerous height, and became a true peripneumony, attended with bloody phlegm, and manifestly requiring frequent bleedings, by which they were much relieved. Towards the middle or end of this illness a few were attacked with intolerable stitches in their sides or loins, so that for two or three days they were confined almost to the same posture, and if they were necessitated to change it, they shewed all the marks of exquisite pain. Lighter cramps in the legs and arms were not uncommon at the going off of this malady.

I knew none who could properly be said to die of it; but it seemed to hasten the death of two or three persons, whom I found dying of age, and of other diseases.

The keeping quiet within doors, together with an abstinence from the grosser foods, and from heating liquors, was all which the generality of patients required.

required. Small quantities of an opiate were very serviceable in allaying the incessant teasing of the cough, and in quieting the restlessness. Where the fever, or any of the symptoms, were considerable, it appeared to me that bleeding was unquestionably useful, and lessened rather than increased the languor. In a few it was necessary, besides bleeding, to employ blisters, with the other usual remedies for inflammations of the lungs.

SIR GEORGE BAKER, BART.

IT is certain that many people, both in this town and its neighbourhood, were attacked by the epidemic disease some days preceeding the 20th of October. As to the precise day when I first heard of it, I cannot speak of it with accuracy.

Men, confined by their business at home, suffered much less than those who were exposed to the air; and women, in general, less than men. Very young children were not much affected by this disease. Boys at school were almost universally disordered. Girls at school (I suppose on account of their greater confinement) were remarkably free from the influence of this constitution; at least, were not so generally attacked.

Many were suddenly seized with *great giddiness*,
and

and *intense* pain in the head; some with a considerable nausea, which sometimes continued several days. Some few had, in the beginning, successive rigours. An uncommon languor, restlessness, and anxiety, seemed to be the general characteristics of this disease.

I saw none whose first indisposition was a *diarrhœa*. Those who had a diarrhœa, had first complained of the common symptoms of a cold; which ceasing, a diarrhœa followed. This, in some, arose even to a dysentery. They had almost constant pains a little above the navel, and a very frequent evacuation of thin excrement, mixed with mucus. This was my case in particular, and that of several whom I visited, and many others, a relation of whose cases has been communicated to me.

Dr. Fothergill says, *the tongue was always white*. This seems too general an assertion: at least the contrary happened in several instances which fell under my notice.

The blood, in the beginning, was not always *fæty*; nor did I, in general, observe *the deep yellow serum* mentioned by Dr. Fothergill. Likewise *the cup-like appearance of the crassamentum* was remarkable in several cases.

In many cases it was necessary to take away blood, even three or four times, on account of the violence of the pleuritic and peripneumonic symptoms.

Clysters,

Clysters, frequently injected, were of singular service.

The fever having sensibly remitted, according to my experience, the Peruvian bark was used with advantage. And likewise, when a languor and debility (as frequently happened) continued after the vehemence of the disease was subdued, this proved an useful remedy.

Many persons, even now, feel the effects of this disease; and I know several who are likely to die tabid.

Accounts received from France, Holland, and Germany, give us reason to conclude, that this epidemic was much more fatal in other countries than in this island. And I believe it will appear that it was more fatal in several distant countries than in this metropolis and its neighbourhood.

January, 1776.

DR. HENRY REVELL REYNOLDS.

My wife had this complaint on the 23d of October, and on the 2d of November I visited several patients who had laboured under it for some days.

All my children had it. The order in which
the

the symptoms appeared is as follows: watery eyes, swelling of the eye-lids, running from the nose, cough, diarrhœa; so that every part of the mucous membrane seemed to be progressively attacked. I saw two others affected in the same way.

In two instances I saw the tongue very dry, parched, and chopped. The patients were both corpulent women, aged between 30 and 40. At the time I was called in to them they laboured under a true peripneumony; but I learned that they were first attacked with the catarrhal symptoms. Blood drawn from both these patients, even at the third bleeding, had a very thick buff coat, and exhibited the cup-like appearance.

Several whom I attended had this kind of diarrhœa; but I did not find it of service to any: on the contrary, I thought it prejudicial to some, as it seemed to prevent a free expectoration, which, to my apprehension, was the most critical and most salutary evacuation. Neither did warm copious sweats, though universal, (unless they happened before the seventh day) give that relief which one might have expected from them.

With respect to the method of cure, mine was nearly the same as yours, and in the same order. Permit me only to mention, that I found the Kermes mineral to answer my purpose exceedingly well, both as a diaphoretic and an expectorant. After several trials I preferred it to any other preparation of antimony.

In those cases where the diarrhœa was troublesome I had recourse to the ipecacuanha in small doses; a grain of the powder, for instance, once in six hours; and it succeeded to my utmost wish, checking the diarrhœa, and promoting a free expectoration.

January 29, 1776.

PRACTICAL OBSERVATIONS.

S E C T. LXVIII.

PARAPHRENÍTIS;

OR,

INFLAMMATION OF THE DIAPHRAGM.

THIS disease, according to Dr. Cullen, is not to be distinguished from Pneumonia, for when the membrane of the diaphragm is inflamed, it communicates the same affection to the other membranes, and is only a more complicated case of pneumonia. Dr. Cullen disputes that it is accompanied,

1. With a raging delirium, like phrenitis.
2. Risus sardonius, and
3. Other convulsive motions.

Dr. Cullen is therefore for dropping the distinction of this disease, as being a needless multiplication of terms, and would therefore wish to include carditis, pleuritis, peripneumony, and paraphrenitis, under one general term PNEUMONIA, or pneumonic inflammation.

PRACTICAL OBSERVATIONS.

S E C T. LXIX.

GASTRÍTIS;

OR,

INFLAMMATION OF THE STOMACH.

THE signs of gastritis are,

1. Most acute pain in the stomach, always increased upon swallowing even the mildest kind of drink.
2. Inexpressible anxiety.
3. Great internal heat, something like heartburn, extending along the œsophagus.
4. Constant retching. •
5. Frequent hiccup.
6. The pulse small, quick, and intermitting.
7. The debility extreme.

When a real inflammation once takes place in such a sensible part as the stomach, there must be very little chance for the patient's escape; for, unless the inflammation can be resolved in the very beginning, it almost constantly ends in a mortification, there being scarcely any room for suppuration, the part affected not having enough of the loose cellular texture, to admit that way of termination.

PRACTICAL

PRACTICAL OBSERVATIONS.

S E C T. LXX.

SPLENÍTIS*;

OR,

INFLAMMATION OF THE SPLEEN.

THE signs are,

1. A fixed, dull pain.
2. A soreness felt upon pressing the ribs most contiguous to the spleen.
3. An obscure remitting fever.

As an original disease, the splenitis is exceedingly rare; but the spleen is frequently loaded in consequence of certain fevers, particularly the remittent, and often remains for a great length of time in the scirrhus or indolent state. Sometimes a suppuration takes place in this viscus, and that without much previous distress, or evident disorder, until, bursting all at once, the purulent matter is let loose among the abdominal viscera, and in a few days puts an end to the patient's life.

* From σπλήν, the spleen.

PRACTICAL OBSERVATIONS.

S E C T. LXXI.

HEPATÍTIS*;

OR,

INFLAMMATION OF THE LIVER.

WE now quit thoracic complaints, and proceed in order to inflammation of the parts contained within the abdomen, situate below the diaphragm.

The first we shall give a description of is the hepatitis.

The acute hepatitis is a very uncommon case in this climate, and may be distinguished by the following characters.

1. There is an acute pain at the top of the shoulder near the clavicle.
2. A dull obtuse pain just under the short ribs on the right side, extending to the back, and round to the shoulder.
3. The countenance appears fallow.
4. The pulse is quick and thready.
5. The patient cannot lie on the left side.

* From *ἥπαρ*, the liver.

6. Pressing under the short ribs gives pain.
7. The breathing is painful and difficult.
8. There is a dry cough.
9. Sometimes great sickness and vomiting, and hiccup.

If the inflammation is not resolved, there is induced often a scirrhus state of this viscus, generally ending in dropsy, or an abscess is formed, which either bursts into the cavity of the abdomen at large, in which case death must inevitably ensue, as the sharp purulent matter will corrode the surfaces of the other viscera ; or it pushes outwardly, and occasions a swelling which sometimes points so as to be favourable for opening.

If it should happen that the liver, where it was inflamed, adheres all round to the peritonæum, so as to form a bag for the matter, and hinder it from falling into the cavity of the abdomen, then opening the abscess by a sufficiently large incision will probably save the patient's life ; but if the adhesion to the peritonæum be imperfect, the matter will fall down between it and the liver into the cavity at large, and the case will be as desperate as that which has been just now mentioned.

Sometimes the matter of an hepatic abscess comes away in the urine, and sometimes it is discharged by stool. When the matter comes off in the urine, we may conclude that it has been taken up by the branches of the vena cava, which are distributed

through the liver, and thus carried back into the circulation, from whence it is separated by the kidneys. But when the pus comes off by stool, it must either have burst into the biliary ducts, and so have been carried by the ductus communis into the duodenum; or the abscess having been formed in the concave part of the liver, where it lies contiguous to the colon, must have adhered to this intestine, and burst into its cavity, from whence the matter will be discharged by stool, in a sudden and large flow, to the great and immediate relief of the patient.

PRACTICAL OBSERVATIONS.

S E C T. LXXII.

EPIPLOÍTIS*;

OR,

INFLAMMATION OF THE OMENTUM.

THIS is a very uncommon disease, and may be known,

1. By a sharp pain in the upper and forepart of the abdomen.
2. Tension and soreness upon pressure.
3. The usual signs of pyrexia, or inflammatory fever.

This inflammation, like the others, resolves itself or terminates in suppuration, when the matter bursting into the cavity of the abdomen, leaves the patient without hopes of recovery.

* From *επιπλοον*, the omentum.

PRACTICAL OBSERVATIONS.

S E C T. LXXIII.

PERITONÍTIS*;

OR,

INFLAMMATION OF THE PERITONEUM.

THE symptoms of this rare disease, perhaps only existing after delivery, are,

1. The extreme soreness felt all over the abdomen, it not bearing the least pressure.
2. General pyrexia.

* From *περιτοναίον*, the peritoneum.

PRACTICAL OBSERVATIONS.

S E C T. LXXIV.

ENTERITIS*.

THE signs of enteritis are,

1. A tension of the belly.
2. Great internal pain.
3. So great external foreness about the navel, as scarcely to bear the slightest touch.
4. Pyrexia.
5. The greatest debility.
6. A quick and thready pulse.

If the inflammation is not soon resolved, the enteritis terminates in gangrene in the course frequently of a few hours. People who die of a mortification in the intestines, feel no distress for ten or twelve hours before death, as the pain ceases entirely by that time, and they sink away, perfectly in their senses to the last minute: the sinking of the pulse,

* From *εγλεσα*, the bowels.

the pale ghastly look, and the cold clammy sweats, all teach us to foretel the fatal event, which the patients themselves are seldom aware of, but, from the ceasing of the pain, are apt to conclude themselves in a way of recovery.

PRACTICAL OBSERVATIONS.

S E C T. LXXV.

NEPHRÍTIS*;

OR,

INFLAMMATION OF THE KIDNEYS.

THE signs are,

1. Acute pain and heat in the small of the back.
2. Urine of a deep red colour and small in quantity, or colourless.
3. Retching to vomit.
4. Retraction of one of the testes not unfrequent.
5. A great numbness along the thigh.
6. The common symptoms of pyrexia.

It is distinguished from the lumbago by the vomiting, retraction of the testes, numbness, and by the patient being able to raise himself up without exciting severe pain.

A suppuration is often formed in the kidneys;

* From νεφός, a kidney.

and

and we may conclude that it is so, when, notwithstanding the abatement of the pain, we still find the patient complain of a sense of weight in the lumbar region, while at the same time there are frequent shiverings, succeeded by hot fits, and the urine, from being red and without sediment, comes to be whitish and turbid. As the purulent matter in these cases is speedily washed off, and carried away by the urine, it is not so liable to be absorbed; and hence it is, that people have been known to labour for many years under an ulcer of the kidneys, without being much affected by the hectic fever.

PRACTICAL OBSERVATIONS.

S E C T. LXXVI.

CYSTÍTIS*;

OR,

INFLAMMATION OF THE BLADDER.

THIS disease is discriminated,

1. By a difficulty and total stoppage in making water.
2. Tenesmus.
3. Pyrexia.

* From *κυστίς*, the bladder.

PRACTICAL OBSERVATIONS.

SECT. LXXVII.

HYSTERÍTIS*;

OR,

INFLAMMATION IN THE WOMB.

1. VIOLENT pain in that part.

2. Pyrexia.

3. Convulsion, or epilepsy.

This disease ends in suppuration, or a diseased secretion, commonly called a cancer of the womb.

* From *υστερα*, the womb.

PRACTICAL OBSERVATIONS.

S E C T. LXXVIII.

ARTHOPYÓSIS*;
OR,
WHITE SWELLING.

WE now proceed to consider disorders of the extremities. Arthopyosis is shewn by,

1. A fixed dull pain, lasting for many months, in some joints.
2. There is usually some swelling, but without marks of inflammation of the joint.
3. No pyrexia.

This disorder usually terminates in a real white swelling, or enlargement of the bone.

* From *αρθρον*, a joint, and *πυον*, matter.

PRACTICAL OBSERVATIONS.

S E C T. LXXIX.

PARONYCHIA;

OR,

WHITLOW.

1. ACUTE pain and swelling at the extremity of the thumb, or finger.
2. Slight, or no pyrexia.

Phlegmons, or boils, are circumscribed inflammation of the same kind, but affecting different parts of the body. These two last are properly the province of the surgeon.

THERA-

THERAPEUTICKS.

THE APPLIANTS

INTRODUCTION.

SECT. LXXX.

GENERAL INDICATIONS OF CURE IN STHENIC DISEASES.

As the morbidic dispositions and remote causes are what we ought to have in view when we endeavour to prevent diseases, so the actual or immediate causes are the things which we must consider when we alleviate or cure them. The *Therapeia* therefore is to be chiefly directed, so as to obviate and remove the actual causes, whether the disease be universal, consisting of the general symptoms; or local, depending on the disorder of some particular part of the corporeal frame.

The general indications of cure in sthenic diseases are,

- I. THE ABSTRACTION OF STIMULI.
- II. THE AVOIDING OF STIMULI BOTH DIRECT AND INDIRECT.
- III. SEDATIVE POISONS.

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PRACTICAL OBSERVATIONS.

S E C T. LXXXI.

OF BLEEDING.

THIS has been long considered as the greatest agent in medicine: for it completely carries off a stimulus, so much the more powerful than any other, as it pervades the whole frame. And if physicians have not precisely known, whereby the living, or moving principle, was produced, yet could they not fail to observe, that the strength of the muscular fibres was in proportion to the quantity of blood in the frame. Hence, when the muscular force of the whole frame is weakened, the heart, as a particular muscle, will want somewhat of its power to propel the blood; hence the circulation becomes more languid, and the balance betwixt the irritable principle and stimuli gets restored.

Where there is an indication for bleeding, that is violent action, with a strong constitution, bleeding freely will be of singular service. As it seldom happens that bleeding once will be sufficient in a considerable

considerable inflammation, the first, or preceding blood taken, becomes a symptom of the disease.

If the coagulating lymph is superabundant *, there will be what is called a thick buff; and if its surface is considerably cupped, then future bleedings may be used with less caution; because such appearance indicates strong powers of coagulation, which always shews strength in the solids; but if the blood is weak in its powers of coagulation, lies flat in the dish, then we must be cautious in our future bleedings; or if it was strong at first in its powers of coagulation, and after repeated bleedings becomes weak, then we must not pursue this further; but in some cases it is proper to pursue it to this point, for we shall sometimes find that the inflammatory symptoms shall not cease after repeated bleedings, if the strength continues; but the moment a degree of looseness is produced in the blood, that moment will the inflammatory action cease.

The following case is a strong instance of this. A lady had a violent cough, tightness in respiration, strong sily blood, and the symptoms continued to the sixth bleeding, when the blood was not quite so

* The superabundance seems to be for the formation of new parts; a wise intention of nature, who has often wounds of the external surface to make up and repair: but this becomes a source of evil in visceral complaints, being the material for the formation of adhesions.

lized: but the most remarkable change was, its remaining flat on the surface. Upon this bleeding, all the symptoms disappeared; and here, although the blood became weak in its power of coagulation, yet it did not produce weakness in the constitution, the vessels of the inflamed parts having still had power to contract.

On the other hand, there may be indications for bleeding sparingly: first, when there is too much action, with weakened powers: secondly, when there is a disposition to form but little blood: thirdly, when the part affected is far from the source of the circulation.

From the above three dispositions that require bleeding sparingly, or with caution, I may observe, that it will most probably be proper in all such cases to bleed from, or as near the part affected as possible, in order to have the greatest effect, with the loss of the least quantity of blood; more so than when the constitution is strong; because the constitution in such cases should feel the loss of blood as little as possible; if from the part, leeches will answer best, because commonly little irritation follows the wound of a leech: however, this can only be put in practice in inflammations not very remote from the surface. But in many cases the blood cannot be taken away from the part itself, but only from some neighbouring part, so as to affect the part inflamed: thus, we bleed in the temporal artery for inflammation

tion of the eyes; we bleed in the jugular veins for inflammation of the brain; and also in the temporal artery, to lessen the column of blood going to the brain, by the internal carotids.

Hippocrates advises taking blood from the right arm in pleurifies, and there appears some reason in this, for the pain is generally seated in the right side, the aorta taking a curve in that direction, and hence the blood is more determined to that side, which occasions all nations to be right-handed.

But the doctrine of revulsion taking place, the practice was to perform blood letting in pleurifies on the opposite side.

This produced the most violent contention among the faculty; and Brissot, who was the supporter of Hippocrates and Galen, discouraged, probably, by the contradictions which he must have suffered at Paris in combating the opinions that were adopted by his masters, conceived a great inclination to travel, even to the new world; he stopped in Portugal, where he did not fail to propose his doctrine.

Denis, physician to the king of Portugal, and whom we should rank in the number of those men who have made themselves known to the world only by unhappy criticisms; this man who was willing to set himself up as sovereign master of the art, maintained, against Brissot, the doctrine of the Arabians; he appealed to the academy of Salamanca, who decided in favour of Brissot.

The partisans of the latter, who died during the dispute, multiplying prodigiously, Denis raised against them every kind of battery; they were publicly taxed with ignorance and temerity; they were represented as innovators and disturbers of the public repose: the dispute was carried to the tribunal of the emperor, who did not declare himself on either side in this affair; in the mean time there appeared books in all parts of Europe in behalf of Brissot, whose sectators remained conquerors for some time.

“Who can help admiring,” says Bayle, “on one side, the obstinacy that is remarkable in mankind in favour of popular tradition, how ill grounded soever it may be; and on the other, the readiness which the public shews in declaring for or against certain remedies; it is generally carried away by the party that cries loudest *.”

Too much action, with small powers may often, if not always, be classed with the *irritable constitution*, and bleeding should then be performed with very great caution: one case out of many I shall relate as an instance of great action with debility.

A gentleman had one of the most violent inflammations I ever saw, in one of his eyes, attended with violent pain in his head, the blood extremely fizy, all of which denotes great action of parts; yet the buff of the blood was so loose when coagulated, that it could hardly bear its own weight, or make any re-

* Diction. art. Brissot.

sistance to the finger when pressed; and although he was bled pretty freely, yet he never found any relief from it. This blood becoming a symptom, both of the constitution and disease, manifestly showed weak powers from its looseness, and too great action from its slowness of coagulation, which was the cause of the buff.

The following case is another strong instance of great action in a weak, irritable habit. A lady had a violent inflammation of the leg, so as to form a considerable suppuration; with a pulse of one hundred and twenty, one hundred and twenty-five, and often one hundred and thirty, in a minute: her blood was extremely fizy, yet she received but little benefit from the first bleeding, although the blood coagulated pretty firmly, which indicated strength. She was of an irritable constitution, so as to receive less benefit from bleeding than another; and when bled three times, the blood became extremely loose in its texture, which bark removed, as well as the other symptoms. Upon leaving off the bark, the symptoms all recurred, and when she was bled again for the second attack, which was the fourth time, the blood, although inflammatory, had recovered a good deal of its proper firmness; but in the second bleeding, for this second attack, it was less so; and in the third it was still less. Suspecting that bleeding in the present case would not produce resolution I paid particular attention to the pulse at the time

of

of bleeding, and found that in this last bleeding the pulse increased in its frequency even in the time of bleeding; and within a few minutes after the bleeding was over, it had increased ten strokes in the minute*. These bleedings retarded suppuration, but by producing irritability they could not effect resolution,

Where there is a disposition to form but little blood, when known, bleeding should be performed with great caution.

When the inflammation is far from the source of the circulation, the same precautions are necessary. In general it can be taken away from the part in such cases. But these are only so many facts, that require peculiar symptoms to ascertain them.

The common indications of bleeding, besides inflammation, are too often very little to be relied upon. The pulse is the great indication in inflammation; but not always to be depended upon. In inflammations that are visible, a knowledge of the kind of inflammation is in some degree ascertained, as has been observed, we therefore go upon surer ground in our indications for bleeding: but all inflammations are not visible; and it is, therefore,

* This fact, of the pulse increasing upon bleeding, is not always to be set down as a sure sign of irritation being an effect; for in a sluggish pulse, arising from too much blood, the increase of stroke, and freedom given to the circulation is salutary; but when a pulse is already quick, an increase must arise from irritation.

necessary

necessary to have some other criterion: however, if we could ascertain the pulse, peculiar to such and such appearances, in visible inflammation, and that was universally the same in all such appearances, we might then suppose that we had got a true indicative criterion for our guide, and therefore apply it to invisible inflammation, so as to judge of the inflammation by the state of the pulse; but when we consider, that the same kind of inflammation in every part of the body will not produce the same kind of pulse, but very different kinds, not according to the inflammation, but according to the nature of the parts inflamed, and those other parts also not visible, we lose at once the criterion of pulse as a guide. When we consider, also, that there shall be every other sign, or symptom, of inflammation in some viscus, and from the symptoms the viscus shall be well ascertained, yet the pulse shall be soft, and of the common frequency; and upon bleeding, in consequence of these inflammatory symptoms, the blood shall correspond exactly with all of them, except the pulse; it shall be fizy, firm, and cup, as was the case in a lady, which has been before described, we shall be still farther convinced that the pulse is a very inadequate criterion.

If a pulse be hard, pretty full, and quick, bleeding appears to be the immediate remedy, for hardness rather shews strong contractile action of the vessels not in a state of inflammation, which also implies

implies strong action of the blood : and from such a pulse, a fizy blood will generally be found ; but even a quick, hard pulse, and fizy blood, are not always to be depended upon as sure indications of bleeding being the proper method of the resolution of inflammations ; more must be taken into the account.

The kind of blood is of great consequence to be known ; for although it should prove fizy, yet if it lies squat in the bason, and is not firm in texture, and if the symptoms, at the same time, are very violent, bleeding must be performed very sparingly, if at all ; for I suspect that under such a state of blood, if the symptoms continue, bleeding is not the proper mode of treatment. The cases of this kind, which have been related, are strong proofs of this.

As the pulse, abstracted from all other considerations, is not an absolute criterion to go by, and as fizy blood, and a strong coagulum are after proofs, let us see if there be any collateral circumstances that can throw some light on this subject, so as to allow us to judge, *à priori*, whether it be right to bleed or not, where the pulse does not of itself indicate it. Let us remember, that in treating of inflammation of different parts, we should take notice of the pulse peculiar to each part, which I may now be allowed to repeat.

First, I observed that an inflammation in parts

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not vital, or such as the stomach did not sympathize with, if there were great powers, and the constitution not very irritable, the pulse was full, frequent, and hard.

Secondly, that on the contrary, in inflammations of the same parts, if the constitution was weak, irritable, &c. that then the pulse was small, frequent, and hard, although perhaps not so much so as when in vital parts.

Thirdly, that when the inflammation is in a vital part, such as the stomach, intestines, or such as the stomach readily sympathizes with, then the pulse is quick, small, and hard, similar to the above.

Now, in the first stated positions we have some guide, for in the first of these, viz. where the pulse is strong, &c. there bleeding is most probably absolutely necessary, and the symptoms, with the state of blood joined, will determine better the future conduct; but in the second, where the pulse is small, very frequent, and hard, bleeding should be performed with great caution; yet in inflammations of the second stated parts, the constitution seems to be more irritable, giving more the signs of weakness, as if less in the power of the constitution to manage.

Bleeding, restricted to two or three ounces, can do no harm, by way of trial; and, as in the first case, the symptoms and blood are to determine the future

future repetition; but in the third, or vital parts, viz. either the stomach, or such as the stomach sympathizes with, we are yet, I am afraid, left in the dark respecting the pulse. Perhaps, bleeding at first with caution, and judging from the blood and its effects upon the other symptoms, is the only criterion we can go by.

The kind of constitution will make a material difference, whether robust, or delicate.

The mode of life will also make a material difference, whether accustomed to considerable exercise, and can bear it with ease: constitutions so habituated will bear bleeding freely, but those with contrary habits will not.

The sex will likewise make a difference, although the mode of life will increase that difference; therefore men will bear bleeding better than women: even age makes a material difference, the young being able to lose more blood than the old; for the vessels of the old are not able to adapt themselves so readily to the decreased quantity; it even should not be taken away so quickly; and probably the constitution may, in some degree, have lost the habit of making much blood, since it has lost the necessity.

The urine will throw some light on the disease; if high coloured, and not much in quantity, it may be presumed, with the other symptoms, that bleeding will be of singular service; but if pale, and a good deal

of it, although the other indications are in favour of bleeding, yet it may be necessary to do it with caution.

However, bleeding should in all cases be performed with great caution, more particularly at first; and no more taken than appears to be really necessary; it should only be done to ease the constitution, or the part, and rather lower it where the constitution can bear it: but if the constitution is already below or brought below a certain point, or gives the signs of it from the situation of the disease, then an irritable habit takes place, which is an increased disposition to act without the power to act with. This, of itself, becomes a cause of the continuance of the original disposition, and therefore will admit neither of resolution, nor suppuration, but continue in a state of inflammation; which is a much worse disease than the former.

By bleeding the attractive power of the muscular fibre for oxygen is diminished. Upon any other principle than this above mentioned, I cannot see why bleeding should have such effects in inflammation as it sometimes has. If considered in a mechanical light, as simply lessening the quantity of blood, it cannot account for it; because the removal of any natural mechanical power, can never remove a cause which neither took its rise from, nor is supported by it: however, in this light it may be of some service; because, all the actions relative to the blood's
motion

motion will be performed with more ease to the solids, when the quantity is well proportioned.

It is probably from that connexion between the solids and fluids, that the constitution, or a part, is in a state of perfect quietude, or health, in which we find that the fluids are, and ought to be, in a large quantity; but in a state of inflammation, or increased powers and actions, those proportions do not correspond, at least in the parts inflamed; and by producing the equilibrium between the two, suitable to such a state, the body becomes so far as this one circumstance can affect it, in a state of health; and this in many cases will cast the balance in favour of health: it is not, however, sufficient to produce this effect in all inflammations.

The modes of direction are,

Mittatur sang. ad unc. —

Let — ounces of blood be taken, mentioning the quantity; or

Hirudines temp. vel part. dolent. applic.

Let — leaches be applied to the temples, or to the part affected, mentioning the number.

Imponant. cucurbitulæ inter scapul. sang. et mit. sanguis ad unc. —

Let cupping glasses be applied betwixt the shoulders, and so many ounces of blood be taken, mentioning the quantity.

PRACTICAL OBSERVATIONS.

S E C T. LXXXII.

VOMITING.

WHEN a moderate dose of an emetic is swallowed, after the disgust proceeding from the taste is past, the stomach remains for some time undisturbed: but within twenty minutes, a half, or a whole hour, an uneasy sensation and nausea commence. These sensations come and go, the sickness on the whole increasing. There is likewise often pain felt in the head, slight rigours take place in various parts of the body, the pulse becomes weak and irregular, but generally slow; the face and lips grow pale; the eyes lose their lustre, and the countenance appears dejected. After these symptoms have continued for some time, the nausea increases to the utmost height, and vomiting begins.

During the action of vomiting, the body is very violently agitated; the straining is attended with a great deal of pain both in the stomach and head; the face and eyes become red, all the veins appearing turgid with blood; a sweat breaks out upon the
face

face and other parts of the body, and the pulse is quick and strong.

The vomiting usually intermits after two or three fits of retching, and all the violent symptoms go off; leaving the patient in a languid state, and oppressed with sickness. After short intervals there are usually two, three, or more attacks of retching, with the same symptoms as the first. At last the vomiting entirely ceases, though the nausea continues some time longer, the pulse being weak and slow, and the patient feeling himself almost exhausted, and drowsy.

Such are the usual symptoms which follow the operation of emetics in general; but there are others attendant on particular emetic substances. When the retching ceases, for example, after an antimonial vomit, the pulse becomes strong and frequent, the skin hot, an universal perspiration generally breaks out, and sometimes a purging occurs. When the squill emetic is taken, instead of these effects, a considerable increase of the secretion of urine usually follows; but whichever kind of emetic has been given, after all the evacuations have ceased, the patient feels considerably debilitated, and his pulse is a good deal lowered.

There is another effect from emetics, which deserves to be noticed, that the evacuation goes further; and the duodenum, with a portion of the jejunum, may be, and commonly is, evacuated at the

same time. The peristaltic motion of the alimentary canal may proceed downwards or upwards; and when any portion of its acting is, by any circumstance, directed in one way, the next adjoining portion follows the same direction. From this, in vomiting, as the peristaltic motion of the stomach is directed upwards, so the motion of the duodenum is directed in the same manner, and pours its contents into the stomach; from which it will appear, that in vomiting, a considerable portion of the upper part of the intestines may be evacuated, as we have alleged.

The most clear proof of the inverted motion of the duodenum is, that in vomiting, and especially after repeated vomiting, a quantity of bile seems to be poured from the duodenum into the stomach, and is in consequence thrown out by the mouth. This frequent appearance may depend entirely upon the quantity of bile for the time present in the duodenum, but it probably extends farther. When, in consequence of digestion, alimentary matters pass into the duodenum, as it may be supposed that Nature intends the gall-bladder and biliary ducts should then pour their fluids more copiously into the duodenum; so it may be supposed, on this occasion, that bile is poured more copiously into the duodenum, and, in consequence of the inverted motion, more copiously into the stomach, from whence it may appear more copiously in what is thrown up by vomiting.

vomiting. If this should not be thought sufficient to account for a quantity of bile being frequently thrown up by vomiting, there is another cause, perhaps one more powerful, to be alleged. In the action of vomiting, as the contraction of the diaphragm and of the abdominal muscles concurs at the same time, the whole viscera of the abdomen are strongly pressed: this pressure must affect the gall-bladder and biliary ducts, and occasion them to pour out their contents very largely; and thereby especially a large portion of bile may be thrown up by vomiting.

On this subject I must remark, that both the vulgar, and even some physicians, have been ready to suppose, that the bile thrown up by vomiting existed previously in the stomach itself, and in some instances it may have been so; but it is more probable that it has been brought from the duodenum, and even from the gall-bladder and biliary ducts, in the manner we have explained. There is this particular reason for supposing it, that if the bile had been previously lodged in the stomach itself, it might have appeared in the first vomitings as well as in the last: but it happens in most instances that the bile is thrown out by the mouth only after repeated vomitings, and often after repeated strainings in the organs employed in vomiting.

It was observed that emetics seldom excite any sensation in the stomach for some short period after they

they are swallowed. This is perhaps owing to the mucus on the internal surface of the stomach preventing the emetic from immediately coming into contact with the nerves. Nausea or sickness is a sensation peculiar to the stomach, of an uneasy nature; but so different from pain, that it seems in some degree another sense. The stomach is susceptible of pain, however, when injured or inflamed. But nausea is produced by a set of substances which have no power to injure the stomach either mechanically or chemically. It is an impression felt by the nerves of the stomach, as flavours and tastes are perceived by the nose and tongue. As the stomach is susceptible of those two sensations so different from each other, it would be curious to inquire whether both are conveyed by the same set of nerves. The stomach receives nerves both from the *par vagum* and *intercostals*. It seems not impossible that the sensation of nausea is conveyed only by the branches of the *par vagum* which arise immediately from the brain; and that the more common sensations proceed from the *intercostals*. But, however this may be, a considerable number of substances produce nausea, and an inclination to vomit.

It is not to be expected that any explanation can be given of a sensation. There must be, however, some reason why our stomachs are made susceptible of this sensation; and all emetics must possess some common quality by which they excite it.

It can hardly be doubted but that the sensation of nausea and power of vomiting are given to the stomach for the beneficial purpose of throwing out such substances as would prove detrimental to the body if they remained in it. It is therefore extremely probable that all emetics possess some noxious quality; which idea is corroborated by this—that if any emetic substance is given in repeated doses, each so small as not to excite vomiting, they usually occasion a purging; and if the medicine gets into the blood, either by the purging not taking place of itself, or by its being prevented by the exhibition of opium, it then either acts as a sudorific or diuretic.

There seems then strong reason for thinking that emetics are of a noxious quality, since, as long as they remain in the body, they excite general uneasiness, and considerable evacuations.

Emetic substances do not produce one evacuation, but many; when they are in the stomach, they excite vomiting; when in the intestines, purging; and when in the blood vessels, sweating, or an increase of urine. In short, whenever they get into the body, every effort is made to throw them out. How these evacuations are excited, I know no other mode of explaining than by referring to the *Vis Medicatrix Naturæ*.

This will be considered by many philosophic persons as a very unsatisfactory explanation, and little better

better than the hypothesis of sympathy; and there is no doubt that admitting of the *Vis Medicatrix Naturæ* as the cause of any effect, is rather cutting than untying the gordian knot. But although it is not a final explanation, yet it brings it to one common principle, with many other phænomena which take place in the human body: just as the floating of cork in water, and the sinking of lead, are said to be owing to gravitation; although gravitation itself is an assumed quality, the cause of which is entirely unknown.

The various symptoms which take place in vomiting are then explained in the following manner.

Emetics are conceived to be substances noxious to the human body. The nausea is a sensation of an extremely disagreeable kind, produced by the application of those substances to the nerves; and, like all other blunt uneasy sensations, occasions a weakness in the pulse, paleness, and debility. The violent exertion of the stomach and muscles, which afterwards occurs, is an effort of the *Vis Medicatrix Naturæ* to expel the noxious matter; and this effort, like all other bodily exertions, is accompanied with a hurried circulation.

The purging, sweating, and increase of urine, are supposed likewise to be efforts to expel the noxious substance from the intestines or blood-vessels.

After the whole tumult is over, a considerable degree of debility and languor takes place: partly proceeding

proceeding from the evacuation, and partly from that depression which always follows great exertions.

There are some circumstances, which ought to be particularly attended to, before we venture to give a full emetic. In the first place, they should never be given where there is very great fulness of the vessels, and where the florid complexion, and brightness or protuberancy of the eyes, together with pain, heaviness and giddiness of the head, shew that the vessels of the brain may be overloaded or ruptured in the straining to puke; in all such cases, bleeding, and that in pretty large quantities, should always be premised. Emetics also should be cautiously administered in cases where we know that there has been, or have sufficient reason to apprehend that there may be, a rupture of any considerable vessel in the lungs: neither are they to be given if the stomach be inflamed.

The best means of applying an emetic is to give it in nauseating doses, whereby more is produced than the mere abstraction of the natural stimuli; for medicines, which have the power of producing sickness, lessen the action, and even the general powers of life, for a time, in consequence of every part of the body sympathizing with the stomach, and their effects are pretty quick. Sickness lowers the pulse; makes the smaller vessels contract, and rather disposes the skin for perspiration, but not of the active

or

or warm kind; but I believe it should proceed no farther than sickness; for the act of vomiting is rather a counteraction to that effect, and produces its action from another cause. It is similar to the hot fit of an ague; a counteraction to the cold one. There are few so weak, but they will bear vomiting, but cannot bear sickness long.

The medicines chiefly employed in this country are the ipecacuanha, and tartar emetic*.

The first is a West-Indian root, of which there are two principal kinds, distinguished by their colour, and brought from different places; but both possessing the same virtues, though in a different degree. The one is ash-coloured or grey, and brought from Peru; the other is brown, and is brought from the Brasils: and these are indifferently sent into Europe under the general name of ipecacuanha.

These two sorts have been by some supposed to be the roots of two different plants: but, according to others, this is a mistake; the only difference being that one grows in a different place, and in a richer and moister soil, and is better supplied with juices than the other. The plant they belong to is a species of *Psychotria*.

The ash-coloured ipecacuan is a small wrinkled root, bent and contorted into a great variety of

* These appear to act upon different principles, for acids assist tartar emetic, whereas even a scruple of ipecacuan will have no emetic effect if given in half a glass of lemon juice.

figures, brought over in short pieces full of wrinkles, and deep circular fissures, quite down to a small white woody fibre that runs in the middle of each piece: the cortical part is compact, brittle, looks smooth and resinous upon breaking: it has very little smell; the taste is bitterish and subacid, covering the tongue as it were with a kind of mucilage. The brown sort is small, and somewhat more wrinkled than the foregoing; of a brown or blackish colour without, and white within. The first sort, the ash-coloured or grey ipecacuan, is that usually preferred for medicinal use. The brown has been sometimes observed, even in a small dose, to produce violent effects. A third sort, called the white from its colour, has also been distinguished. It is woody, has no wrinkles, and no perceptible bitterness in taste. This, though taken in a large dose, has scarce any effect at all. It is supposed to belong to a species of *Viola*. Mr. Geoffroy calls this sort bastard ipecacuan, and complains that it is an imposition upon the public. Geoffroy, Neumann, Dale, and Sir Hans Sloane, inform us, that the roots of a kind of apocynum (dogs-bane) are too frequently brought over instead of it; and instances are given of ill consequences following from the use of it. But if the marks above laid down, particularly the ash-colour, brittleness, deep wrinkles, and bitterish taste, be carefully attended to, all mistakes of this kind may be prevented.

Ipecacuan was first brought into Europe about the middle of the last century, and an account of it published about the same time by Piso; but it did not come into general use till about the year 1686, when Helvetius, under the patronage of Lewis XIV. introduced it into practice.

This medicine is employed either in the wine or in the powder; and the latter, as operating in a smaller dose, gives a more manageable emetic: for the powder is pretty certainly thrown out in the first vomitings, and therefore ceases to operate, whilst the wine often adheres longer to the stomach.

The medicine in either form proves very certainly emetic; and the powder, to the quantity of a grain, or perhaps less in many persons, can hardly be given without exciting nausea and perhaps vomiting. Such small doses do not indeed always produce these effects; but as they frequently do, we mention them to show that small quantities often operate upon the stomach: and the instances of it make me ready to listen to the accounts which have been reported of very small doses of this medicine.

Among these reports, however, I have difficulty in giving faith to those of Dr. Pye, reported in the London Medical Observations, Vol. I. art. 22. whilst he gives no account of the nature of the ipecacuanha that he employed, as different from, or of superior power to, that in common use with us. In this, though I have often observed in certain persons the

the effects of small doses above mentioned, yet they are not to be observed in every person; and I can assert, that in nine persons out of ten they will hardly appear from doses under five grains. For exciting vomiting, and especially to excite repeated vomitings, we hardly depend on any dose under ten grains, and frequently a larger dose is required. It appears to me that the small doses would hardly answer our purpose without the assistance of warm water. Larger doses indeed may be given with safety, because, as we have said, they are commonly thrown out in the first vomitings: but even on this account, they do not answer the purpose that may be required of repeated vomiting; and our practitioners commonly find, that to give any powerful or permanent stimulus to the stomach, it is necessary to add to the ipecacuanha some portion of emetic tartar.

℞ Ipecac. pulv.—scr. 1.

Antim. tart.—gr. 2.

F. pulv. emetic.

That is, take of

The powder of ipecacuanha—one scruple.

Tartarized antimony—two grains.

To make an emetic powder.

Perhaps the best mode of giving this powder is as follows.

℞ Ipecac.—scr. 1.

Antim. tart.—gr. 2.

Aq. font.—unc. 2.

F. mist. emetic.

Cap. tertiam partem, et post quadrantem par horæ, repet. coch. min. i. omni decem minutâ usque ad vomitionem.

That is, take of

Ipecacuanha—one scruple.

Tartarized antimony—two grains.

Common water—two ounces.

To make an emetic mixture.

Take of this a third part, and after a quarter of an hour repeat a tea-spoonful every five minutes until it vomits.

The other is simple emetic tartar. Of these two substances, the ipecacuanha is by far the mildest in its operation; which is not solely owing to a difference in the dose, because when a dose of tartar emetic is given, barely sufficient to occasion vomiting, it almost always operates with violence; whereas, when the dose of the ipecacuanha is twice or three times larger than is necessary, it still operates mildly.

The tartar emetic not only excites a much more violent action on the stomach, but it likewise generally operates either as a purgative or a sudorific, or both; these latter effects are, without doubt, owing to some portion of the medicine not being thrown up during the vomiting.

On the other hand, a dose of ipecacuanha seldom produces any other effect than vomiting, which probably proceeds from its being usually all-thrown up. It must naturally happen, that part of a dissolved salt will be more apt to escape the action of
the

the stomach, than a part of an undissolved powder. For the solution of tartar emetic will diffuse itself through the fluids of the stomach so minutely, that if one drop of fluid remains in the stomach, that drop will have some of the tartar emetic in union with it. Repeated draughts of warm water being swallowed and thrown up, must always lessen the quantity of tartar emetic; but it will hardly be possible to discharge the whole. Powdered ipecacuanha will be easier expelled by the action of the stomach, because it does not diffuse itself so minutely as a dissolved salt.

This idea is confirmed by a fact mentioned by Dr. Cullen, who is a very accurate observer of the powers of medicines; namely, that the * powder of ipecacuanha is a more manageable emetic than the tincture †, because “the tincture often *adheres* longer to the stomach.”

By the expression *adheres*, Dr. Cullen could only mean, that it remains longer in the stomach, and occasions sickness for a longer time than the powder; because it is impossible for a subtle fluid like white wine literally to adhere. But, as in the tincture, the resin of the ipecacuanha is in a state of solution, it will be difficult to expel the whole; for the same reason that it is difficult to expel the solu-

* Cullen's Treat. Mat. Med. vol. ii. p. 475.

† The tincture of ipecacuanha, or what is more commonly called ipecacuanha wine, is taken thus; a tea-spoonful every ten minutes, until it vomits.

tion of tartar emetic. But, although the tincture of ipecacuanha produces a severe and lasting sickness, it seldom occasions much purging or sweating, like the tartar emetic. This is probably owing to its being a much weaker medicine. If a half or quarter of a grain of emetic tartar gets into the intestines, it will often excite a considerable evacuation; whereas it requires several grains of ipecacuanha to produce an equal effect.

Almost all writers on the *Materia Medica* have observed, that powdered ipecacuanha acts with nearly equal powers, whether a small or large dose is swallowed: which is in all probability owing to this; that as soon as ever a small portion of the powder is dissolved, it occasions nausea and vomiting, and all of it is quickly expelled from the stomach. So that the quantity given is not very material, provided enough is swallowed to excite vomiting. No man, however, ought to venture to give an excessive dose, depending upon this general fact; lest the powder should not all be expelled, and serious effects be produced.

The antimonial powder * of the London Dispensary is also employed as an emetic.

In this preparation, the antimony is not in a saline state, like the tartar emetic, but in that of a calx.

Before

• R Antim. pulv.—gr. 3.

Glycyrr. pulv.—gr. 7.

Mucil. G. arab.—gr. 1.

F. bolus statim sumendus.

That

Before this, medicine can produce any effect upon the stomach, it must be dissolved by its juices.

It is probably this circumstance alone which is the cause of the difference between the action of the pulvis antimonialis and the tartar emetic in the human body.

Antimony is the basis of both these medicines; but the tartar emetic, when exhibited, is in a saline and dissolved state, and capable of acting upon the nerves of the stomach as soon as it comes in contact with them; whereas the antimonial powder is in a calcined undissolved state, and cannot excite any action till it is dissolved.

The tartar emetic is consequently much more apt to excite vomiting; and the antimonial powder is more apt to produce purging and sweating.

It has often been tried to produce these effects, by exhibiting very small doses of tartar emetic, and repeating them frequently. But it is now pretty generally admitted, that by no management of tartar emetic, can it be made to excite sweating and purging without vomiting, with such success as the antimonial powder. The slow and gradual solution of this calx lets loose the antimony upon the stomach in a small quantity at a time. A slight nausea is

That is, take of

Antimonial powder—three grains.

Liquorice powder—seven grains.

Mucillage of gum arabic—as much as is sufficient.

Make a bolus to be taken immediately.

only felt, which is not sufficient to occasion vomiting. The antimony then passes into the intestines, and part of it is absorbed, and purging and sweating are produced.

The antimonial wine is a medicine also much in use. Its powers appear to be exactly the same with a solution of tartar emetic. It is not very easy to ascertain the exact comparative strength of these medicines; but, as far as I can judge, a grain of emetic tartar * is nearly equal to a dram of antimonial wine.

Ipecacuanha and antimony are considered as so decidedly the best and most manageable emetics, that it is hardly necessary to treat of the others.

The only remaining emetic perhaps that may require any attention is that of squills, and this has been frequently ordered by Dr. Thornton with

* The emetic tartar is prescribed from 2 to 5 grains.
The following is a very good formula.

R Antim. tart.—gr. 4.

Ag. menth. fativ.—unc. 6.

Syr. croci—dr. 2.

M. sum. coch. larg. 2 omni quadr. hor.

Donec vomitus moveatur, vel ad nauseam creandam.

That is, take of

Tartarised antimony—four grains.

Simple peppermint water—six ounces.

Syrup of saffron—two drachms.

For a mixture. Take of this two table-spoonsful every quarter of an hour until vomiting is produced, or a violent nausea.

much

much advantage, especially in inflammation of the lungs. The formula is,

Tinct. scillæ—unc. 3.

Cap. coch. min. 1. omni quinque minutâ usque ad vomitionem.

That is,

Tincture of squills.

Take a tea-spoonful of this every five minutes until vomiting comes on.

I need mention but one more, which is an infusion from half a drachm to a drachm of the dried leaves of tobacco, or of these as they are commonly prepared for chewing, for an hour, or more, in four ounces of boiling water, affords an emetic which produces great nausea and depression, but as the sickness is less manageable in both these last, than with the ipecacuan and emetic tartar, and appear, what practitioners would term, extremely inelegant, their specific powers have not been as yet sufficiently ascertained.

It may be proper here just to mention that to bring up opium the best emetic is zinc *, and where arsenic, or corrosives, are taken, we should employ ipecacuan, or use oil, or butter.

* The formula is,

Zinc vitriolat.—scr. 1.

Aq. tepid unc. 4, solve ut ft. hauf. emetic.

That is,

A scruple of vitriolated zinc dissolved in four ounces of water for an emetic.

PRACTICAL OBSERVATIONS.

S E C T. LXXXIII.

PURGING.

PURGING abates an intenseness of motion in the vascular system, on two accounts; first, as it draws off a considerable quantity of animal fluid, of course lessening the force of the motory fibres in general, and those of the heart and arterial tunics in particular; and, secondly, as it clears the intestines of many acrid and stimulating matters, which by their stay would necessarily keep up an unusual degree of irritation.

Hence it is of great service in all cases where the motions of the vascular system are raised much above the healthy rate, to subjoin the use of cathartics to the letting of blood; or even frequently to give them previous to venesection.

The substances used for emptying downwards through the alimentary canal are distinguished into such as are lenient; opening the belly but gently; and such as are drastic, and purge briskly. Their
action

action consists in irritating the sensible fibres of the intestines, whereby not only the peristaltic motion is accelerated, but also the secretion of mucus and lymphatic vapour, which ouze every where into the cavities of the intestines, is increased, as well as unusual quantities of pancreatic juice and bile derived from their several sources. Hence we may easily judge how great a quantity of humours may be carried off by one brisk purge, and in how sensible a degree the whole mass of fluids may be thereby decreased.

Consequently it is obvious, that the evacuation by stool may be so large as to diminish the quantity of fluids in the whole system; and therefore, that whenever such a diminution is indicated, it may be obtained by the use of such medicines: and I need not say that particularly by this means any preternatural increase of the activity, or of the active powers of the system, may be thus greatly diminished.

It is at the same time however to be remarked, that although by purging a great debility of the system may be induced, it may not produce any great evacuation of the sanguiferous system. A large evacuation by stool may sometimes be merely of the contents for the time present in the intestines, and therefore not drawn from the blood-vessels: and though the evacuation may be still larger by what is drawn from the mucous follicles,

this we know may be very copious from the matter contained in the follicles themselves, without much liquid being drawn from the blood-vessels. The evacuation indeed may also be increased by what is drawn from the arteries by the exhalant vessels; but as this must be drawn off slowly in very divided portions, it can have little effect, and at least no sudden effect in the depletion of the sanguiferous system: and from the whole it will appear, that the evacuation by stool may be very large, without much effect in taking off the tension and tone of the blood-vessels. In this respect, indeed, it seems to fall far short of the powers of blood-letting, though this be contrary to the common opinion, and even contrary to the practice of SYDENHAM: for in truth we have not found purging to be of so great effect in taking off the phlogistic diathesis of the system as the other.

Besides the general evacuation of the whole system, purging is powerful in changing the distribution of the blood into the several parts of it.

The circumstances according to which the distribution of the blood is made into the several parts of the system, we suppose to be commonly known, and to this effect, That if an evacuation is made from one set of vessels, the afflux of fluids will be increased in these, and that the afflux into other parts of the system will at the same time be diminished. Upon this principle it will be readily understood,

derstood, that if the afflux of fluids in the descending aorta is increased, as it must be by purging, the afflux must in some proportion be diminished in those vessels which carry the blood to the head. By this the quantity and impetus of the blood in the vessels of the head must be diminished by purging; and hence it is that this operation of cathartics has been found so extremely useful in the diseases of the thorax.

With respect to the choice of purgatives, the neutral salts have been usually preferred.

As they do all that can be effected by an evacuation from the intestines, without acting strongly upon the moving fibres, they give no stimulus, or at least no inflammatory stimulus, to the whole system, and are therefore most usefully employed when any phlogistic diathesis prevails in it.

The whole of the neutral salts may be employed for these purposes, but some of them more conveniently than the others.

That formed of the fixed acid of vitriol with the vegetable fixed alkali *, from its being of difficult solution, is not a convenient medicine; but if the neutral be formed of the sulphureous, or volatile vitriolic acid, when it comes under the title of Sal Polychrestus †, this, to persons who can bear its odour, taken from one dram to four, proves a very

* Potash.

† Sulfate of potash.

convenient

convenient laxative. But I must remark here, that those apothecaries mistake the matter much who take the residuum of the distillation of Glauber's acid of nitre for the *sal polychrestus*.

The vitriolic acid with the fossil alkali *, gives the neutral named Glauber's salt †, in very frequent use; and which indeed, on every occasion, serves the purpose of the neutrals.

It is now well known, that such a neutral may be made of the vitriolic acid with either the fossil alkali or with *magnesia alba* ‡; and from every observation I can make, there seems to be no difference in the two compositions for all the purposes of a neutral salt.

The nitrous acid with either of the alkalines gives laxative neutrals; but they are not conveniently employed in practice, because the quantity that is necessary to be a laxative dose is commonly very disagreeable to the stomach.

The muriatic acid gives neutrals which may be employed when largely diluted; but to most persons the salt taste is disagreeable, and large doses are ready to excite an uneasy thirst, that continues after the operation of the salt is over.

The vegetable acids, either native or fermented, give neutrals that may be employed; but they are

* Soda.

† Sulfate of soda.

‡ Carbonat of magnesia.

not very powerful, and therefore feldom conveniently uſed as laxatives.

It is the acid of tartar * that gives ſome of the moſt convenient laxatives; and they are prepared by ſaturating the cryſtals with the quantity of alkali neceſſary to render the whole exactly neutral. For this purpoſe, either the fixed vegetable or foſſil alkali may be employed. The former gives the tartarum ſolubile, or alkali tartariſatum †; and the latter gives the ſal Rupellenſis, or natrum tartariſatum ‡. The tartarum ſolubile is not eaſily brought into a cryſtalline ſtate, or kept in a dry form; whilſt the ſal Rupellenſis has not either of theſe diſadvantages. It is of a leſs diſagreeable taſte than almoſt any other neutral; and as anſwering every purpoſe for which theſe can be required, I expect it will come to be very generally employed. As the acid of tartar is of a weaker attraction than almoſt any other acid, ſo it may be often diſlodged by the acid of the ſtomach, and this often renders the operation of the tartarum ſolubile leſs certain, as the combination of the alkali with the acid of the ſtomach is a leſs powerful laxative; but the ſal rupellenſis is not liable to this diſadvantage, as the acid of the ſtomach combined with the foſſil alkali is ſtill a tolerably powerful laxative.

* Tartarous acid.

† Tartrite of potaſh.

‡ Tartrite of ſoda.

The next that presents itself to us is rhubarb. Much pain has been taken to ascertain the species of this genus that gives the root which the physicians of Britain have considered as the species of greatest value, and such as has been imported under the name of Turkey Rhubarb. Whether this may be exactly determined or not, I cannot clearly judge; and in the mean time, I do not think it necessary to prosecute the matter farther with any anxiety, as we have now got the seeds of a plant whose roots, cultivated in this country, shew all the properties of what we considered as the most genuine and valuable rhubarb; and which, if suffered to grow old, and being properly dried, will in time supersede the importation of any other.

The qualities of this root are that of a gentle purgative; and so gentle that it is often inconvenient, by reason of the bulk of the dose required, which in adults must be from half a dram to a dram. When given in a large dose it will occasion some griping, as other purgatives do; but it is hardly ever heating to the system, or shews the other effects of the more drastic purgatives.

The purgative quality is accompanied with a bitterness, which is often useful in restoring the tone of the stomach when it has been lost; and for the most part its bitterness makes it sit better on the stomach than many other purgatives do. Its operation joins well with that of the neutral laxatives;

and both together operate in a lesser dose than either of them would do singly.

The present is an excellent formula,

℞ Rhei pulv. scr. i.

Kali vitriolat. scr. $1\frac{1}{2}$.

Aq. Cinnam.

Aq. Menth. Pip. aa dr. 7.

F. Haustus.

That is, take of

Rhubarb—a scruple.

Vitriolated Kali—a scruple and a half.

Cinnamon Water.

Simple peppermint water, equal parts—
seven drachms.

To make into a draught.

Sometimes, to quicken its operation, addere licet,

Antim. tart. gr. $\frac{1}{2}$.

It is proper to add of

Tartarized antimony—half a grain.

Vel Jalapii pulv. gr. 6.

Or, of Jalap in powder—six grains.

Vel Calomel. gr. 2.

Or, of Calomel—two grains.

The next purgative which claims our consideration is Jalap. Here is a medicine of certain and
great

great efficacy. Even to the eye-sight, the entire root contains a resinous part; which can, in considerable quantity, be extracted from it by spirit of wine, leaving the residuum nearly quite inert. The resin thus separated is an acrid inflaming matter, which, thrown into the stomach, proves a drastic purgative; but it is rendered milder by being divided by a triture with any hard powder before it be exhibited. It is certainly by its resinous part that the entire jalap proves purgative, and in large doses proves a strong one; but as it is given in powder, the previous triture, by dividing the resin, renders the entire jalap a milder medicine than the resin taken separately. It may be given to persons not very irritable to half a dram for a dose, but lesser doses will commonly answer; and while it very certainly operates, it is commonly without violence, and often without griping. If it be well triturated, before exhibition, with a hard powder, and the crystals of tartar * are the fittest for the purpose, the jalap will operate in lesser doses than when taken by itself, and at the same time very moderately and

* R Jalap pulv.—gr. 8.

Tart. Crystal pulv.—dr. $\frac{1}{2}$.

F. pulv. statim sumend.

That is, take of

Jalap in powder, eight grains.

Crystal of tartar, half a drachm.

Make into a powder to be taken immediately.

without

without griping. Except when given in very large doses, I have not found it to be heating to the system; and if it be triturated with a hard sugar, it becomes, in moderate doses, a safe medicine for children, which in this form they will readily receive, as the jalap of itself has very little taste.

While jalap may be thus rendered mild and safe, it may, however, by being given in large doses, and especially by being joined with calomel, which has no taste, be rendered one of the most powerful purgatives, and, if we mistake not, more safe than any of the other drastic purgatives.

For the sake of dear children, whose reasons are not strong enough, nor our influence over them, often sufficient, to get them to take nauseous medicines, I must add one more purgative, which is sufficiently mild and quick, I mean fenna *, which
may

* Take of the leaves of fenna, deprived of the stalks, a drachm, and pour boiling water over it, and give a cup of this occasionally. How far preferable is this to the common practice of always giving *calomel* only, because children will take it, forgetful of the frightful consequences that often ensue.

For grown up persons the following are the best formulæ,

R Infus. fen. simp. unc. 3.

Antim. tart. gr. 1.

• M. F. Haustus statim. sumend.

may be made into tea, sweetened, and milk put to it, or cream, when it becomes, if not made too strong, sufficiently palatable, and a cup may be given every hour and a half until it operates.

That is, take of

Simple infusion of fena—three ounces.

Tartarized antimony—one grain.

To be made into a draught, to be taken immediately.

Or,

R Inf. fen simp. unc. 3.

Natr. vitriolat. unc. $\frac{1}{2}$.

Sp. Piment. dr. 2.

F. Haustus statim. sumend.

That is, take of

Simple infusion of fena—three ounces.

Vitriolated natron—half an ounce.

Spirit of allspice—one drachm.

To be made into a draught, to be taken immediately.

PRACTICAL OBSERVATIONS.

SECT. LXXXIV.

BLISTERING, AND OTHER TOPICAL APPLICATIONS.

It might appear at first sight, that blistering is not the abstraction, but the addition of a powerful stimulus, and as such it is sometimes given to rouse the animal œconomy. Its first action is certainly that of stimulating: but in this it invites the blood to the surface, deriving from the part most suffering by inflammation, and by its action expends the irritable principle, which becomes engaged in pouring out serum under the cuticle, and hence the abstraction of so much of a stimulus, thereby discharged. It is a kind of half bleeding. The after process of healing is another expence of the irritable principle.

Where the throat is inflamed, hartshorn and oil mixed in equal parts, and put upon a flannel, is an excellent application round the throat.

From this principle blisters are put behind the

ears for inflammation of the eyes, and setons are cut in the arm.

There are, however, other applications in use, which directly meet our principle. In inflammation of the liver it is customary to apply wet cloths dipt in a frigorific mixture over the abdomen, and as often as the cloths get warm fresh cooling applications are applied. This was lately done by Dr. Garthshore, in a case of peritonæal inflammation, which in half an hour produced the greatest ease, and sunk the pulse from a hundred and twenty to ninety. This practice is new, and deserves every attention.

In inflammation of the eyes there is nothing so good, as keeping a rag constantly wet over the eye, the usual application is rose water.

The effect of a poultice seems to be founded entirely upon this principle, for it seldom when first put over an inflamed part is more than ninety-seven degrees of heat, and soon sinks below that, and the quantity of aqueous matter, rising in the form of vapour, produces an additional abstraction of heat.

• PRACTICAL OBSERVATIONS.

S E C T. LXXXV.

REFRIGERANTS.

THESE are medicines supposed, as their title implies, to diminish the heat of the living body.

As the neutral salts, which are the refrigerants chiefly employed, do, upon being dissolved in water, generate a considerable degree of cold; so it has been supposed that they may in like manner generate cold in our bodies, and therefore produce their effects as by an actual cold applied. See Brocklesby's Observations, p. 122.

This conclusion, however, will readily appear to be mistaken, when it is considered that the cooling power of these neutral salts in water appears only during the time of their solution. When taken indeed undissolved, they may, as in Brocklesby's and Alexander's experiments, generate cold in the stomach, and from thence have particular effects: but as after solution they produce no permanent cold;

so, when taken in a dissolved state, as they commonly are, their refrigerant powers cannot be ascribed to any actual cold applied.

The conclusion drawn from their solution in water further appears to be very erroneous, from this; that acids, which are as powerfully refrigerant in the human body as the neutrals, do however, upon being mixed with water, always generate heat; and even the neutral salts, when any how deprived of the water necessary to their crystalline state, do, upon that water's being restored to them, always generate heat. It is not therefore any thing in the nature of the saline matter that has a power of generating heat or cold in water or other bodies, but that the appearance of such a power depends entirely upon the circumstances of solution or mixture, and appears no longer than these circumstances subsist.

They produce, upon this principle, however, great good in inflammations of the fauces, and I have known a sore throat in the forming stage, cured in a few hours by putting pieces of nitre in the mouth, which gradually dissolves, and the saliva is swallowed. I have found it almost an infallible preventive.

At the head of the list of refrigerants acids are usually placed; and although these might come under some other of our general titles*, I shall here

* As a tonic.

consider all their several powers and virtues as refrigerants.

It might be expected that I should here, in the first place, enumerate all the several substances which may be, and generally are, comprehended under this general title; but this I find would be a difficult, and we hope it is an unnecessary work. The chemists of late have been discovering a great number of different species of acids that were not known before; and it is probable that their inquiries are not yet finished; but in the mean time, it appears, that although it was very proper for the purposes of chemistry to mark and ascertain the diversity of acids, yet as few of the whole number have been employed as medicines, and that we are at least uncertain how far several of them may be employed as such, it does not seem necessary for us to take notice of any but those which we know to have been employed in the practice of physic.

In doing this, we shall in the first place mention the medicinal qualities which we suppose to be in common to all the species of acids employed in physic; and shall afterwards consider how far these qualities may be anywise different in the particular species.

Upon this plan, the quality first to be mentioned is that of their refrigerant power. This we suppose to be established by the experience of all ages; and practitioners still constantly employ them in every

case in which the heat of the body is preternaturally increased; and although there may be some of the other qualities of acids which may not be suited to the constitution of certain persons, yet as to this quality there are hardly any exceptions.

These effects, however, are not very evident to our senses, nor are easily subjected to experiment; because they cannot be remarkable in consequence of any one exhibition; and the effects are only found in consequence of frequent repetitions. It is proper, therefore, that we should confirm it by other observations.

One is, that any preternatural heat arising is accompanied with thirst; which especially directs to the choice of acids: and as instincts may be commonly supposed to be suited to the purposes of the animal œconomy, so this desire of acid is presumed to be a proof that these are suited to moderate the heat that is the cause of thirst.

Another consideration may be, that acids especially abound in warm climates and warm seasons; and therefore, that nature has made this provision of what is suited to moderate the heat of the human body, arising in such climates and seasons*.

* Vide Vol. II. page 36, where the rationale of the cooling properties is attempted to be explained.

VITRIOLIC ACID *.

When it is to be employed for internal use, it must be largely diluted with water; and the dispensaries have ordered seven or eight parts of water to be added to one of the concentrated acid. The proportion of water is not a matter of much nicety; but

* Vitriolic acid, (new name, the acidum sulphuricum) is generally in a liquid form. It exists in various metallic and earthy bodies, but is chiefly obtained from green vitriol, and from sulphur; 16 oz. of the latter forming 9 oz. of the acid.

It is the strongest of all acids, and has the greatest specific gravity; the proportion of which to distilled water, is as 1800 to 1000. It generates much heat with water; becomes dulcified, that is, loses its acidity, when incorporated with spirit of wine; dissolves iron, zinc, and copper; and with boiling heat may be united to all metals. It corrodes all animal and vegetable substances, checks fermentation, and neutralizes alkalies; and will become volatile, by mixing it with liver of sulphur, made with caustic alkali; but in this volatile state its affinities and powers are much diminished.

Stahl, the scholar of Becher, and promulgator of the phlogistic doctrine, derived the vitriolic acid from sulphur, deprived of phlogiston. The French chemists declare it to be a compound of sulphur, a simple substance, and oxygen, attracted from atmospheric air during combustion.

Diluted or weak vitriolic acid, (new name, acidum sulphuricum aqua dilutum).—This was lately called spiritus vitrioli tenuis, and is frequently ordered instead of the elixir vitrioli

acidum

but it is proper for the sake of prescribers that it should be fixed, which, however, cannot be done without determining the specific gravity of the concentrated acid, which neither of the colleges have done.

Even the diluted acid is seldom employed in any precise dose, but mixed with water, or with tinctures or infusions, in such quantity as the patient's palate will easily bear. This however is a very inaccurate practice, as it generally occasions the dose of the acid to be too small. In my opinion, it would be better to fix the quantity of acid, and leave it to be diluted to what the patient's palate may require.

The simple acid properly diluted, and sweetened perhaps with a little sugar, is generally grateful to the palate, and is of service in quenching thirst. When it is carried down into the stomach, it is useful in curing the nausea which arises from any

acidum of the former dispensatory. The dose may be from 10 to 30 drops.

The following is an excellent formula.

R Infus. rosæ unc. 7.

Natr. vitriolat unc. $\frac{1}{2}$.

Capt. coch. larg. 4, sextâ quâque horâ.

That is, take of

The infusion of roses—eight ounces.

Vitriolated natron—half an ounce.

Take four table spoonsful every four hours.

putrid

putrid matters there; and either by this means, or by its stimulus applied to the stomach, it excites appetite, and consequently promotes digestion.

I have never found that, in any quantity, the vitriolic acid mixed with the bile proved laxative, as the vegetable acids so readily do.

NITROUS ACID *.

This acid, from its being so commonly employed in chemical operations under the title of aquafortis, has probably, from the opinion of its corrosive nature,

* Nitrous acid, (new name, acidum nitricum).—Nitric is a neutral salt, composed of an acid and an earthy basis, impregnated with animal or vegetable matter. This acid may be separated by the force of fire, but is much more easily obtained by the assistance of a proper quantity of vitriolic acid; the latter having a greater affinity to the alkaline part sets free the nitrous acid, which by distillation, is carried over into the receiver.

This acid is commonly in a fluid state, of a reddish colour, and emits noxious fumes; it is specifically lighter than vitriolic acid, effervesces strongly with oils and vinous spirits, dissolves most metallic, and all kinds of animal and vegetable substances, generates cold, increases inflammability, and promotes fusion. Exposed to intense heat, it produces a large portion of pure air: $13\frac{1}{2}$ dr. of this acid will saturate 1 oz. of salt of tartar, or prepared kali. The more concentrated it is, the more volatile, the more diluted, the more fixed. The specific gravity to the weight of distilled water, is as 1550 to 1000.—*White*.

Diluted

nature, prevented physicians from employing it as a medicine. This however was a mistake*; for this acid, properly diluted, may be very safely employed, and has all the powers and virtues of acids in general. Though the instances are few, there is one in Boerhaave's *Nitrum Nitratum*, in which the acid is in greater proportion than is necessary to saturate the alkali; and I have frequently, says Cullen, employed it as a grateful and cooling medicine.

Diluted nitrous acid, (new name, acidum nitricum aqua dilutum).—The vapour which rises in mixing these fluids, is nitrous acid air. This acid is used as a menstruum, and in a few particular preparations.

This is used as the vitriolic acid, but in a larger dose.

* It has of late been so much employed in venereal cases, that we may in future venture more freely upon its use, and probably greatly augment the quantity given of the other mineral acids.

The proper formula may be.

℞ Acid. nitros dr. $\frac{1}{2}$.

Decoct. hordei. lb. 2. M.

Bibat æger quotidie, ope tubuli vitrei, a libra una ad libras duas usque.

That is, take of

The nitrous acid—half a drachm.

Barley water, or thin gruel—a quart, thin.

Let the patient drink, by means of a glass tube (a quill may serve the purpose) from one to two pints daily.

At present cremor tartar drink is most common.

MURIATIC

MURIATIC OR MARINE ACID *.

In the last century Glauber took great pains to introduce the use of this acid, ascribing many virtues to it both in diet and medicine. Hence it happened that physicians employed it a good deal in the diseases of the stomach; and many have been of opinion, that in restoring the tone of the stomach, it operates more powerfully than the vitriolic: but as the latter can be more easily brought to a stand-

* Muriatic acid, or marine acid, is generally procured from sea salt, which is compounded of fossil alkali, or natron, and muriatic acid. It may also be obtained from vegetables, fossils, urine, foot, &c. In this process likewise the vitriolic acid is commonly employed to decompose the salt, and to set the marine acid at liberty. The neutral salt left in the retort is, when cleansed, the vitriolated natron, or Glauber's cathartic salt, viz. the alkaline basis of the sea salt, and the vitriolic acid united.

The marine acid acts readily on metallic bodies, and has a greater affinity to most of them than other acids. It does not touch gold in its metallic state, except mixed with eight times its quantity of the nitrous acid, which forms an aqua regia. It mixes readily with spirit of wine, and affords a true æther. When concentrated, it is of a yellow colour, and oily particles float on its surface. Its specific gravity to that of distilled water, is as 1170 to 1000.

This is the weakest of the mineral, but stronger than the vegetable acids, and is chiefly used as a menstruum. It is given to adults in doses of 10 to 40 gtt. or more, with draughts of diluting liquors.—*White.*

ard than the other, it has entirely thrown this other out of our practice. Although the London college, in the last edition of their Dispensatory, have omitted both the simple spirit of salt and the spiritus falis dulcis, yet the Edinburgh college have retained both: and wherever the latter is employed, I consider it as an employment of the acid; for, in the ordinary preparation of it, the qualities of the acid are never entirely destroyed.

But the most remarkable instance of the employment of this acid was in the *tinctura aperitiva moebii*, which Dr. Hoffman informs us was, in the course of the last century, much employed and celebrated for its virtues. Dr. Hoffman informs us that it consisted of a solution of common salt supersaturated with its acid. I have frequently employed it by making a solution of half an ounce of good bay salt in four ounces of water, adding to this two drachms of a well-rectified spirit of salt; and this given in a tea spoonful or two in a glass of water I have found useful in improving appetite, and frequently in stopping vomiting.

Acids I shall consider as of three kinds; the native, the distilled, and the fermented.

The native acids are chiefly those found in the fruits of plants, sometimes however also in the leaves and roots. They are in different degrees of acidity, and different by the texture of the fruit in which they are lodged; and still more considerably
by

by the various matter adhering to them, both in the fruits and in the juices expressed from these.

The effects of these different conditions in the use of them as aliments I have endeavoured to explain when treating of them above *; but, as medicines, I do not find that I can apply any distinction of them. Although they may be distinguished in a chemical view, I do not find that I can apply such distinctions to the purposes of medicine; and that, with a view to this, I must consider them in general, and merely as acids. In considering them therefore as medicines, I must observe, in the first place, their refrigerant power; and that, especially upon account of the quantity in which they may be given, they are the most effectual of any we can employ. As we have said above, that they enter into the composition of the animal fluid *, and thereby diminish the putrescent tendency of this, they therefore, as I judge, obviate the heat that might otherwise arise; and it is in proof of all this that they are the most ready and certain cure of scurvy.

The same acids are never in such a concentrated state as to show any caustic or even stimulant powers; but they show readily the stimulant power which is in the weaker or much diluted acids, so far as they excite appetite and promote digestion: and probably it is by the same power that they excite the urinary excretion.

* Vide Vol. II. page 36.

All these powers are to be ascribed to the pure acid that is in this native acid of vegetables; but it is now to be remarked, that in all of them, even the most purely acid, there is present a quantity of fermentable matter: and if this happens to be in large proportion, or even in small proportion, and thrown into the stomachs of an acescent disposition, the acid undergoes a fermentation, which is attended with flatulency, a more powerful acidity, and all the other symptoms which we term Dyspeptic. This does not however much affect their refrigerant power, or do much harm to the system, except in those cases of gout and calculus renalis, in which the taking down the tone of the stomach may be very hurtful. It seems to be in consequence of this acescent disposition of the stomach that a more copious acidity, and perhaps of a peculiar kind, united with the bile, forms a laxative which may occasion more or less of diarrhœa, and the cholic pains which so frequently accompany the operation of laxatives.

DISTILLED ACID OF VEGETABLES.

All vegetables except mushrooms, if these be truly such, when treated by distillation without addition, give out, in the first part of the distillation, a quantity of acid, and continue to give out more during the whole of the distillation. This acid is
somewhat

somewhat different according as it is drawn from different vegetables: but that difference has not been ascertained; and we know them even in chemistry, and more certainly in medicine, only by the common quality of acid.

This acid has been but little employed as a medicine, and has hardly been remarkable but by its late use in the form of tar-water. In making tar, it is exhaled from vegetables whilst they are burnt, in the same manner as in the distillation above mentioned; and accordingly, in the making of tar, an acid water is found in considerable quantity in the same ditches that are prepared for receiving the tar during the burning of the wood. In the countries where tar is prepared, particularly in North America, this acid was accidentally employed as a medicine. It was found to prove very useful; and the benevolent and worthy Bishop Berkeley being informed of this, was desirous of rendering such a medicine very generally known. But as the water collected, as we have said, during the burning of the wood, could not properly or conveniently be obtained in Britain, he perceived that a quantity of the acid remained in the tar as it was imported, and conceived that it might be extracted from it by infusion in water. It is such an infusion that gives the celebrated tar-water which has been so much talked of.

It was at first by many persons celebrated as a very valuable medicine; and, from my own obser-

vation and experience, I know it in many cases to be such. But, as happens in all such cases, the commendations of it by the patrons and favourers of it were very often extravagant and ill founded; and though the persons who disparaged it had some foundation for their opinions, yet they also told many falsehoods concerning it.

Although it would have been difficult, at that time, to balance between these opposite accounts; yet, in the course of sixty years, the matter has found its own balance. The excessive admiration of it has entirely ceased, and the most part of practitioners, from causes we could assign, have neglected the use of it; but there are still many judicious persons who believe in and employ its virtues. In many instances this preparation has appeared to strengthen the tone of the stomach, to excite appetite, promote digestion, and to cure all the symptoms of dyspepsia. At the same time it manifestly promotes the excretions, particularly that of urine; and the same may be presumed to happen in that of others. From all these operations it will be obvious, that in many disorders of the system this medicine may be highly useful.

It may be however, and has been a question, upon what, in the composition of tar-water, these qualities depend: and I have no doubt in asserting that it is entirely upon the acid produced in the manner above mentioned. Mr. Reid, the author
of

of a dissertation on this subject, has rendered this sufficiently probable, from the accounts of Glauber and Boerhaave with respect to the virtues of such an acid, and from the opinion of the Bishop of Cloyne in preferring the Norway tar to that of New England, as the acid part is not taken from the former so entirely as it is from the latter; and he also properly supports it by this, that any other parts of the tar-water which may be found in it, unless carefully separated, are commonly very hurtful.

Upon the first introduction of tar-water, some physicians were of opinion, that it derived part of its virtue from some oily matter in its composition; but it would not be difficult to show, that this, in many respects, is very improbable, and that, upon the contrary, the presence of these oils, as Mr. Reid has particularly pointed out, is frequently pernicious. But, to supersede all controversy on this subject, I can assert from much experience, that the tar-water, as it abounds in acid, and is more free from all oily matters, is the most effectual medicine: and I have this clear proof of it, that when, instead of extracting the acid by infusing the tar in water, I procured it by distillation from solid fir or other woods; and, by taking only the first part of the distillation, I obtained the acid as free as possible from all oily matter. I found that by employing this acid as a medicine properly diluted with water, every virtue appeared that was ever found in any tar-water. In

this practice I found a particular advantage; as I could, by a proper rectification and concentration, bring the acid into a small bulk; which being readily portable, is, on occasion of journeys, or other circumstances, rendered very convenient. But it is very necessary to observe here, that this acid, to be rendered a very useful remedy, must be always largely diluted with water; and how much the water may favour its operation in every respect will be sufficiently obvious.

ACID OF VEGETABLES.

This is the well known liquor named Vinegar, the preparation of which need not be given here. As it is found in our houses and shops it is in different conditions, the causes and circumstances of which are not well ascertained; and we can only judge of its purity by the sharpness of its acid taste, and its being free from all others.

As this acid is prepared by fermentation, it is always in a diluted state; and, both for the purpose of medicine and of pharmacy, it has been desirable to be obtained in a more concentrated condition. The purposes and the execution of this are various; but the most ordinary practice has been by distillation, which seems to me not to be the most proper: for the distillation cannot be practised without the acids becoming empyreumatic, which always renders

ders it a disagreeable medicine; and at the same time, by the ordinary practice, the acid is hardly or not at all rendered stronger than it might have been by a proper fermentation. The directions of the London College I could never follow with any exactness; and I have always found, that before the aqueous part be drawn off, an empyreuma is communicated to the whole liquor.

The Edinburgh directions may be exactly executed; but the empyreuma is made very strong, and at the same time the distilled acid, as I have said, is hardly stronger than it is in good vinegar; and I know of no advantage that this distilled acid has over the other.

If a concentrated vinegar is much to be desired, there are two other ways of obtaining it. The one is by freezing, which has now been frequently practised in the northern countries of Europe; and the management of it is prescribed in many books of chemistry, that I believe are almost in every body's hands.

The other means is by a distillation from any neutral containing this acid, by the addition of a strong vitriolic acid. This gives a very volatile acid, which by its volatility may be applied to several purposes; and by its being in a concentrated state it may be, by a proper dilution, applied to every purpose of medicine that the fermented acid of vegetables is fit for.

It is true that this distilled acid wants some substances which are joined with it in the vinegar prepared by fermentation; and Dr. Boerhaave insinuates that some virtues may be derived from these. I have not however truly perceived them; but allow, that if there are any such advantages to be desired, they may be more certainly obtained by employing the vinegar concentrated by freezing.

After these remarks upon the different management of this acid, I proceed to consider its virtues. It is certainly a refrigerant power, which we conclude both from experience and from its antiseptic powers; and it has this advantage over the fossil acids, that it can be thrown in, in much larger quantity, and with more effect, as it enters into the composition of the animal fluid. It is grateful to the palate and stomach, and certainly stimulates the latter so far as to excite appetite. By the same stimulant power it acts upon the mucous excretories of the mouth and fauces; and at the same time it seems to act as an astringent on the blood-vessels of these parts, and proves useful in the inflammatory affections of them. When it is carried in large quantity into the blood-vessels, a portion of it passes off by the excretions, and proves manifestly diuretic. It is celebrated also for its diaphoretic and even sudorific virtues; and these are commonly ascribed to its power of dissolving the fluids. But this, upon the general principles which will be explained hereafter,

after; we must deny; and if it ever has appeared to have this effect, we must impute it to its refrigerant powers in the stomach, and its gently stimulant powers in the whole system, assisted by a sudorific regimen.

We have now mentioned most of the acids that are well known in the practice of physic; but I must own that there are many others which have been sometimes employed, and may I believe deserve to be inquired after, but I own that I find the facts too few to determine the matter clearly, and at least that I am too little acquainted with these facts to be able to speak positively on the subject.

Of the large list that might be mentioned, the only one that I am disposed to take notice of is the

ACID OF BORAX.

This was the invention of the celebrated Homberg; and, as he imagined it to be possessed of strongly sedative powers, he gave it the name of the *Sedative Salt*. Upon such an authority it was introduced into practice; and such is the favour for a new medicine, and such are the excuses so readily found for its failure, that it soon came to be much employed in France: and Mr. Geoffroy having found a cheaper method of preparing it, the govern-

ment ordered, at their expence, that it should be furnished to all the medicine chests of the army and navy.

This certainly gave an easy opportunity of trying its virtues; but we have hardly ever had any favourable reports of these from France, or from any other country of Europe: and it appears that the practice with it has ceased every where; and long ago Mons. de la Mettrie has, in disparagement of our art, observed, "*Que le sel sedatif n'est pas aussi sedatif qu'autre foi.*" "That the sedative salt is not as sedative now as formerly." To all this I could add my own experience, which has shown me, that even in large doses this salt has but slight if any effect on the human body.

NEUTRAL SALTS.

The next set of refrigerants I am to speak of, are the neutral salts; and these, with acids, are certainly the refrigerant remedies we chiefly depend upon in practice. The refrigerant power seems to be in common to every neutral, so far as we have yet tried them, except those neutrals composed of the muriatic acid and fossil alkali, and perhaps some other acids which carry into the composition of neutrals some other matters of an acrid kind: but these are not well ascertained; and we take it for granted that it is of the nature of a neutral salt,
composed

composed of an acid and alkali, with the exception mentioned, to give a refrigerant substance.

This power in these salts is a matter of common experience, and may be presumed from their antizymic and antiseptic powers; but in what proportion it is in the several species, is not exactly ascertained, though Dr. Smith, in his experiments, has done somewhat to this purpose. In the Doctor's experiments it appears, that, except in common salt, some sedative power in every one takes place. In these, indeed, composed of the fossil alkali, some stimulant power appears upon their first application; but soon after this, their sedative power becomes manifest by their destroying the irritability of the part. After all, however, I cannot apply these experiments so as to explain the respective powers of these salts as they appear in the practice of physic. It appears here, that all them which show a sedative power in Dr. Smith's experiments, when thrown into the stomach, produce a disposition to sweat. The prejudices of practitioners at present are in favour of the neutral formed of the native acid of vegetables with the fixed vegetable alkali; and while this is the most agreeable, I have no objection to its being the most commonly employed in practice: but I make these observations to show country practitioners, that when they happen to be in want of lemon juice, they may employ any other acid except the muriatic to form neutrals that may
answer

answer the same intentions; and a very little chemistry will teach them every thing else that may be here necessary. In the time of our last wars upon the continent, our practitioners frequently employed the vitriolic acid, and which was indeed employed in making the original antiemetic draught of Riverius.

With regard to particular neutrals, I have a few observations only to make. I have said just now, that the vitriolated tartar may be employed as a refrigerant; and as it is thereby diaphoretic, it is employed in the composition named after Dr. Dover.

The sal mirabile is almost only employed as a purgative; but that it has refrigerant powers, appears from the intestines being left, after the operation of this purgative, in a lax and flatulent condition.

What is named the secret sal-ammoniac is little employed in practice; but there is no doubt that it is nearly of the same nature with the common ammoniac.

Nitre has been commonly esteemed as the most powerful refrigerant; and from Dr. Smith's experiments, as well as from those of Mr. Alexander, it appears to be so. But as all refrigerants produce a determination to the surface of the body; so, before this operation, they prove directly stimulant to the stomach and alimentary canal: and in this way nitre
is

is as remarkable as any other; and it is therefore, in large doses, very often uneasy and painful to the stomach. When it is therefore necessary to continue its operation as a sudorific, it is at the same time necessary to give it in divided doses, and at proper intervals.

I do not doubt but the practice of Dr. Brocklesby may be often successful; but I could never find it convenient to imitate it, as I could hardly, or at least seldom, find a stomach that would bear half the quantity of nitre that he seems to have employed; and in most cases I have been limited in the doses of nitre that I could exhibit. I believe that the employment of nitre, as recently dissolved, will be a more powerful refrigerant * than when the solution of it is entirely finished; but I am of opinion that the practice has no advantages to compensate the inconvenience that sometimes attends its exhibition.

I have so seldom employed the cubic nitre that I know little of its qualities and powers.

Of the peculiar power of neutral salts formed of the muriatic acid, I have had occasion already to remark, that by Dr. Smith's experiments, common

* Dr. Percival made many accurate observations on nitre, and he found it to increase the force of the circulation, and hence he excluded it from the class of refrigerants. Given, however, in the way recommended, it may act like *Ice*, a very powerful and common remedy in Italy, and perhaps iced water might be very usefully employed in this country.

salt composed of the muriatic acid and fossil alkali is the neutral which, applied to the nerves or other irritable parts, shows a strongly stimulant power, and is therefore to be thrown out of our list of refrigerants. Its stimulant power seems in part to be owing to the fossil alkali in its composition; for this alkali, joined with the nitrous or vegetable acids, do also, in the first application to the nerves, in Dr. Smith's experiments, show somewhat of a stimulant power, which however soon passes away, and they afterwards prove manifestly sedative. These neutrals, therefore, consisting of the fixed vegetable or volatile alkali, though formed by the muriatic acid, may be taken into our list of refrigerants; and their common employment as sudorifics, which they generally produce, is only to be explained upon this ground.

The use of the common ammoniac has been otherwise frequent in practice; but what are its peculiarly useful powers, I dare not determine. Its resolving powers, by attenuating or dissolving the fluids, I do not admit of; but that, like other saline matters, in passing by the excretions, they are suited to promote these, may be really allowed.

The neutrals composed of vegetable acids must be different according to the species of this acid employed: but they are all in general refrigerant and diaphoretic, and we know them only in that light. The one most frequently employed is that composed

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ed of the native acid and the fixed vegetable alkali, commonly known under the name of the Saline Mixture. The acid commonly employed is the juice of lemons; but that only because a quantity of acid juice is most easily obtained from that fruit. I have frequently employed the expressed juice from several other fruits, which the country practitioner should know in the case of the want of lemons; and I have frequently employed the juice of apples with equal advantage.

It is hardly necessary to say that the alkaline salt of wormwood, so frequently employed before, be now used, as the purer the alkali the medicine is the better.

This neutral salt, formed and given in due quantity, is, for what I can perceive, equally refrigerant and sudorific as any other, and has this particular advantage, that it is, or can be, easily rendered more agreeable than any other. In my opinion it is commonly given in too small doses, and at too great intervals; and though given in large doses, it is not ready, to give uneasiness to the stomach. When given in quantity, its diuretic and purgative qualities appear as in the other neutrals.

It has been of late a favourite practice to give the saline mixture during the act of effervescence; and besides the advantages of introducing a quantity of aerial acid, I am persuaded that the detachment

ment of that acid in the stomach renders the whole of the mixture more refrigerant.

The neutral salts as purgatives have been considered before. They operate upon the intestines, producing an easy, sudden, and copious discharge, is equally explainable upon our principle. For the water, after having performed its strengthening and exhilarating office upon the stomach, passes quickly into the intestines as fluids do, carrying along with it more or less of all its ingredients, but particularly its purgative. When there, the purgative, by its great dilution and consequent dispersion all over the internal surface of the canal, vellicates the innumerable little exhalent vessels, with which that cavity is crowded, into a plentiful secretion: and notwithstanding the stimulus may be but slight on any particular part, on account of the minuteness of the particles of the salt, yet as they are universally diffused, and act upon the whole system of exhalents at once, a more copious and expeditious evacuation is produced, than what is often attainable from a much larger quantity of any of the other more stimulating purgatives less attenuated; attended at the same time with these important advantages; that as the stimulus is gentle, no griping pain is likely to be excited; and as it is superficial, the particles must soon be washed off in the general current, without leaving behind them any of those disagreeable feelings

feelings that usually hang in the rear of other cathartics.

That the Cheltenham purgative owes its great superiority in the particular circumstances I have here described, chiefly to the principle of attenuation, will appear still more evidently from comparing it with other purgatives of that class: as we find that according to the quantity of water they retain in their crystallization, and their consequent degree of solubility, the nearer and more remote in general is their resemblance to it in their mode of operation.

Authors seem to differ widely in their accounts of the quantity of water contained in the different purgative salts, and also concerning their different degrees of solubility; owing probably to a variety of little circumstances that affect their experiments at the time they are made. Such as the condition of the salt, and of its original constituent parts, the state of the atmosphere, the degree of heat, the quantity, if any, of the other contents separated along with the water, in the evaporation; the temperature and purity of the water used in the solution, with other particulars not easy to be attended to or accurately ascertained. But on comparing the different accounts, the following arrangement may, in a great measure, be depended on.

First, the Cheltenham salt may be placed at the head of all the usual purgatives of that class; its
crystals

crystals being found to contain considerably above sixty parts out of an hundred, of pure water; and to be soluble in about an equal weight of that fluid. Next to the Cheltenham, may stand the pure Glauber salt; as the water in its crystals is found to amount to more than fifty out of the hundred; and to be soluble in a little more than double their weight. Next the Glauber, may rank the Epsom salt; its crystals containing somewhat under fifty of water. As to the solubility, it is said by some authors, that its crystals are more susceptible of solution than the Glauber salt, notwithstanding they contain less water in their composition. When so, the variation may be owing to a small commixture of other ingredients besides the magnesia earth and the vitriolic acid of which they are composed, as is not unusual in the native salts, conjoined with the feeble attraction that is known to subsist between its original constituent parts. After the Epsom comes the sea salt, but at great distance; as it is found to contain of water in its crystals, but sixteen parts out of the hundred; and requires above three times its weight for solution. Lastly, at the bottom of the scale, may be placed the vitriolated tartar; its crystals containing but six out of the hundred, and not being soluble in less than sixteen times their weight of water. As to the other artificial purgatives composed of the different acids united with the different alkalies; such as soluble tartar, diuretic salt,

Rochelle salt, and the digestive salt of Sylvius; their places in the above scale, vary according to the various circumstances of their preparation.

Now we find by experience, that the operation of these different salts, when compared with that of the Cheltenham salt, generally accords with the place in which they stand in the above arrangement. For example, if we take the second in the scale, the *Glauber salt*, and compare its mode of operation with that of the last, the *vitriolated tartar*, we find it approaches much nearer to the Cheltenham salt in all the recommendable circumstances before enumerated; notwithstanding it differs from the other, only in its having the fossil alkali, instead of the vegetable, united with the vitriolic acid in its composition. But as its crystals contain a much greater proportion of water, and are much more susceptible of solution, its operation as a cathartic is gentle and expeditious, while that of the vitriolated tartar is rough and sluggish.

Upon the whole then, we may conclude, that the principle will extend to the saline purgatives universally, and may be applied as the criterion by which we may judge beforehand concerning their different modes of operation; their action being merely mechanical, and all the varieties of their operation to be accounted for from their different degrees of stimulus upon the fibres of the living subject.

Could any principles be found out that would

apply to the vegetable and animal kingdoms; so as to explain in the same mechanical manner the effects of their operation; such a discovery would be of the utmost importance, as it would lay open the whole material world at once to the intelligent physician. He might then be truly styled the *minister naturæ*, as all her stores would be subject to his direction; and from that inexhaustible magazine he would be able to select on all occasions what was best adapted to his purpose, and to determine with precision what operation and what effects were to be expected in general from every medicine he administered.

But those curiously organized productions of nature are so very complicated in their construction, and the ingredients of which they are composed are so numerous, and so intimately and inextricably blended together, and at the same time acquire so many new properties from the manner of their arrangement, which on the slightest efforts to separate them are totally lost, that no just analysis of them has ever yet been made, or is ever to be expected; and without that, their mode of operation upon the living subject must ever remain in obscurity. Neither can the medicinal store be very copious while it continues to derive its supply from mere accident, and the result of vague undirected experiment.

Whereas in the fossil kingdom in general, the compositions

compositions are comparatively simple, and the ingredients few and permanent. Their structure can therefore be easily unfolded, and their parts subjected to the various methods of examination without undergoing any considerable change by the process. We are consequently capable of obtaining an absolute command over that class of bodies; so as to be able not only to de-compose them, but to re-compose and restore many of the most useful among them to their original forms, as by the hand of nature, according to our occasions. From thence we are enabled to acquire a competent knowledge of their properties, both in their separate and their aggregate state, and to ascertain and regulate their different modes of action, in all cases whatever.

In order to illustrate the distinction between those different classes of natural bodies, we need not go beyond the present subject of evacuation for an example.

The operation of the saline purgatives has been shewn to proceed from mere mechanical stimulus upon the sensible parts of the living body. But by what mode of action jalap operates as a cathartic, or ipecacuanha as an emetic, no satisfactory account has been given. Much less is any to be attempted for that extraordinary sympathy which confines the operation of each principally to its

respective organ, whatever may be the channel by which it is introduced into the constitution. How for instance an infusion of jalap when injected by a vein into the course of the circulation, and consequently conveyed to every individual spot of the body, affects no one particular part till it is secreted and discharged into the alimentary canal; and that there its operation should commence, acting ultimately as a cathartic. Or how an infusion of ipecacuanha, when injected in the same manner, suspends its action till it arrives at the same place, and when there should operate invariably as an emetic.

These wonderful facts seem totally inexplicable: and yet they are established upon the firm basis of experiment, as will appear from the following account communicated to me by my late friend Mr. John Hunter, whose singular talents for investigation have thrown a light upon the physiology of animals, and indeed of most parts of organised nature, that has shone through all Europe. The experiments were these.

He infused one scruple of jalap root in two ounces of water, and let it stand in infusion for about two hours. He then injected one half of the clear liquor into the crural vein of a dog. In less than a minute the dog puked a little, and then seemed to be quite well. Thinking therefore there would be no farther effect from that injection, he
threw

threw in the remainder, but no more puking ensued. However, by degrees, the dog grew dull and feeble in his legs, so as to be induced to lie down. After lying a little time he got up again, and in about a couple of hours after the last injection, he had a motion downwards; the first part of which was of the usual consistence; but the remainder was loose; and in about two hours more he had a very loose purging stool. He then gradually recovered, and seemed to continue pretty much as usual.

He in like manner infused one scruple of ipecacuanha root in two ounces of water, and then injected about one half into the same vein of a dog. The infusion was no sooner injected than the dog grew very sick, and before his mouth was untied he began to vomit; and the moment after, he threw up every thing that was in his stomach, and continued sick, so as not to be disposed to eat for above a day afterwards.

These experiments clearly demonstrate our total ignorance of that class of bodies, their qualities and mode of operation; and that we must be indebted for our medicinal knowledge and application of them to accident alone.

Of the combination of acids with metallic substances, they are generally acrid and stimulant; and there are none of them that can be considered as sedative or refrigerant excepting the sal plumbi,

or saccharum saturni: of which I shall speak hereafter.

The following formulæ may be directed.

R Kali ppti. fcr. 1.

Suc. limon recent. unc. $\frac{1}{2}$.

Aq. distil. dr. 10.

Syr. tolut. dr. 1.

Kali acetat. gr. 8, vel

Kali tartarifat. fcr. 1, vel

Kali vitriolat. fcr. 1, vel

Natron tartarifat. fcr. $1\frac{1}{2}$, vel

Natron vitriolat. fcr. 2.

Spermacet. v. o. f. fcr. 1.

F. Haustus, 4ta quaque horâ fumend.

That is, take of

Prepared kali—a scruple.

Fresh lemon juice—half an ounce.

Distilled water—ten drachms.

Syrup of tolu—one drachm.

Acetated kali—eight grains, or in lieu of it

Tartarized kali—one scruple, or

Vitriolated kali—one scruple, or

Tartarized natron—a scruple and a half, or

Vitriolated natron—two scruples.

Spermaceti dissolved in the white of an egg—one scruple.

To form a draught, to be taken every four hours.

THE
AVOIDING OF STIMULI,

BOTH
DIRECT AND INDIRECT.

PHYSICAL OBSERVATION

ELECTRICITY

CHAPTER I

THE first object of the present inquiry is to ascertain the nature and properties of electricity, and to determine the laws which govern its action. It is a subject of great importance, and one which has attracted the attention of philosophers and naturalists for many ages. The study of electricity has led to many valuable discoveries, and it is now one of the most important branches of natural philosophy. The present chapter will treat of the general principles of electricity, and of the laws which govern its action. It will also describe the various methods of producing and measuring electricity, and will give an account of the various experiments which have been made on this subject. The chapter will conclude with a description of the various applications of electricity to the arts and sciences.

PRACTICAL OBSERVATIONS.

S E C T. LXXXVI.

REGIMEN.

IN the former volumes, we have shewn what were the stimuli, both direct and indirect, and we are here to call that knowledge into practice.

The purity of the air is not in the sthenic class of diseases to be an object of consideration; on the contrary, from facts before the public, it appears that great advantage might be derived from the employment of a reduced atmosphere, or one containing less oxygen, or even of some of the mephitic airs, as the hydrogen, hydrocarbonate, and fixed airs. But great caution is required in the exhibition of such active agents, unless it be in a state of the highest dilution.

We select the following as a very promising omen of success in cases of the sthenic disease.

Dr. Thornton, physician to the Mary-le-bone General Dispensary, and lecturer on Medical Botany

tany at Guy's Hospital, writes the following account to Dr. Beddoes.

SIR,

September 26, 1796.
Duke Street, Grosvenor Square:

MRS. LEWELLIN, ætat. 25, lives at Camden Town; she was brought to bed of her first child last July, and, having very sore nipples, she attempted, after a few days, to wean the babe, and for thirteen weeks kept it from the breast; during which time the milk was constantly produced in the greatest abundance, so that it run through every thing that was placed to receive it; notwithstanding nipple glassess, and that the milk was frequently drawn off by means of a glass pipe, by an obliging neighbour. Inflammation gradually ensued, and it occupied the inferior half of both breasts, and, extending down to the umbilical region, was terminated by a distinct line. The babe was now applied to the breast, but would not take to it. The heat and pain became extreme. There were many knotty and hard tumours on both breasts. Matter ouzed out from the surface. The pulse was 110, full; perspiration constant and profuse; agony so great, that she was deprived of sleep; and the child not thriving, and continually crying in the night, increased the affliction. She had given up all hopes of recovery, or even outliving many days, when she applied to me; and her case seemed to authorize a new practice. Appearing too weak for
the

the lancet, this remedy was precluded. As to evacuations, the same reason weighed also against that plan. The speediest benefit, however, might arise from *disoxygenating* of the *blood*, and the case was urgent. I therefore filled a bell glass with atmospheric air, and burning two table spoonsful of æther in it, as it was suspended over water, I rendered it chiefly azote, and inflammable air. She persisted in inhaling this for about five minutes, standing up, until the pulse was obliterated; the eyes became dim, and no longer represented the objects of vision; the face was deadly pale; and swooning coming on, she fell into the arms of a servant, and we placed her on a chair, and I opened the window to admit fresh air. In about ten minutes she revived; she fetched several deep sighs, and appeared faint, and still very languid. The pulse was feeble, and only 98; and for the first time, she said, for some weeks, she felt her breasts cold and easy. I directed her, when she got home, to apply cloths wrung in yeast to the inflamed surface; and I ordered an electuary three times a day of sulphur, and sulphurated kali; and on the sound part, around the inflammation, I directed half a dozen leeches to be applied; and to divert the current from the inflamed parts, I ordered a large burgundy pitch plaster to be placed betwixt the shoulders, which however acted like a blister. On the third day, when I saw my patient, her spirits were revived; the vivid red colour was abated;

the

the tumours of the breasts were softened; and the milk could be drawn off without torture. Mrs. Lewellin inhaled the air as before, but with less sedative effect; when I ordered four fresh leeches (for the others had died immediately after the operation), and the yeast and electuary as before. On the fourth day there was no longer occasion for leeches, or the yeast fomentation. The electuary, and a reduced atmosphere, were, however, continued; and in a week the cure was perfected; and the child was applied to the breast, and health and happiness were restored to both.

I have the honour to be, &c.

R. J. THORNTON.

Colds have been very speedily cured by the inhalation of a reduced air.

The exclusion of light is another essential circumstance.

The next consideration is heat. From attention to nurses*, and persons about the patient, the chamber in which the sick man lies is too often allowed to have a large fire. Even all the things

* Nurses are to be considered as watchmen, and should be well clad. There should be always two, to make a proper relief. It is a great pity that so much money is expended to have wise doctors, and so little is given for good nursing, when these are the actual agents of his will, and are always chosen from a class most prone to counteract him.

are cooked there, to avoid the trouble of going down stairs. And practitioners admit this, sooner than offend the low talkative hirelings of the day, forgetful of the sacred duty they owe to the patient. Whoever, when in bed, has had a fire lighted in his room, cannot have failed to notice the excessive inconvenience that this additional stimuli has created. Not contented with this, nurses usually heap on clothes, that the patient may not catch cold, and the curtain is slyly drawn, in order that the dying man may not see the use made of his wine, and other things provided for his use. Whoever will peruse the work of Sydenham will find that his chief merit consisted in noticing the evil of too much heat, and he seldom would allow his patient even to lie in bed, and the room was constantly kept ventilated with cool air.

Conjointly with the first bleeding, the first vomiting and purging, with abstinence and watery fluids, it must not be forgotten, says Dr. Brown, that particular regard is to be paid to temperature *: for, if cold always debilitates, and if that is its proper operation †, if it only seemingly acts otherwise, because heat succeeding to its action, or alternating with it ‡, renders its effect stimulant, if cold alone is adequate to

* See Par. CCLXXXII. of the Elements. Vol. II.

† See Par. CXVII.

‡ See XXXVII.

the cure of the small pox *, or prevents the violence of that disease, if it is the best remedy for catarrh †, and, when heat is avoided, of the greatest efficacy in every sthenic disease; it is not to be doubted, but that it is of the greatest benefit in diseases of the highest sthenic diathesis.

Its operation in the small-pox, and in other sthenic diseases, is not different, but altogether the same. Nay, in all the diseases of this form, cold is productive of the highest good, especially when the sthenic diathesis, as is the case in the diseases that are our present subject, rises to its greatest height, and demands instant relief; because, in that case, every moment's delay brings instant danger; though the remedies, which we have mentioned, are sufficient for the solution of the disease, of which we have direct proof in practice; though that degree of cold, which would produce the effect, is neither always within our reach, nor can be properly applied by every person; and many persons might not be disposed to believe its effects so beneficial: yet we should not desist from the plan of cure here laid down ‡, but do our best for the patient, by taking off the blankets, and other clothes, by cooling the room, and, instead of laying him on a couch or bed, putting him into a chair. This indeed should, for the most part,

* See Par. CXXI.

† See Par. CCCCVII.

‡ From CCCCLIV. to CCCCLXV.

as the cold bath, on another account; for the shortness of the time in which any one could possibly remain in intense cold, would oblige him immediately to return to a higher temperature, which would produce a greater excitement than he had been under before his exposure, at least too great an excitement*.

After the application of intense cold, the application of heat must be studiously avoided, because its operation, from the increase of the excitability by cold, becomes more effective. And the consequence is the more to be dreaded, because, at the same time, other stimuli are usually applied.

Cold is then the beneficial temperature in the cure of the sthenic diathesis, but it must not be followed by any considerable degree of heat. The mistake, therefore, in medical practice, of thinking cold hurtful in sthenic diathesis by a stimulant operation, should be corrected: its use in the small pox is not to be understood to arise so much from its mere debilitating degree, as from avoiding the stimulus of heat after its operation. When the same precaution is employed, cold either alone, or in conjunction with other debilitating powers, has lately been found the most effectual remedy for catarrh, or for a cold, as it is vulgarly called.

From which circumstance, and because a cap of fresh earth put upon the head, has been of service in phrenitis; and because that degree of cold,

* See Par. XXVI.

which attends frost and snow, when applied to the naked body, has removed a synocha accompanied with delirium*; and because cold is so efficacious a remedy

* Such a disease is called, says Brown, the common inflammatory fever, very improperly, as being no fever, but a general pyrexia, or affection of the whole system, without inflammation or local affection. Its proper generic name is pyrexia. See Elements, par. LXVIII. where that appellation is assigned to it. Great mischief has been occasioned by vague terms. Thus when a person is said to be affected with a disease; when it is asked what disease it is, and the answer given, that it is a fever, immediately bleeding is thought of, though that, and every, evacuation is as hurtful in putrid fever as it may be serviceable in the pyrexia. There has nothing done greater injury to medicine than this bad classification of diseases. In Ireland an apothecary coming to die, the widow taking a liking to the boy who curried his late master's horse, married the boy, and he was immediately put into possession of the *Edinburgh Pharmacopœia Pauperum*, and alphabetically arranged he found *fevers*, and the remedies good for them, *sores eyes*, and the remedies for them, and so forth, and plucking out his remedies from a cabinet thus labelled and furnished, he became a famous doctor, for such *as lived he cured*, and those *who died, nature killed*. In all pyrexias, where the patient is uneasy with the weight of clothes, have shook them off, and courageously exposed themselves to cold, and drank freely of cold water, instead of death recovery, contrary to the prognostic of the physician, has ensued. From which, and a prodigious number of facts to the same purpose, all concurring in the proof of the debilitating operation of cold, there can hardly arise a doubt in the mind, that in a certain high degree, if it could be conveniently used, or if there were occasion to have recourse to it for want

a remedy in the small-pox; it clearly follows, that the use of cold should be extended to the whole range of predisposition and the whole circle of diseases, depending upon sthenic diathesis.

The effect, therefore, falsely imputed to cold, of occasioning the striking in of the measles, is not to be imputed to cold alone, but to heat and other stimuli; giving, as has been explained, more excitement *, than if cold had not preceded. And how can it be otherwise? If cold does not interrupt the eruption in the small-pox; but, on the contrary, by an enlargement of the diameters of the perspiratory vessels, which are shut up by sthenic diathesis, much promotes the discharge of the matter †: why, in a perfectly similar case, should its operation be sup-

want of efficacious remedies, it would at once remove the highest degree of sthenic state that ever occurs in disease, and reduce the excitement from the nearest approach to 70 down to 40. Nay it might run into the opposite extreme and go all the way to death. But we shall, by and by, have occasion to observe, that we are so well provided with effectual remedies as not to be under any temptation of straining this to its height. And we shall also find that a number of remedies in a moderate degree are preferable to any one, or to a smaller number in a higher degree. The discovery of the principle upon which the cure of sthenic diseases turns, has enabled us to render the cure both more complete and exact, than it could have been without principle.

* See XXVII. and the addition, and CCCLXXX.

† See CCCLXXVI.

posed different, not to say, diametrically opposite? Must we again have the trouble to refute the false notion that *a cause precisely the same may produce contrary effects*? Cold diminishes the eruption in the small-pox: it makes the eruption disappear in the measles. What then? Take a nearer view of the fact: is its effect in both these cases to be supposed the same, or different? How do you know, that the matter, which has disappeared, is driven into the interior parts? What proof will you bring? Confess the truth: and be candid enough to acknowledge, that this is another relic of the alexipharmic doctrine, according to which, the stimulus of heat as well as other stimuli promotes, and cold impedes perspiration. After a great man had shown the error of that doctrine, both in the small-pox and other diseases *, because he did not carry the application so far as the measles, neither has any one of his followers, who never could step a nail's breadth beyond his words. But it might have been observed, if observation had been any part of their employment, that the measles was a sthenic disease as well as the small-pox. Are not all the successful remedies in both of the debilitating kind? And as it was manifest, that in the small-pox also cold debilitated, or, in the common language, acted as a

* In peripneumony he took his patients out of bed, and set them in a chair, for the sake of cooling them, and avoiding the hurtful effect of heat.

fedative;

sedative; might not some suspicion, from that very circumstance, have arisen in their minds, that cold, in the measles, does not stimulate, or act as an astringent, and repel the eruption, but produces the same effect as in the small-pox? Is it, to such a degree, up-hill work, to use one's own understanding, that a great part of mankind, even those who take upon them the business of teaching and taking the lead of others, in no case ever thinking of exercising a moment's reflection?—But, it may be contended, that the action of cold is in this case peculiar, because, after the eruption, which it is supposed to check, has disappeared, all the symptoms increase in violence. Consider what that circumstance makes for your argument, or whether it makes any thing for you, and not absolutely against you? Was the action of cold followed by that of stimulant or debilitating powers? If it was by the former, the cause of the mischief must be imputed to them; which, as has been just said, produce excessive excitement after a previous application of cold, and more than without it; if debilitating powers had been applied, then there would be room for suspicion, that cold had a concern in the effect. But it is not so: and, in every case, in which the action of cold has been followed by sthenic diathesis, the true cause was not sufficiently guarding against the stimulus of heat, as well as that of other noxious powers. This is clearly proved by the application

of heat being positively ordered, instead of being forbidden, in the common practice. Nor is that to be wondered at: for if the cause of catarrh* deceived physicians so much, the catarrhal symptoms in the measles could not fail to deceive them. And, if doctrines, discarded in words, are often observed in practice; what was there to hinder this part of the alexipharmic doctrine from meeting with this fate?

If cold, therefore, can scarce be so managed, that the effect occasioned by the accompaniment, the succession, or the alternation, of stimulants, can be prevented, whether that be the fault of the physician, or owing to the nature of the thing†; it is, notwithstanding, a rule in common to the measles and other diseases of the same stamp, to avoid heat, and compensate for the degree by the greater duration of cold, and to guard with all possible care against every stimulant power. It is now then most evident, that the opinion of cold being peculiarly hurtful in the measles, both in that and every other disease of the same form, falls to the ground‡.

Dr. Brown, in confirmation of this doctrine, gives us a very remarkable case of a person labour-

* See from CCCCVII. to CCCCXII.

† Turn back to CCCCLXV. and CCCCLXVI.

‡ Brown.

ing under fever, who living in the old town of Edinburgh, escaped the vigilance of his nurse; flew naked out of the house in a very keen frost with snow upon the ground, across the streets, passed over into the new town, and from that to the fields beyond it. He soon became sensible of his state, stole into a house next to him, got some clothes thrown about him, and was carried home in a chair, perfectly cured of his disease. From which, and a prodigious number of facts to the same purpose, all concurring in the proof of the debilitating operation of cold, there can hardly arise a doubt in the mind, that in a certain high degree, if it could be conveniently used, or if there were occasion to have recourse to it for want of efficacious remedies, it would at once remove the highest degree of sthenic state that ever occurs in disease, and reduce the excitement from the nearest approach to 70 down to 40. Nay it might run into the opposite extreme and go all the way to death. But we shall by and by have occasion to observe, that we are so well provided with effectual remedies as not to be under any temptation of straining this to its height. And we shall also find that a number of remedies in a moderate degree are preferable to any one, or to a smaller number in a higher degree. The discovery of the principle upon which the cure of sthenic diseases turns, has enabled us to render the

cure both more complete and exact, than it could have been without principle.

Every exertion of the mind and body should be prohibited. No good news, on any account, should be suffered to be related. With regard to terror, on telling the patient he will not recover, it is dangerous. But the mind, nevertheless, ought to be kept in some suspense.

In order to facilitate the operation of all these various means of allaying intenseness of motion in the vascular system, we are to keep the patients on such a course of diet as shall be perfectly light, and not at all irritating.

In most of the species of Ithenic diseases there is, a loss of appetite, which is an essential symptom; it is therefore a superfluous caution to say, that in these cases we are not to allow the patients solid flesh-meat or broths, because they naturally nauseate, and refuse such food, and the things that people chiefly relish at these times are those which are most proper, namely, subacid and watery drinks, or at most thin gruels, or panada acidulated.

In Ireland, the patients, in all febrile diseases, generally use a kind of drink which seems almost peculiar to this country, and which is extremely grateful, and well adapted to cool and quench thirst; it is whey, made of four butter-milk and new milk, boiled up together; hence called Two-milk Whey.

In

In the commencement of inflammatory diseases, and while the pulse continues full and strong, this is the drink which is most in use, and it appears to answer remarkably well; but in places where this two-milk whey cannot be procured, almond-milk, barley-water, sage-tea, decoction of the roots of couch-grass; hot water poured on currant jelly, or on sliced apples, and lemonade, are in their turns to be given to the sick person; and if there be any appetite for somewhat more substantial, barley or oat-gruel, panada, roasted apples, currant jelly, or such light nourishment, is to be given, in such quantities, and at such intervals, as the patients shall desire, and the particular circumstances of the case may suggest.

But in some purely inflammatory cases, there is sometimes no great degree of sickness, and the patients have a desire for taking more solid food than is proper; but in such cases, it will be the business of those who have the care of the sick person to see that he does not touch solid flesh-meat, or even broth, so long as the intenseness of motion in the vascular system shall continue so great as to give sufficient reason to apprehend any danger.

We should not only enjoin what is to eat, but the patient should always be required to abstain from every sort of food but vegetable, as well as from all strong liquors, and indeed, one might say, from all but watery liquors acidulated. This di-

rection does not seem to have been so much neglected in words by former writers and authors, as in the actual application to practice; it having been delivered slightly, by the by, and as if it had been thought of no consequence, so that it made no impression upon the mind of the reader or hearer. No stimulus is more powerful, and, therefore, in this part of the practice, more hurtful, than that of the articles of diet: consequently, whatever quantity of blood is taken from the vessels, whatever quantity of serous fluid is carried off by the mouth and anus, if this stimulus is not effectually guarded against, the effect of all this evacuation may easily be counteracted by improper diet.

PRACTICAL OBSERVATIONS.

SECT. LXXXVII.

SWEATING.

THE terms fudorific* and diaphoretic† are, for the most part, used indiscriminately; for all those things that are supposed to have the power of promoting and increasing the cutaneous discharges: but, strictly speaking, fudorifics mean such things as raise plentiful sweat, while diaphoretics do little more than increase the insensible perspiration.

Neither fudorifics nor diaphoretics are by any means so certain in their operation as emetics or cathartics; for, whereas we can almost certainly assure ourselves, that vomiting or purging will ensue after taking any of the different medicines which have been already mentioned, yet we never can be certain that a sweat will break out in consequence

* From fudor, sweat.

† From διαφερεῖν, to carry through.

of giving any of the things termed fudorifics. From this great uncertainty concerning their operation, it happens that things of opposite sensible qualities shall occasionally become fudorifics; for, in order to raise a sweat, the medicine must not only increase the circulating force of the fluids, but also have power to take off spasmodic constriction. Hence all stimulating things that have power to irritate the heart and increase the blood's progressive motion will prove fudorifics; if, at the same time, the cutaneous pores shall happen not to be preternaturally constricted; and, on the other hand, all very cooling and sedative things, whose power consists in causing an extraordinary relaxation of the cutaneous pores, may occasionally raise a sweat. Thus, drinking fermented liquors or whey, taking some of the volatile alkaline salts, or other acrid stimulants, will, at certain times, prove fudorific; and thus, drinking of cold water, or taking a large dose of nitre, will, at other times, excite the cutaneous discharge.

From this we may easily infer how little dependence is to be had on the fudorific virtues, which are ascribed to a multitude of things by writers on the *Materia Medica*.

Since, in order to raise a sweat, either the force of the circulating fluids must be so far increased as to overcome the resistance in the extremities of the cutaneous arteries, or their orifices, which open on the

the surface of the body, must be so far relaxed, that their resistance shall not be equal to the force exerted by the heart; the most certain way of promoting this discharge is, to apply such things to the surface of the body as shall relax and set open the cutaneous pores. Nothing can do this more effectually than warm vapour: and therefore a stove or vapour-bath is the most certain way of raising a plentiful sweat, which may be increased to a very high degree; if at the same time that the vapour is applied to relax the pores at the circumference of the vascular system, some stimulating drink be plentifully administered to increase the power of the heart, and cause a greater force to be exerted from the center. I know not that this has ever been applied in thoracic inflammation.

The most powerful, as well as most certain internal sudorifics, are combinations of antimonial, or of ipecacuanha, with opium; the latter is termed Dover's Powder, and is sometimes used with success in cases of inveterate rheumatism.

R Pulv. Ipecac. comp. gr. 10.

Horâ somni sumend.

That is, take of

The compound powder of Ipecacuan—
ten grains, going to bed.

Or,

Or, Antim. tart. gr. $\frac{1}{2}$.

Pulv. opiat. gr. 5.

M. F. pulv. horâ somni sumend. super-
bibend. feri lactis tepid. lb. $\frac{1}{2}$.

That is, take of

Tartarized antimony—half a grain.

Opium powder—five grains.

For a powder to be taken at bed time,
drinking after it half a pint of milk
whey, made with vinegar or wine.

Or the following :

Kali ppti. scr. 1.

Suc. limm. recent. unc. $\frac{1}{2}$.

Aq. font. unc. $2\frac{1}{2}$.

Syr. simp. dr. 2.

Tinct. opii, gt. 12.

Vin. antim. gt. 30.

F. Haustus h. f. sumend.

That is, take of

Prepared kali—a scruple.

Lemon juice—half an ounce,

Water—two ounces and a half.

Simple syrup—two drachms.

Tincture of opium—twelve drops.

Antimonial wine—thirty drops.

Make into a draught to be taken at bed
time.

Addere

Addere liceat tinct. scill. gt. 30.

Vel kali vitriolat. gr. 10.

F. Haustus ter in die repet.

It is proper sometimes to add, when the lungs are oppressed, thirty drops of tincture of squills; or, to keep the body soluble, ten grains of vitriolated kali, and the draught thento be taken three times a day.

The use of diaphoretics in febrile diseases must depend on such a number of nice circumstances that no general directions can be given; only this caution seems necessary, that so long as the spasmodic constriction is found to continue, we are never to give any of those things mentioned in the books under the titles of Diaphoretics, Febrifuges, or Alexipharmics; for all these, unless the constriction has already given way, will only add to the distress by augmenting the heat, and increasing the disturbance in the vascular system. But when signs of this relaxation appear, then we may assist the power of the heart, by giving wine whey, or some of the pharmaceutical diaphoretics.

Dr. Brown was a great stickler for sudorifics. He endeavoured to confute the objections against them thus. Some, says he, may say that the heat, which accompanies the first part of the operation of sweating, may be hurtful; for, as he never made
trial

trial of it, he has it not in his power to say, that for certain it will be hurtful. This is readily admitted in an high diathesis, threatening indirect debility; but it cannot also be granted, that in a moderate degree of the diathesis, either original, or effected by other remedies, and, consequently, after the plan of treatment, that we have laid down, has been executed, such heat will not be compensated by the great profusion of fluids taken away from the whole surface of the body; or that, when this part of the vascular system has been freed from a violent stimulus, the diminution of excitement will not be more equal in all the vessels, and over the whole nervous system. If the numerous vessels, that open into the intestines and into the stomach, afford such an opportunity to diminish sthenic diathesis, how is it possible that a similar evacuation in the similar perspiratory vessels should have no tendency to produce the same effect? To which reasoning if the facts just related be added, what can any person have to say against the use of sweating, if a degree of heat, not greater than what cannot be avoided in the operation, can no longer be hurtful, and if the sweating itself is certain to be of great service *?

Let

* In an excitement of sixty-seven, within three degrees of indirect debility, the heat in the first part of the sweat, by adding these, might kill the patient, if you will, without leaving any chance of relief from its evacuant effect. But, if the

Let the spasmodic caviller against the use of that remedy in the cases of sthenic affection where it is admissible, muster up all his facts and all his theories, let him turn himself into all shapes, he will never produce a solid argument against this remedy.— But what, again, is the tendency of all this disputation? Will there never be an end of running from one extreme of error into the opposite? Shall no mean be found betwixt the alexipharmic plan of cure, and one equally bad or worse? If that doctrine hesitated not to prescribe sweating in the rage of a peripneumony, and that too procured by means of the most heating stimulant powers; does it therefore follow, that a plan of treatment must be admitted, which rejects the certain and safe use of this remedy, when excited by the most gentle means*?

If

the excitement be no higher than 60° , the addition of the three degrees will keep greatly within the point of indirect debility, and, therefore, be safe; while the succeeding evacuation may reduce the excitement perhaps 10° , and bring it within the range of predisposition; and a new course, or a little prolongation of this, carry it down to the point of health, and finish the cure.—*Brown.*

* Brown's practice was, when the signs of a spontaneous sweat are perceived, nothing more is to be done, but first to lay the clothes about the patient, remove the sheets, put the blankets next to his body, guard against the approach of air, and keep up the discharge for a sufficient length of time, at least ten or twelve hours. If from this management there shall ensue a copious and universal flow of sweat, there will

be

If it was the opinion of Dr. Sydenham, that heat should be avoided in the cure of sthenic diseases, which was quite right, as heat certainly increases the excitement; are we, for that reason, to avoid that tolerable degree of heat, which accompanies a remedy the most powerful in restoring the healthy state, and, thereby, deprive ourselves of great benefit upon the whole? If such persons do not know, that several remedies diminish excitement more powerfully than one; and if they are to be excused for their ignorance; are they also to be excused for not seeing, what any empiric might have seen, that some things are of service, and others of disservice; is such want—not of genius, for genius is not required of them—but of common sense also, to be pardoned? If to think for themselves, and to make any sort of discovery, was too much to be expected from them*; is it not somewhat surprising, that out of a thousand writers, who have treated of every part of medicine, and entertained different senti-

be no occasion for giving medicine for the purpose.—After sweating has increased the relief formerly procured; if it should disappear towards the end, it should at last be supported by Dover's powder, or by laudanum alone; at the same time the body should be covered, so that it may get as quickly as possible to the surface, till the expected benefit be obtained.

* The reader is referred to what is said in Vol. III. page 108, when treating of catarrh, where we gave our reason for dissenting from Dr. Brown.

ments

ments, from one another, they could squeeze no information, but always trod in the footsteps of one single man * ?

* Such are the expressions of Dr. Brown, who always shewed a hearty contempt for the faculty, who had so very illiberally opposed his doctrines !

PRACTICAL OBSERVATIONS..

 S E C T. LXXXVIII.

HOW THE REMEDIES SHOULD BE VARIED.

THE error of physicians in general is that they have a great reliance on bleeding. It was to the honour of the great Dr. Brown first to notice this dangerous error, and I feel the more pleasure, in stating his *practical* improvements in medicine, as they are so little understood even by those who profess themselves to be *Brunonians*.

As the noxious powers, that produce predisposition to diseases, or diseases themselves, act some on one part, some on another, with somewhat more force than on any other equal part; and as this part is commonly that to which they are directly applied*; so the powers, which are employed as remedies, in order that their general effect may reach the whole body with the more certainty, should be,

* Vide Par. XLIX. of Brown's Elements.

in the same manner, differently applied to different parts.

The action of every exciting power, whether salutary or hurtful, or curative, always extends over the whole body, the whole seat of excitability, but still with the inequality mentioned in the fourth chapter of part the first. This is the basis of the distinction with respect to the present subject: which is, that, as every power acts most effectually on the part where its action is immediately exerted, it is better to trust to a number, every one of which possesses that advantage, than rely on *any one remedy*, however powerful otherwise; as by that means, whatever be the indication, whether it be to increase or diminish excitement, the effect will be more equally produced over all in consequence of there being a number of parts that have had a strong action exerted upon them.

The cure, therefore, of any sthenic disease whatever, is improperly entrusted to bleeding alone, though that is one of the most powerful of the debilitating remedies. The reason is, that, though the excitability is sufficiently reduced by that remedy in the greater blood-vessels, perhaps too much, yet in the extremities of these, as well as in the rest of the body, it is not sufficiently reduced. Nor is the alteration of bleeding with purging a perfect mode of cure*; because, though the excessive excitement

* This was Sydenham's practice.

be sufficiently, and more than sufficiently, removed in the greater blood-vessels, and in the innumerable small arteries, whether exhalant or mucous, which discharge their fluid into the intestines; yet, neither on the perspiratory terminations of the arteries, nor on the rest of the body, is an equal debilitating energy exerted: the small vessels, for instance, which open into the stomach, are not sufficiently relieved of their distending load, and therefore stimulating load, the stimulus in any vessel being the quantity of its fluid. And although vomiting* should be conjoined with the two remedies just mentioned, even this would not be enough to produce an equally diminished excitement; as there would still remain in the perspiratory vessels the same state of excitement, as also in the rest of the body, that is not vascular. In violent sthenic diseases, therefore, after diminishing the diathesis, and in the slighter from the beginning of the disease, the addition of the operation of sweating to the evacuations that have been spoken of, will produce a more equal diminution of excitement, and a more perfect solution of the disease. For by means of this evacuation, not only from the larger blood-vessels, in the interior parts of the body, but from an infinity of outlets both of the external, and in-

* Bleeding should come first, in the evening; then purging, the next morning; then vomiting; perhaps bleeding again, or more mild cathartics, or sudorifics,

ternal surface of the body, an immense quantity of fluids, every where distending, and, thereby, producing a very great sum of excitement, is withdrawn. Nor is this all. For, since in slight sthenic affections, the patient can take much nourishing food, and in them all, too much; the consequence must be, that, however the quantity of blood and other fluids has been diminished, if food, which is the only power that can produce blood, continues to be taken, all the vessels, in proportion to the quantity that has been taken, will again go on to be filled, and to be fired with the fewel of excessive excitement. To prevent this inconvenience, and to diminish excitement, with still greater equality over the system; abstinence, or a certain allowance of vegetable matter in a fluid form, and watery drink, will have a very great effect. Nor is this sufficient. For if, after taking all the precautions and securities that have been recommended, the degree of heat, that proves hurtful from its stimulus, be allowed to approach the external surface of the body; it will produce another inequality of excitement, however much it may have been properly and equally diminished by the other means of cure. Wherefore, as the sthenic diathesis depends so much upon the stimulus of heat, directly affecting the skin*, and is, on that account, prevalent in the skin in preference

* See Par. CXIII. of the Elements.

to other parts; to make sure of rendering the diminution of excitement as equal as possible, the debilitating effect of cold should be opposed to the high degree of excitement, which the heat has produced. When, at last, all the directions, which have been thus fully pointed out, have been executed, still, to re-produce the equality of excitement, suited to good health; it remains, that we be on our guard against the stimuli that arise from the intellectual functions and passions. For, as they have great effect in producing sthenic diathesis*, so the prevention of them, must be equally effectual in removing that diathesis, and in re-producing that equality of excitement, upon which health depends†.

If the cure of sthenic diseases hitherto has consisted in bleeding, purging, and in the use of refrigeration in a few cases; and, if the other objects, which have now been so fully explained, have either been totally neglected, or mentioned in a slight way, by the by, and as if of no consequence, and, in the treatment prescribed in these cases, not reduced to any principle; it will easily appear, from what has been said above and in other parts of this work,

* See Par. CXXXVIII. CXL.

† As the most healthy state of man is occasioned not by the operation of any one, or of a few exciting powers, but by the united operation of them all; so neither is its re-establishment to be effected, but by the same united operation of all the remedies, the last of which come to be the ordinary means of the support of the healthy state.—*Brown.*

how

how much the knowledge of these diseases has been *improved*, both in the practical and reasoning part: and it will now, at last, be found a certain and established fact, that both the nature and true theory of •sthenic diseases, as well as the method of treatment, considered either as an art and imitative, or as rational and scientific, has been discovered and demonstrated*.

* This is taken verbatim from Brown's Elements of Medicine; being his eleventh chapter, and deserves every attention of the practitioner.

SEDATIVE POISONS.

• SEDATIVE POISONS.

FRAGMENTS OF OBSERVATIONS

C. L. LXXIX

THE FIVE SENSES

... according to their ...
... not ...

... a medicine which ...
... the ...

... I mean ...
... through ...

... power ...
... (...) ...
... to a ...

PRACTICAL OBSERVATIONS.

S E C T. LXXXIX.

SEDATIVE POISONS.

IN considering sedatives according to their effects, may they not be naturally divided into two kinds, viz. *Direct* and *Indirect*?

By a *Direct Sedative*, I mean a medicine which operates more or less immediately as a sedative, without producing any stimulating effects; such as the cicuta, hydrogen air, and perhaps many other substances.

By an *Indirect Sedative*, I mean a medicine which, although it ultimately produces sedative effects, yet has some other previous stimulating operation; such as opium, &c.

Now, although opium has generally been ranked as the chief of the sedantia, yet its stimulating power is at present very well ascertained: and every practitioner knows (what we have already mentioned), that, if applied to the eye, or to a tender surface,

surface, it will produce more or less of irritation and pain, whatever ultimate sedative effects it may occasion. From this stimulating property, which is always more or less discoverable on its first exhibition, are we prevented from employing it in cases of strong active inflammation? For, in them, if opium is given alone, the phlogistic diathesis of the system is in general thereby increased, and the disease thus rendered more difficult of cure.

But this is probably not the case with some other substances, the subject of our present consideration, or if they are directly stimulant, and indirectly stimulant, that is, first produce a stimulant effect, this first stage is of so short a duration, that they may well rank as *direct* sedative powers, contrary to the sentiments of some Brunonians.

The cicuta, if applied to the most irritable surface, or even injected into the cavity of the chest itself, produces no pain; on the contrary, it will immediately relieve it, shewing its direct sedative power. No exhilaration is perceived; on the contrary, always a distress of the system, and a diminution of both mental and bodily powers. If the head is affected, the images presented to the imagination are frightful, vertigo and sickness are produced, and often violent convulsions. Indeed the direct and quick sedative effects of the class of poisons we are considering have made them be esteemed as narcotic, or stupifying; and the very terror of their
name

name has hindered them from being employed, except in diseases where all other means have failed. But let it be remembered, that the virtue of any drug is only relative, and that poisons are either good or evil according as they are applied; for direct powers which are capable of suspending all the actions of the body, even of the heart and brain itself, are surely capable of restraining inordinate action, and therefore, of being applicable to the large and dangerous class of sthenic, or acute diseases.

Our first consideration will be that of the cicuta. There have already appeared three separate publications from Dr. Stork of Vienna on this subject; but his cases will help us very little in the present view of our subject. They at any rate shew, that these sedative poisons, blunting the sensibility of the nerves, mitigate the pain of excruciating sores*, and

* The formula is,

R Cicut. herb. exsiccat.

Chamæm. flor. sing. unc. 1.

Aq. fervent. lb. 1.

Coque per sextam horæ partem, et liquori expresso, adde.

Farin. sen. femin. q. f.

Ut fiat cataplasma.

Parti dolenti calidum, et pauxillo olei olivæ illinitum, applicetur, et renovetur bis die.

That

and they may have done some service in epilepsy and mania. But we are to consider their use in sthenic diseases.

The following is one among the many cures performed in this way by Dr. Thornton.

Samuel Parker, coachman to Mr. Mills, Lincoln's Inn, was wet through driving his master, and the next day felt a violent pain in the right side, and could not fetch a breath without great pain, breathing extremely difficult, and cough severe; he was so ill, that every one despaired of his recovery. He was ordered an emetic, to be taken in such small quantity at a time, as to create considerable nausea, and the following day he was to pursue the following directions.

℞ Suc. cicut. spif. gr. 3.

Pulv. trag. comp. dr. 2.

Simul terantur, et in portiones sex
equales dividantur; quarum sumat

That is, take of

The dry stalks of cicuta,

Chamomile flowers, of each an ounce.

Boiling water a pint.

Boil during ten minutes, and to the liquor, passed
through a bag, add

The meal of linseed,

As much as is sufficient.

Apply this warm to the painful part, first spread-
ing over it a little olive oil, and renew this
twice a day.

- unam primo mane, horâ xi. matutin.
et horâ somni sing. diebus.

That is, take of,

The inspissated juice of hemlock—three grains,

Compound powder of tragacanth—two drachms.

Let them be rubbed together, and divided into six equal parts, of which let one be taken early in the morning, another at eleven in the morning, and at bed time every day.—Or,

R Suc. cicut. spissat. dr. i.

Herb. cicut. exsicc. in pulv. trit. q. s.

F. pil. 30, quarum cap. duo, dein plures, aucto^r illarum pro re nata numero, sing. dieb.

That is, take of,

The inspissated juice of hemlock—one drachm.

The dried powder of cicuta—as much as is sufficient.

Make into thirty pills, of which take every day two, afterwards more, increasing their quantity, as the occasion may require.

In other cures of peripneumony, a pill of the powder of digitalis, of which one grain has been given night and morning, and the cicuta at eleven and seven in the day.

As other narcotic poisons may be found hereafter to merit attention, we will conclude with some formulæ, which should be very cautiously tried.

℞ Suc. spissat. aconit. gr. 1.

Glycyrrh. pulv. gr. 2.

Conf. cynosb. q. s.

F. pilula, bis terve in dies sumend.

That is, take of

The inspissated juice of aconite—one grain.

Liquorice powder—two grains.

Conserve of hips—as much as is sufficient.

To make into a pill, to be taken twice or thrice a day.

℞ Belladon. folior. exsicc. dr. $\frac{1}{2}$.

Aq. fervent. unc. 12.

Macera per quadrant. part. hor. in vase operto, et liquorem cola; et cap. coch. larg. duo ter in die.

That is, take of

The dried leaves of belladonna—half a drachm.

Boiling water—twelve ounces.

Digest

Digest in a covered vessel for a quarter of an hour, and then strain off the liquor. Take two large table spoonsful three times a day.

These have already been employed as medicines; we will proceed now to another poison, the dose of which I am unable to ascertain.

Since Dr. Madden communicated to the Royal Society an account of the deadly effects of the simple distilled water from the lauro-cerasus, many experiments have been made, here in England, to prove and confirm the truth of the same; but I don't know of any attempts that have been made towards discovering what influence this water, or the leaves from whence it is distilled, would have on animal bodies, if exhibited in *small doses*, and continued so for some time. Now as this, in my humble opinion, is the only way of investigating the useful properties of such plants whose modus of action we are unacquainted with, I hope the following experiments will be acceptable; for let them be ever so simple, they may lead us to greater discoveries, and without doubt one of the most considerable services we can do to mankind, is to be diligent in making a variety of experiments, and collecting observations; and when we have procured a number of these, it will be allowable to reason upon, and deduce proper inferences from them.

To find out the virtues of plants, says Dr. Langrish, has ever been reckoned the most commendable undertaking, and nothing is more certain than that the likeliest means to discover the efficacy of such as are not as yet used in physic, is to have recourse to proper experiments with them upon brutes; for though some things may be hurtful to man, that are not so to other animals, and vice versa, yet as the greatest number of medicines affect both equally, the exhibition of them to brutes will afford good opportunities for observing their effects. Doubtless, says the illustrious Boyle, we trample upon many things that, did we know their uses, might serve the noblest ends. We despise many common plants of extraordinary efficacy for want of taking pains to discover their virtues; and though some may be deleterious or poisonous in themselves, or in large doses, yet it is probable that art may discover ways and means to reduce such drugs into useful medicines.

I am of opinion we have simples of our own growth, capable of curing the most formidable diseases, did we but understand their efficacy, and the best manner of applying them; and I doubt not but a further acquaintance with experimental philosophy will hereafter suggest ways and means of discovering their virtues, and of making most noble medicines from such plants which are little thought of at present, at least, for such uses. I therefore, with all humility, beg leave to offer the follow-

ing experiments to the consideration of the learned.

EXPERIMENT I.

To an old cast-off horse, blind, and troubled with the poll-evil, I gave a pint (wine measure) of laurel-water in the morning fasting, he having been tied up to an empty rack, all night, for that purpose.

Just before I gave it him, I took seven ounces, a drachm, and a scruple of blood from the jugular vein, which was extremely viscid and foul, looking at first like coarse grease, and after it had stood some time, it had *a coat upon it above an inch thick, tough and horny, rather resembling one part of brawn than buff-leather.* The gore was of a deep black. The serum was pellucid, but no more in quantity than six drachms.

The pulse, before he took the laurel-water*, beat 34 strokes in a minute, and indeed they were not so much accelerated by the dose as I expected, they never exceeding 45 that day. The only visi-

* It was prepared as follows. Having procured a peck of fresh laurel leaves, says Dr. Langrish, I weighed them very exactly, lest I might be deceived by different measures in future trials; and accordingly I found their weight to be two pound one ounce and a half avoirdupois. To these I put three gallons of spring water, and distilled off, in a common alembic, two quarts, which were mixed together.

ble effect was stopping the humour that flowed from his poll; which, though it ran in an extraordinary manner before he took the laurel-water, was quite suppressed in the evening. About two hours after he had taken his dose, I gave him some oats, which he eat greedily, and continued perfectly well all night.

The next morning I let seven ounces and a drachm of blood, which, after it had stood twenty-four hours, as the other did, separated an ounce and two scruples of clear, straw-coloured serum. The crassamentum was something improved in its colour, and *the horny coat at the top of it was not quite $\frac{3}{4}$ of an inch thick.*

The poll-evil was quite shut up all this day, and therefore that I might know how long it would remain so, I desisted from giving any more laurel-water for three days. The next morning the humour began to flow again, though not so much as before; but on the third day there seemed to be as great a discharge as ever.

EXPERIMENT II.

A fine, fresh, young horse being seized with the glanders, was turned into a salt marsh, and neglected till the distemper arrived at its greatest height, or what the farriers call the chine-glanders, which among them is deemed incurable.

The

The matter which was discharged from his nose was very viscid, yellow, and extremely offensive. His blood was exceeding glutinous and foul, and had a *buff-coat upon it more than half an inch thick*. The cohesion of the crassamentum was so strong as to resist the weight of a column of mercury, in a glass tube, with an obtuse point about the size of a pea, $13\frac{1}{2}$ inches high, before the point of the tube cut through. The bore of the tube was $\frac{1}{3}$ inch diameter. Eight ounces of this blood, which was taken from the jugular vein, separated, after standing 24 hours, no more than two drachms ten grains of yellow serum.

• July 28, 1734. I gave to this horse six ounces of laurel-water, diluted with half a pint of spring-water, and repeated it every morning for eight days.

August 5. I increased the dose to eight ounces, and continued it for eight days more.

The same day eight ounces of blood afforded one ounce two drachms of serum, not quite so yellow as before. *The buff coat was $\frac{3}{8}$ inch thick*. The cohesion very little altered.

Aug. 13. The dose was increased to twelve ounces, and repeated every morning for eight days.

The same day eight ounces of blood separated one ounce and a half of good coloured serum. *The buff-*

coat was now not above $\frac{1}{4}$ inch thick, and gave way to the weight of ten inches of mercury.

August 21. The dose was increased to a pint, wine measure, and given every morning for eight days, mixed with a quart of spring-water.

The same day eight ounces of blood separated one ounce four $\frac{1}{2}$ drachms of dark coloured serum. There was *now very little or no appearance of a buff-coat*, only here and there a bluish speck, or film. Its cohesion was equal to seven and a quarter inches of mercury.

August 29. Eight ounces of blood separated one ounce six drachms of dark coloured serum. The gore had *not the least film upon it*, and was now grown so tender, that a column of mercury four inches high cut through it.

During the whole time the horse appeared very brisk and well, and his appetite continued good. But as to his distemper, the running at the nose increased in quantity, but the matter was altered into a white, well digested pus, without any offensive smell, as at first.

The quantity of laurel-water which was taken in the whole time, was 336 ounces, or 21 pints.

EXPERIMENT III.

The following experiments were made to shew that even out of the body the laurel-water has great power over the blood.

To

To six ounces of blood extracted from a young man violently afflicted with an inflammatory rheumatism, I put one ounce of laurel-water, which altered the crassamentum, rendering it soft and tender, *without a speck of size upon it.* The serum was of a light red, like burgundy wine, and, after standing 24 hours, weighed exactly two ounces.

Six ounces more of the same blood, being saved in another porringer, by itself, appeared very foul and *fizy*, with a *thick, tough buff-coat upon it.* The serum was of a bright yellow, and weighed two ounces, one drachm, and ten grains.

EXPERIMENT IV.

Sixteen ounces of blood being drawn from a woman on the third day of a pleuritic fever, I put one ounce of warm laurel-water into a basin which received about one half of it. The next day I found the blood which was mixed with the laurel-water of a bright colour, the coagulum exceeding tender, the serum of a pale red, and in a small quantity.

The other parcel of blood had a *buff-coat* upon it at least $\frac{1}{3}$ inch thick; the glumous part looked very foul and black; the serum was of a straw colour, and much more in quantity than what was in the other porringer. But this patient being in the

country, I had not an opportunity of examining into the exact proportions.

EXPERIMENT V.

Half an ounce of laurel-water being mixed with three ounces of blood, as it ran from the arm of a child ten years old, and troubled with the St. Anthony's fire, it preserved a beautiful colour, and let go one ounce three drachms of dark coloured serum.

Whereas three ounces, six drachms, and fifty grains of the same blood, in another cup, separated one ounce, a drachm, and a scruple of straw coloured serum. The fibrous part had a coat $\frac{1}{6}$ of an inch thick, exactly resembling melted suet.

I could add a great many more experiments of this kind, but as they all exhibited the same phenomena it would be useless. I shall therefore only observe, that from these experiments it is evidently demonstrated, that laurel-water has a power of making great alterations in the blood; but whether it performs these effects by altering the figuration or bulk of the component particles of the blood, or whether it only fixes the serous and fibrous parts together, in such a manner as not to give the lightest corpuscles an opportunity of ascending to the top, and by that means prevents the formation of the buff-coat, so usual in inflammatory cases, I shall

shall leave to the learned to determine, and shall only take notice, that as the serum is always altered into a burgundy colour, when laurel-water is mixed with the blood as it flows from the vein, and not at all when it is put to the serum only, it evidently follows, that the tinge is taken from the globular parts of the blood.

Thus have I, says Dr. Langrish, barely but faithfully related the result of my experiments, and am inclined to think some further use might be made of them, since, from all the phænomena, it appears that laurel is capable of producing surprising effects in an animal machine.

By a series of experiments, and a long experience of the good or bad qualities of any drug upon brutes, we may investigate, in a great measure, its nature, and what effects it is likely to produce in human bodies; which to determine expressly *à priori*, seems insuperable to our understanding.

Considering how ineffectual many of our common and known remedies are in some diseases, I esteem, with the noble Boyle, the discovering and divulging useful things in physic, and the recommending good remedies, among the most extensive acts of charity, whereby a man becomes, really, more serviceable to the world than by building of an hospital. And as the best remedies are to be sought after among the most active and pungent drugs,

drugs, or such as in large doses, or without proper management, may be deemed poisonous; it follows that whoever is so happy as to discover a method of converting such things into safe and useful medicines, will greatly advance the art of medicine; and will be enabled thereby to cure such diseases, as others might think incurable.

The pleasure, variety, and usefulness, that attend these sort of experimental inquiries have happily brought them into great credit and repute. We have a large and beautiful scene already opened to our view; and whoever endeavours to cultivate or enlarge it will be sure to be recompensed for his pains. One experiment oftentimes suggests other inquiries little thought of before, which together with the inferences and applications to be made, lead us insensibly on; and it not unfrequently happens, that even when we obtain not what we seek, we find something as valuable: so fruitful is nature, that industrious researches will sure to be rewarded with ample discoveries.

PRACTICAL OBSERVATIONS.

SECT. XC.

ON YEAST.

ALTHOUGH perhaps *yeast* may not with strict propriety come under the head of sedative *poisons*, yet as being a new remedy lately introduced and successfully employed in cases of peripneumony, it may be proper here just to notice it.

Having, says Dr. Thornton, in a communication sent to Dr. Beddoes, ascertained that the sthenic pulse was sunk by the operation of the fixed air, extricated in the warm stomach from yeast, I conceived, that in violent inflammation it might sometimes preclude the free use of the lancet, and a case happily occurred, at the close of last winter, which seemed to authorize the trial.

Mr. Kennedy, a hair-dresser by trade, living at No. 86, in Tottenham-court Road, aged 35, of so nervous a frame that he could not shave his customers

tomers (his hand being subject to tremble), was attacked with the prevailing inflammatory disease of the last spring, which took off such a number of persons. He was seized with rigour and headach, succeeded by acute pains in the chest; his breathing became laborious, and towards night he had violent delirium. I was sent for early in the morning, and I observed 1st, a tense and oppressed pulse; 2d, great heat; 3d, great difficulty of breathing; 4th, acute pains in the right side; and 5th, total loss of sleep. I instantly called to mind Brown's ideas on catarrh. After a severe frost, with snow on the ground, the weather became mild, and the *accumulated irritability* was by the heat called into action.— Had blood been taken from the arm, the blood partaking of the same *increased irritability* would have contracted strongly, and we should have had that cupped appearance, buff-coat, and hard coagulum, so expressive of inflammation.

From this theory the art of cure seemed to be to adjust the stimuli to the tone of the irritable fibre; and as the ordinary stimuli produced inordinate action, from the increased irritability of the fibre, it became necessary to reduce these as early as possible. I was convinced, from former experience, that the oppressed pulse would have risen under the finger, as the stimulus of the blood was withdrawn; but as this fluid is with difficulty regenerated in habits like that of my patient, and in *this* epidemic bleeding

bleeding had, as I observed, precluded quick recovery, I resolved to omit for the present the abstraction of this stimulus. I ordered the fire to be put out; I removed the stimulus of light; I would allow no one to sit in his room, or speak to him: to take off the stimulus of food from the stomach I gave him an emetic of tartarized antimony; and to take away all stimulus from the intestinal canal, I ordered a cathartic of rhubarb quickened by vitriolated kali. During the operation of these, I applied a very large blister to the chest, the stimulus of which I conceived would do no harm under the operation of the cathartic, and might do good by deriving from the lungs, and afterwards by drawing off the serum of blood, which is a species of half bleeding. To supply oxygen without caloric, I ordered from six to ten lemons in the twenty-four hours, in tamarind drink. Not contented with this, I wished the famished system to absorb as much fixed air as possible (whose sedative power on the heart and arteries you have sufficiently proved), and he took therefore yeast in his acidulated water, and was ordered frequently to plunge his arm in this fermenting ingredient. I directed two grains of calomel to be taken at bedtime, the acid drink to be frequently repeated with the yeast, and I encouraged no hopes in my patient, and in the morning he was to take the cathartic before mentioned, to which was added half a grain of

of tartarized antimony. The next day I found the pulse of my patient less oppressed considerably. I asked him to attempt an inspiration, but he could not bear it. The want of sleep was now easily accounted for. The lungs being in part a voluntary organ, as strong action of the respiratory muscles was acute agony, the mind was kept constantly alert in preventing a too free respiration, hence perhaps the reason why the breathing was quick and laborious.—He had no return of delirium. I repeated the purges on the two following days. The pulse became softer; the tongue looked less white; the thirst was abated; the breathing relieved; he sweated profusely; and began now to covet some food. I now admitted the stimulus of light; I raised his hopes; and progressively adding different stimuli, I came to bark; and in less than a fortnight he was about on his business, and as well as ever.

PRACTICAL OBSERVATIONS.

 S E C T. XCI.

OF THE UTILITY OF POPULAR INSTRUCTIONS,

WITH AN

EXHORTATION TO PHYSICIANS.

HAVING now finished with the general mode of treating cases of sthenic disease, we would exhort the patient to an early application to the medical practitioner, and to the practitioner an energetic practice suited to the occasion.

The friends of the patient (especially nurses) may object to the violence of the measures advised, but the practitioner must be steady in his resolution, convinced that he has a most sacred duty to perform. It may be right for him to confess, that his measures may seem cruel, that medicine was not designed for us in health, but that it resembles the operations of surgery, which are ever consented to for the sake of life; and that to complain of purging, vomiting, bleeding, and blistering, as hard treatment, is as ridiculous as a person in the water
in

in the act of drowning, refusing a rope, because it is rough and dirty, or calling out, that the person who is saving him takes him by the hair, and hurts him. The danger is serious, and the imperious voice of duty forbids all mean compliances.

We would next exhort the patient not only to an early application to the medical practitioner, but also to make a good choice in his physician. For the disease he labours under admits of no parley; a mistake here cannot be afterwards rectified, and must terminate in death, or a state ten times worse than death. Even lay-persons educated in the principles of the science (unless the necessity is great) should be distrusted. Medicine is not a speculative science only; but also an active and practical art, the proper exercise of which can be attained only by long experience. This is allowed to be the case in all the other practical arts, and the education in them is conducted accordingly. Let us suppose of a young man designed to be a sailor, that for the first years of his education he studies mathematics, natural philosophy, and navigation, but has never been at sea; when he makes his appearance there, what must be his situation? He can talk of mechanical powers, of friction, of the nature of magnetical effluvia, of the theory of the winds, and, in short, shew himself master of every branch of his profession, so far as speculation could carry him. But can he handle a rope? can he go aloft

aloft and furl the fails? can he make an obfervation in a rolling fea? can he do any one ufeful work aboard the fhip, or direct the failors how to navigate her in a ftorm? Who would truft himfelf to the direction of fuch a fea commander?—The cafe is much the fame with the lovers of our art, who have had what is called good instruction, and are well grounded in every branch of our profeffion except the practice; in which they muft be defective, if they have not for fome years diligently attended the fick. So I doubt whether even Sir Ifaac Newton would have fupplanted the fimple fteersman of a fhip.

• The knowledge acquired from this work, however, will enable him to know the merits of his phyfician, and make him readily acquiefce in his injunctions, and this is a matter of no fmall importance. For the ftate of our profeffion is fingular. A common artificer has no other way of rendering himfelf eminent in his trade, but by excelling in it. Of this, all mankind are judges. If he is a bad workman, no addrefs or qualifications of any other kind can avail him. No gentleman can hope to rife in the profeffion of the law, who does not poffefs the abilities of a lawyer. The proofs of his knowledge, ingenuity, and eloquence, are daily exhibited to the world, and their value is duly afcertained. In fhort, every man's merit, in his profeffion, may be well known to the public;

and is in general suitably rewarded. But the case is not so here, and imposing garb may make the flock mistake the wolf for the lamb, and I would wish every one to be shepherds upon so trying an occasion.

The objection then of laying medicine open to the world like other sciences, from its tendency to multiply bad practitioners, and to lessen the authority of the physician, is not well founded. It is not possible to confine the practice entirely to regular physicians. Cases are continually occurring of people labouring under diseases, who can have no access to the assistance of the faculty. It would be barbarous to hinder those from using such remedies as appeared to them most likely to afford them relief; or to prohibit a friend or a bystander from giving their assistance in such a situation. In fact, as every person prescribes occasionally, the only question is, whether they should receive any assistance from art, or be left to act as their fancy may lead them. If, by withholding this assistance, every disease, where a physician was not consulted, was to be left to nature alone, physicians would have a plausible excuse for keeping the world in ignorance; because it might be alledged, that more diseases would be cured by the efforts of unassisted nature, than by the random management of people imperfectly instructed in medicine. But, in reality, this is never the case in diseases of any consequence. I shall give

give an example, in the general treatment of fevers among the lower class of people, when they are deprived of medical assistance.—The unhappy patients are generally confined to a close room, where they breathe a hot and putrid air; every method is tried to raise a sweat; they are loaded with bed-clothes; sometimes they are made to drink spiced and strong liquors; at other times large quantities of warm water gruel, although their stomach loathe it, and it occasion flatulence, sickness, and oppression. If, in consequence of great heat or delirium, they attempt to get out of bed, they are confined to it by force; nor are they suffered to change their bed or body-linen, till the fever is quite removed; by which means the air becoming more putrid, aggravates the symptoms, and makes the disease contagious.—In such cases, because the patients have no physician, and take no medicine, the disease is said to be left to nature. But this is a mistake. If such patients had been really left to nature, they would have been treated very differently. They would have been indulged in whatever was agreeable to them; they would have breathed cool and fresh air; they would not have been teased to eat or drink beyond what their appetite demanded; they would have been indulged with cold water or small beer in what quantity they pleased; they would have been suffered to get out of bed and to enjoy the cold air, or to have had few bed-clothes,

with liberty to throw out their limbs without control; their linen would have been changed daily, and every thing kept clean and sweet about them. Similar instances might be produced from other diseases. Patients are so far from being left to nature, when no physician is called, that they are commonly oppressed with a succession of infallible cures recommended by quacks, or by their weak and officious friends.

Learned physicians, then, have nothing to fear from the intrusion of men of science who have turned their attention to medicine. Such will be modest in proportion to their knowledge of the subject, and will be the readiest to call for the assistance of a physician of experience and abilities, to respect his judgment, and to enforce his prescriptions; while, at the same time, they may suggest what may be useful to the ablest of the profession.

If we consider the situation of a young physician of genius, brought forward and supported in his profession under the honourable patronage of those who are judges of that genius; and that of another destitute of such assistance, and compelled by necessity to attend to the prejudices, and to humour the caprices of the ignorant and impertinent intruders into his office; how pleasant, how creditable is the one? how humiliating the other, to every man of spirit and sensibility?

I have

I have thus endeavoured to shew that, by laying medicine open, and encouraging men of science and abilities, who do not belong to the profession, to study it, the interests of humanity would be promoted, the science would be advanced, its dignity more effectually supported, and success more certainly secured to each physician, in proportion to his real merit.

Before I conclude, I cannot help observing, that such objections as are made against any person pretending to judge of medical subjects, who has not been regularly bred to the profession, were formerly urged against the reformers from popery. Besides the divine authority claimed by the church, it was said, that a set of men, who devoted their whole time and studies to so deep and complicated a subject as theology, were the only proper judges of whatever belonged to it; that calling their authority in question, was hurting the cause of religion, and lowering the sacerdotal character. Yet experience has shewn, that since the laity have asserted their right of inquiry into these subjects, theology, considered as a science, has been improved; the real interests of religion have been promoted; and the clergy have become a more learned, a more useful, and even a more respectable body of men, than they ever were in the days of their greatest power and splendour.

APPENDIX

TO

CLASS THE FIRST.

THEORETICAL OBSERVATIONS

SECTION X

THE RHEUMATIC GOUT

I will endeavour to distinguish a disease about to be described from that disease which is frequent in cold, and more common in warm climates. It appears most frequently in autumn and spring, less frequently in winter when the cold is considerable and constant and very seldom during the heat of summer. It may occur, however, at any season, in varieties of heat and cold, but for the time the disease.

The acute rheumatism is usually early from the application of cold to the body, when any way usually warm, or when one part of the body is exposed to cold while the other parts are warm; or, finally, when the application of the cold is long continued, as it is when the whole system is exposed to any part of the body.

There

• PRACTICAL OBSERVATIONS.

SECT. XCII.

THE RHEUMATIC GOUT.

• I WILL endeavour to distinguish a disease about to be described, from that disease which is frequent in cold, and more uncommon in warm climates. It appears most frequently in autumn and spring, less frequently in winter when the cold is considerable and constant, and very seldom during the heat of summer. It may occur, however, at any season, if vicissitudes of heat and cold be for the time frequent.

The acute rheumatism generally arises from the application of cold to the body when any way unusually warm; or when one part of the body is exposed to cold while the other parts are kept warm; or, lastly, when the application of the cold is long continued, as it is when wet or moist clothes are applied to any part of the body.

These

These causes may affect persons of all ages ; but the rheumatism seldom appears in either very young or in elderly persons, and most commonly occurs from the age of puberty to that of thirty-five years *.

These causes may also affect persons of any constitution ; but they most commonly affect those of a sanguine temperament.

This disease is particularly distinguished by pains affecting the joints, for the most part the joints alone, but sometimes affecting also the muscular parts. Very often the pains shoot along the course of the muscles, from one joint to another, and are always much increased by the action of the muscles belonging to the joint or joints affected.

The larger joints are most frequently affected ; such as the hip-joint, and knees of the lower, and the shoulders and elbows of the upper, extremities. The ankles and wrists are also frequently affected ; but the smaller joints, such as those of the toes or fingers, seldom suffer.

This disease, although sometimes confined to one part of the body only, yet very often affects many parts of it ; and then it comes on with a cold stage, which is immediately succeeded by the other symptoms of pyrexia, and particularly by a frequent, full,

* There are some instances, however, of rheumatism extremely acute in old people.

and hard pulse. Sometimes the pyrexia is formed before any pains are perceived: but more commonly pains are felt in particular parts, before any symptoms of pyrexia appear.

When no pyrexia is present, the pain is sometimes confined to one joint only; but when any considerable pyrexia is present, although the pain may be chiefly in one joint, yet it seldom happens but that the pains affect several joints often at the very same time, but for the most part shifting their place, and, having abated in one joint, become more violent in another. They do not commonly remain long in the same joint, but frequently shift from one to another, and sometimes return to joints formerly affected; and in this manner the disease often continues for a long time.

The pyrexia attending this disease has an exacerbation every evening, and is most considerable during the night, when the pains also become more violent; and it is at the same time that the pains shift their place from one joint to another. The pains seem to be also increased during the night, by the body being covered more closely, and kept warmer.

A joint, after having been for some time affected with pain, commonly becomes affected also with some redness and swelling, which is painful to the touch. It seldom happens, that a swelling coming on does not alleviate the pain of the joint; but the swelling

swelling does not always take off the pain entirely, nor secure the joint against a return of it.

This disease is commonly attended with some sweating, which occurs early in the course of the disease; but it is seldom free or copious, and seldom either removes the pains or proves critical.

In the course of this disease the urine is high coloured, and in the beginning without sediment; but as the disease advances, and the pyrexia has more considerable remissions, the urine deposits a lateritious sediment. This, however, does not prove entirely critical; for the disease often continues long after such a sediment has appeared in the urine.

When blood is drawn in this disease, it always exhibits the buff appearance.

The acute rheumatism, though it has so much of the nature of the other phlegmasiæ, differs from all those hitherto mentioned, in this, that it is not apt to terminate in suppuration. This almost never happens in rheumatism; but the disease sometimes produces effusions of a transparent gelatinous fluid into the sheaths of the tendons. If we may be allowed to suppose that such effusions are frequent, it must also happen, that the effused fluid is commonly re-absorbed; for it has seldom happened, and never indeed to my observation, that considerable or permanent

permanent tumours have been produced, or such as required to be opened, so as to have the contained fluid evacuated. Such tumours, however, have occurred to others, and the opening made in them has produced ulcers difficult to heal. Vide Stork. Ann. Med. II.

With the circumstances mentioned before when describing it, the disease often continues for several weeks. It seldom, however, proves fatal; and it rarely happens that the pyrexia continues to be considerable for more than two or three weeks. While the pyrexia abates in its violence, if the pains of the joints continue, they are less violent, more limited in their place, being confined commonly to one or a few joints only, and are less ready to change their place.

When the pyrexia attending rheumatism has entirely ceased; when the swelling, and particularly the redness of the joints, are entirely gone; but when pains still continue to affect certain joints, which remain stiff, which feel uneasy upon motion, or upon changes of weather, the disease is named the Chronic Rheumatism, as it very often continues for a long time. As the chronic is commonly the sequel of the acute rheumatism, I think it proper to treat of both also in this place.

The limits between the acute and chronic rheumatism are not always exactly marked.

When the pains are still ready to shift their place;

place ; when they are especially severe in the night-time ; when, at the same time, they are attended with some degree of pyrexia, and with some swelling, and especially with some redness of the joints ; the disease is to be considered as still partaking the nature of the acute rheumatism.

But, when there is no degree of pyrexia remaining ; when the pained joints are without redness ; when they are cold and stiff ; when they cannot easily be made to sweat ; or when, while a free and warm sweat is brought out on the rest of the body, it is only clammy and cold on the pained joints ; and when, especially, the pains of these joints are increased by cold, and relieved by heat applied to them ; the case is to be considered as that of a purely chronic rheumatism.

The chronic rheumatism may affect different joints ; but is especially ready to affect those joints which are surrounded with many muscles, and those of which the muscles are employed in the most constant and vigorous exertions. Such is the case of the vertebræ of the loins, the affection of which is named Lumbago ; or that of the hip-joint, when the disease is named Ischias, or Sciatica.

PRACTICAL OBSERVATIONS.

SECT. XCIII.

THE GOUT.

It is an inflammatory affection of some of the joints which especially constitutes what we call a paroxysm of the gout. This sometimes comes on suddenly without any warning, but is generally preceded by several symptoms; such as the ceasing of a sweating which the feet had been commonly affected with before; an unusual coldness of the feet and legs; a frequent numbness, alternating with a sense of pricking along the whole of the lower extremities; frequent cramps of the muscles of the legs; and an unusual turgescence of the veins.

While these symptoms take place in the lower extremities, the whole body is affected with some degree of torpor and languor, and the functions of the stomach in particular are more or less disturbed. The appetite is diminished, and flatulency, or other symptoms of indigestion, are felt. These sym-
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toms,

toms, and those mentioned above, take place for several days, sometimes for a week or two, before a paroxysm comes on: but commonly, upon the day immediately preceding it, the appetite becomes greater than usual.

The circumstances of paroxysms are the following. They come on most commonly in the spring, and sooner or later according as the vernal heat succeeds sooner or later to the winter's cold; and perhaps sooner or later also according as the body may happen to be more or less exposed to the vicissitudes of heat and cold.

The attacks are sometimes felt first in the evening, but more commonly about two or three o'clock in the morning. The paroxysm begins with a pain affecting one foot, most commonly in the ball or first joint of the great toe, but sometimes in other parts of the foot. With the coming on of this pain, there is commonly more or less of a cold shivering, which as the pain increases, gradually ceases, and is succeeded by a hot stage of pyrexia, which continues for the same time with the pain itself. From the first attack, the pain becomes by degrees more violent, and continues in this state, with great restlessness of the whole body, till next midnight, after which it gradually remits; and after it has continued for twenty-four hours from the commencement of the first attack, it commonly ceases very entirely, and, with the coming on of a gentle

gentle sweat, allows the patient to fall asleep. The patient, upon coming out of this sleep in the morning, finds the pained part affected with some redness and swelling, which, after having continued for some days, gradually lessens.

When a paroxysm has thus come on, although the violent pain after twenty-four hours be considerably abated, the patient is not entirely relieved from it. For some days he has every evening a return of more considerable pain and pyrexia, which continues with more or less violence till morning. After continuing in this manner for several days, the disease sometimes going entirely off, not to return till after a long interval.

When the disease, after having thus remained for some time in a joint, ceases very entirely, it generally leaves the person in very perfect health, enjoying greater ease and alacrity in the functions of both body and mind than he had for a long time before experienced.

At the beginning of the disease, the returns of it are sometimes only once in three or four years: but, after some time, the intervals become shorter, and the attacks become annual; afterwards they come twice each year, and at length recur several times during the whole course of autumn, winter, and spring; and as it happens that, when the fits are frequent, the paroxysms become also longer, so, in the advanced state of the disease, the patient is

hardly ever tolerably free from it, except perhaps for two or three months in summer.

The progress of the disease is also marked by the parts which it affects. At first, it commonly affects one foot only; afterwards every paroxysm affects both feet, the one after the other; and, as the disease continues to recur, it not only affects both feet at once, but after having ceased in the foot which was secondly attacked, returns again into the foot first affected, and perhaps a second time also into the other. Its changes of place are not only from one foot to the other, but also from the feet into other joints, especially those of the upper and lower extremities; so that there is hardly a joint of the body that is not, on one occasion or other, affected. It sometimes affects two different joints at the same time; but more commonly it is severe in a single joint only, and passes successively from one joint to another; so that the patient's affliction is often protracted for a long time.

When the disease has often returned, and the paroxysms have become very frequent, the pains are commonly less violent than they were at first; but the patient is more affected with sickness, and the other symptoms of the atonic gout, which shall be hereafter mentioned.

After the first paroxysms of the disease, the joints which have been affected are entirely restored to their former suppleness and strength: but after the

disease

disease has recurred very often, the joints affected do neither so suddenly nor so entirely recover their former state, but continue weak and stiff; and these effects at length proceed to such a degree, that the joints lose their motion altogether.

In many persons, but not in all, after the disease has frequently recurred, concretions of a chalky nature are formed upon the outside of the joints, and for the most part immediately under the skin. The matter seems to be deposited at first in a fluid form, but afterwards becomes dry and firm. In their dry state, these concretions are a friable earthy substance, very entirely soluble in alkalies. After they have been formed, they contribute, with other circumstances, to destroy the motion of the joint.

In most persons who have laboured under the gout for many years, a nephritic affection comes on and discovers itself by all the symptoms which usually attend calculous concretions in the kidneys, and which we shall have occasion to describe in another place. All that is necessary to be observed here is, that the nephritic affection alternates with paroxysms of the gout, and that the two affections, the nephritic and the gouty, are hardly ever present at the same time. This also may be observed, that children of gouty or nephritic parents, commonly inherit one or other of these diseases; but whichever may have been the principal disease of the parent, some of the children have the one, and

some the other. In some of them, the nephritic affection occurs alone, without any gout supervening; and this happens to be frequently the case of the female offspring of gouty parents.

In the whole of the history already given, I have described the most common form of the disease; and which therefore, however diversified in the manner I have said, may be still called the regular state of the gout. Upon occasion, however, the disease assumes different appearances*; but, as I suppose the disease to depend always upon a certain diathesis or disposition of the system; so every appearance which we can perceive to depend upon that same disposition, I still consider as a symptom and cause of the gout. The principal circumstance in what we term the regular gout, is the inflammatory affection of the joints; and, whatever symptoms we can perceive to be connected with, or to depend upon, the disposition which produces that inflammatory affection, but without its taking place, or being present at the same time, we name the irregular gout.

* These different appearances which the gout assumes, are extremely unlike the regular gout above described: the young practitioner ought therefore to pay peculiar attention to them, that when he observes them in patients, he may not think them symptoms of other diseases, or even mistake them for primary diseases. Errors of this kind are frequently committed by ignorant practitioners, to their own discredit and the danger of their patient's life.

Of

Of such irregular gout there are three different states, which I name the atonic, the retrocedent, and the misplaced gout.

The atonic state is when the gouty diathesis prevails in the system, but, from certain causes, does not produce the inflammatory affection of the joints. In this case, the morbid symptoms which appear are chiefly affections of the stomach; such as loss of appetite, indigestion, and its various circumstances of sickness, nausea, vomiting, flatulency, acid eructations, and pains in the region of the stomach. These symptoms are frequently accompanied with pains and cramps in several parts of the trunk, and the upper extremities of the body, which are relieved by the discharge of wind from the stomach. Together with these affections of the stomach, there commonly occurs a costiveness; but sometimes a looseness with colic pains. These affections of the alimentary canal are often attended with all the symptoms of hypochondriasis; as dejection of mind, a constant and anxious attention to the slightest feelings, an imaginary aggravation of these, and an apprehension of danger from them.

In the same atonic gout, the viscera of the thorax also are sometimes affected, and palpitations, faintings, and asthma, happen.

In the head also occur, headaches, giddiness, apoplectic and paralytic affections.

When the several symptoms now mentioned oc-

cur in habits having the marks of a gouty disposition, this may be suspected to have laid the foundation of them; and especially when either, in such habits, a manifest tendency to the inflammatory affection has formerly appeared; or when the symptoms mentioned are intermixed with, and are relieved by, some degree of the inflammatory gout. In such cases there can be no doubt of considering the whole as a state of the gout.

PRACTICAL OBSERVATIONS.

S E C T. XCIV.

NEPHRITIC COMPLAINTS.

THIS disease, like other internal inflammations, is always attended with pyrexia; and is especially known from the region of the kidney being affected by pain, commonly obtuse, sometimes pungent. This pain is not increased by the motion of the trunk of the body, so much as a pain of the rheumatic kind affecting the same region. The pain of the nephritis may be often distinguished by its shooting along the course of the ureter; and is frequently attended with a drawing up of the testicle, and with a numbness of the limb on the side affected: although, indeed, these symptoms most commonly accompany the inflammation arising from a calculus in the kidney or ureter. The nephritis is almost constantly attended with frequent vomiting, and often with costiveness and colic pains. Usually the state of the urine is changed; it is most commonly

of a deep red colour, is voided frequently, and in small quantity at a time. In more violent cases, the urine is sometimes colourless.

The remote causes of this disease may be various; as, external contusion; violent or long-continued riding; strains of the muscles of the back incumbent on the kidneys; various acrids in the course of the circulation conveyed to the kidneys; and perhaps some other internal causes not yet well known. The most frequent is that of calculous matter obstructing the tubuli uriniferi, or calculi formed in the pelvis of the kidneys, and either sticking there, or fallen into the ureter.

PRACTICAL OBSERVATIONS.

SECT. XCV.

OF CALCULI AND THEIR SOLUTION.

WHEN the illustrious Scheele read, in 1776, to the Academy of Stockholm, his examination of the bezoar, or stone of the human bladder, no one then had an accurate idea of the nature of this concretion, though Margraaf had already observed, that it was not formed of an absorbing earth, as was pretty generally believed before him, and as has been repeated so often since in many works on medicine. Scheele observes in the beginning of his dissertation, that he examined several calculi, smooth, rough, or angular; that he found them possess the same nature and properties: it is therefore the history of the genus that he meant to give. His memoir is divided into ten sections. To ascertain properly the value of his labour, I must here make the reader follow him through some of his experiments.

I. Potash united to the carbonic acid does not dissolve the urinary calculus, either hot or cold; but a perfectly caustic ley of the same alkali, without any trace of the carbonic acid, dissolves it even cold. This solution is yellow, of a sweetish taste; it is precipitated by all the acids, even the carbonic; it does not render lime water turbid; it decomposes and precipitates metallic solutions, those of iron brown, of copper grey, of silver black, of zinc, mercury and lead, white: it exhales an odour of ammonia.

II. Lime water dissolves the calculus by digestion; 200 parts almost are necessary to take up one; it then loses its sharp taste; this solution is precipitated in part by acids.

Scheele concludes from numerous experiments, that the urinary calculus does not contain either sulphuric acid or lime; but that it is composed of a *concrete acid*, oily, volatile, mixed with a little gelatinous matter.

He says he found a little of this acid in all urine, even in that of children. This liquor evaporated to $\frac{1}{112}$ of its weight (14 pounds reduced to two ounces) deposits a subtle powder similar to the calculus, which adheres to the vessel, and which the caustic alkali dissolves very easily. The deposit from the urine of patients labouring under fevers exhibited the same nature; it is formed in close vessels as well as in those that are open; it is re-
dissolved

dissolved by means of heat, and its precipitation is owing only to the cooling of the urine.

All urines thus contain phosphat of lime, kept in solution by an excess of the phosphoric acid; which is the reason that it reddens blue paper, and deposits a white powder by means of ammonia. Urine gives of it $\frac{1}{578}$ of its weight. This precipitate dissolved in the nitric acid is rendered turbid by the addition of the sulphuric acid, which forms with it a sulphat of lime; the supernatant liquor, when evaporated, leaves the phosphoric acid after separating the nitric acid by evaporation. The urine of diseased persons is more acid, and contains more phosphat of lime, than that of healthy persons.

It results from all these facts, says Scheele in concluding his dissertation, that urine, independently of the substances already known, viz. the muriats of potash, soda, and ammonia, the phosphat of soda and ammonia, and an oily extractive matter, contains a *concrete acid*, hitherto unknown, (which forms the urinary calculus), and phosphat of lime.

The discovery of Scheele, communicated to the Academy of Stockholm, was confirmed by Bergman, who gave, under the title of a supplement, a memoir containing his own experiments on the stone of the human bladder, with which he was occupied at the same time as his pupil and friend; and it may be readily perceived what must be the weight

weight of the assent of that celebrated man, who first introduced into the description of chemical phenomena, and the reasoning on them, the purity, precision, and method of the geometricians. In announcing that his experiments conducted him to the same conclusion, viz. that the urinary concretion was composed chiefly of a *particular acid*; he says he found some differences, which, though he ascribes them to those of substances which they had both examined, were, however, found in all those which he treated.

Bergman, in mentioning that he made numberless experiments on the stone of the bladder, takes care to point out that they prove nothing more or any way different from what Scheele has said in his excellent memoir. All researches, says he at the end of his supplement, for the purpose of discovering a remedy for this disease, ought to be founded on a perfect knowledge of the properties of the calculus. He observes that *alkalies* are the only truly active remedies, the efficacy of which has been acknowledged by medical experience, in concert with chemical researches. He concludes his note by announcing that he hoped to be able to determinate more accurately whether all calculi of the bladder were really of the same nature. But during the eight years which were added to his life after this epoch 1776 (he died in 1784) his occupations and deranged state of health prevented him from completing

pleting this labour, as he wrote nothing more than what I have here made known.

My view, says Monsieur Fourcroy, in commencing my labours on this subject, was not only to establish the facts announced by Scheele, but also to pursue much farther the examination of urinary calculi; and to add to it that of all the animal concretions I could procure. This plan will be found partly executed in the details I have published.

1. On the intestinal calculus of the horse, which I found to be a triple salt, formed of two parts of phosphat of magnesia, and one part of the phosphat of ammonia.
2. On a renal calculus of the same animal, in which I discovered three parts of the carbonat of lime, and one part of the phosphat of lime, without any matter analogous to that in the human calculus.
3. On a calculus of a cat, which gave me three parts of the carbonat of lime, and one part of the phosphat of lime.
4. On the tartar of the teeth, which I found to be pure phosphat of lime.
5. On the calculus of the human reins, the nature of which I determined to be perfectly similar to that of the calculus of the bladder.

With regard to the human urinary calculus, I had examined a sufficient number to be able to trace out the general characters which I thought it necessary to add to those given by Scheele. Having indeed represented it, after this illustrious chemist, as a solid acid crystallized in laminæ, insipid,
giving

giving a faint red tinge to blue colours, soluble in caustic alkalies and in the nitric acid, assuming with the latter a beautiful red colour, decomposable by fire, yielding a great deal of the carbonic acid and little oil; the weakest of all the acids; containing lime and alkaline phosphats only by accident. I add to these characters the following properties established by the analysis of a great number of varieties of these concretions: 1. Their solution in water reddens turnsole paper. 2. They give the prussic acid by distillation, and by the action of the nitric acid. 3. The calculus of the human bladder contains but little hydrogen, since it gives but little oil; and but little oxygen, since it furnishes but a very small proportion of the prussic and carbonic acids.

The experiments which I afterwards described on the four calculi carefully treated by different agents, may be taken, according to all the other experiments, which I did not think it necessary to describe in the same manner, as an account of the properties of the urinary calculus considered as a genus; and I must indeed here observe, there are none of them which do not present results more or less similar. Thus: 1°. The augmentation of its weight in water, into which the calculus was entirely immersed. 2. The earthy smell of marl which it diffuses, when diluted as a powder in this liquid. 3. The little alteration it exhibits, and the impu-

trefcibility

- treascibility it preserves during more than fifteen days under water at a temperature above 12 degrees (57° Fahr.). 4. Its almost perfect solubility in 2000 times its weight of water, when repeatedly treated in powder. 5. Its solubility in less than half that quantity of boiling water; its separation only partial in lamellated crystals by cooling—the manner of obtaining it thus pure. 6. Its property of reddening turnsole paper, when after this purification it is rubbed on this paper with a little water. 7. Its solution in lime water, which by exposure to the air soon deposits both carbonat of lime and the lithic acid separate from each other, proves that the atmospheric carbonic acid decomposes the calcareous lithiat which was there formed. 8. Its almost total solubility (except $\frac{1}{12}$) in a ley of caustic potash, which often disengages much ammonia. 9. Its precipitation of a golden yellow colour from this alkaline solution by the acetous acid, which separates from it the lithic acid in small white brilliant and almost pulverulent needles, and which furnishes more than a half of the crystallized lithiat of potash. 10. This precipitation of the lithic acid from the alkaline solution by the acetous acid, given as a good process for procuring this animal acid pure. 11. The solubility of the calculus sometimes entire, sometimes in powder, in the oxygenated muriatic acid, which at first afforded me the hope of a lithon-
triptic; but which being destroyed by other suc-
cessive

cessive experiments, presented only a singular fact worthy of being further investigated. 12. The action of the fire and distillation in a retort upon the calculus of the human bladder, using a quantity five times greater than that employed by Dr. Pearson, and which gave me as products near a quarter of a sublimated lamellated acid, still analogous to the *lithic acid*; some drops only of water and thick oil, fixed, containing a little prussiat of ammonia; $\frac{1}{8}$ concrete carbonat of ammonia, a bulk of more than six kilogrammes of impregnated water, $\frac{2}{3}$ of which were carbonic acid; a coal weighing a little more than a quarter of the calculus, and which yielded only $\frac{1}{80}$ of its weight of ashes, without any sensible trace of lime.

All these facts, which I was obliged to concentrate here in some manner in order to render them more striking, served to confirm the first results of Scheele and Bergman; and enabled me to add several observations which had escaped them. I had concluded with them that the human urinary calculus, whether that of the reins or that of the bladder, contained a matter different from all other animal substance, not found in any other humours of the human body, nor in any of those of the bodies of the different animals now known; a weak *concrete acid*, almost insoluble, the principal solvents of which were the caustic alkalies; that this *particular*

cular acid very little hydrogenated and oxygenated, but much charged with carbon and azot, was an immediate production of the reins and of the diuresses, or of the formation of urine; that it was sometimes joined with some parts of the phosphats of lime, of soda, and of ammonia, with a colouring animal matter; but that these different substances, foreign to the lithic acid, seemed to be only accessories, variable in their proportions, which might not have been found there at all, and which did not seem to constitute the particular essence of it.

I may add to this notice of my labours, which are already pretty old, that the experiments I have had occasion to make for ten years past on this animal matter, either for some particular purpose or in the course of my annual lectures, by confirming me more and more in my former ideas, agreeing with those of Scheele and Bergman, have only taught me that some human urinary calculi contain phosphat of lime, insoluble in water and in pure alkalies, and the alteration which the lithic acid experiences by the action of the nitric acid when boiled in the latter—an alteration during which there is disengaged carbonic acid gas, azotic gas, and the prussic acid gas; so that the calculous matter appears to me really to change its nature during this action of the nitric acid. But all this ought not to change any thing of my opinions in regard to the particular character and *acid* pro-

perties of the peculiar matter of the human urinary calculus.

C. Fourcroy then asks, whether the labours of Dr. Pearson have given different results, and of such a nature as should induce the French chemists to give up their former ideas respecting the nature of the peculiar matter of the human urinary calculus; or whether his experiments are sufficiently conclusive to induce them to admit its non-acidity, and consider it as an oxyd? He insists that Dr. Pearson has not correctly comprehended the labours either of the Swedish or French chemists; that he has improperly believed that they gave the name of lithic acid to the sublimate of the calculus obtained by fire, whereas they gave it, either to the entire calculus as it comes from the reins or the bladder, when wholly formed of that substance, or, to this matter obtained by cooling a solution of it in water, or by precipitating it from an alkaline solution by the acetous acid; and that Dr. Pearson's pretended oxyd is really Scheele's acid, at first called the bezoardic, and since, in the new nomenclature, the lithic acid.

As to the product of the numerous experiments which Dr. Pearson tried on more than 300 human urinary calculi which Mr. Heaviside's extensive museum* furnished him, and which he compared with

* This grand repository of subjects relating to the human economy arising from the large fortune and industry of one man

with each other, I find, adds Fourcroy, no other difference between what he announces and what was announced by his predecessors, but the variety of the nature which these experiments shewed to him between these concretions—a variety which, however, always shews the greatest proportion in the kind of matter called by him the uric oxyd. It is in this result that Dr. Pearson deviates most from Scheele, who asserted that all the calculi of the human bladder resembled each other and exhibited no difference. But it may be readily perceived, that this difference between our author and the chemists whom he seems to combat no way affects the intimate nature of the real calculous substance, and it is only on the latter that it is of importance to fix the opinions of philosophers.

Dr. Pearson has, however, the merit of discovering by exact chemical experiment, that the chalky concretions of gout are of the same composition as calculi of the reins or bladder.

man is ever open, for the promotion of science, to every lover of it, nor did the illustrious possessor, I will venture to say, a moment lament the 300 fragments obliged to be taken from so invaluable a collection. Every Friday during the winter season cards of invitation are sent round to gentlemen of respectability, and in this immense room are found all the newest publications, and the whole museum being illuminated, presents the highest feast for the philosopher, or lover of wisdom.

PRACTICAL OBSERVATIONS.

S E C T. XCVI.

THE SAME QUESTION PURSUED.

Books and tradition never fail to offer a multitude of medicines for diseases that are frequent and incurable; many of these medicines are the suggestion of the most fantastical analogies *, and the greater part are incapable of even palliating for a moment

* There exists, probably, no human malady, not even the jaundice, consumption, asthma, or cancer excepted, for which so many whimsical and nugatory means of relief have been proposed, as for the stone and gravel. Besides an infinity of inefficacious simples, the whole series of remedies, from the warm goat's blood of Alexander Trallianus, the pounded glass of Bericellus a Sancto Marco, the essence of pigeon's dung of Johannes Poppius, the quinta essentia urinæ humanæ of Fabri, down to the stercus humanum found in the first Pharmacopœia of the London College, at once afford a proof of the inefficacy of each particular medicine, and of the prevalence of a disorder, which could enforce so much attention, and suggest so many extravagant projects. *Dr. Beddoes.*

the

the sufferings of the patient; yet a list, at first sight so unpromising, is not absolutely without its use. *The physician, says Dr. Beddoes, stalks abroad with an air of greater dignity when he feels a full quiver at his shoulders, however blunt may be the arrows it contains; and it supplies a staff, however feeble, on which the wearied spirits of the patient may rest, and defers a little that season of settled gloom when futurity has nothing farther to promise to hope.*

But from all the testimonies that have fallen under my observation, continues the justly celebrated and philanthropic Dr. Beddoes, I can collect that, during the former part of the present century, some approaches have been making towards a remedy, which, whatever may be its mode of operation, or precise degree of efficacy, is undoubtedly capable both of relieving pain, which renders the disorder so formidable, and of suspending the progress of the disease itself.

As early as the year 1721, Robinson proposed salt of tartar, among other things, as a solvent for the stone. In disorders of the uropoetic organs, whether arising from concretions or not, Hoffman praises the efficacy of the hot alkaline springs of Germany, as well as the salt obtained from the waters of Carlsbad.

Mrs. Stephens having met by accident with a receipt for the stone, consisting of egg-shells dried in an oven and powdered, she administered it to several

ral persons afflicted with that disease. Afterwards she burnt the egg-shells, which became at first black, but being kept longer in the fire, turned to a grey colour, bordering on a perfect white. After some trials of these black and grey powders in the quantity of as much as would lie on a shilling, three times a day, it appeared to her that the powder was more efficacious in proportion as the egg-shells were more burnt. But finding that it often caused great costiveness, she added a small quantity of soap occasionally, to each dose, with a view to prevent this inconvenience. And thus she continued giving the burnt egg-shells with a small quantity of soap for several years, curing *gravelly complaints* thereby, and sometimes *dissolving stones in the bladder*. After twelve years, she gave her powder in larger doses to one Mr. Coxon, adding to it very frequently half an ounce of soap in decoction. He had the symptoms of a stone in his bladder, voided, while taking the remedy, many concave and convex scales, with some solid fragments of stone, grew at length perfectly well, and never after that had any return of his complaint. He died at the age of eighty. As this gentleman had received a more conspicuous cure than any other person before him, Mrs. Stephens began to augment the quantity of the powder and the soap, and found them attended with proportionably greater success.

In the year 1735, the Hon. Edward Carteret,
Esq,

Esq. Post-Master General, began Mrs. Stephens's medicines, and received great benefit. This engaged the attention of the public, and more particularly of such as were afflicted with the stone or gravel, so that the number of persons that took her medicine increased every day.

In the year 1737, the cures performed were so many, and so well attested *, that the speedy publication

* Mr. Bolton having obtained a cure by Mrs. Stephens's medicine, wrote to Dr. Hartley as follows, from Newcastle upon Tyne.

Dear Sir,

A more particular and exact account of all that have taken Mrs. Stephens's medicines, when it comes out, must be a great and most convincing proof of the good effects of them, and prevail on the charitable part of this nation to put a helping hand towards ~~for~~ universal a good, and the unspeakable benefit the poorer sort may reap from it.

For my own part, I thank God I am so perfectly cured of the stone by taking them, that I never since have felt the least symptom of pain from that distemper with which I had been sore afflicted about two years before, and could not endure to ride on horseback, which exercise I can now bear with pleasure.

I took all the things before this that I could hear of in this country to make me easy, but without effect. I began the medicines in much pain, which, with some intermission, continued for about a fortnight, and then it abated, and I was somewhat easy; but had more or less of pain, night and day, with some remission indeed, during the time of taking the remedy. I did not hear of any that complained so much as I did; perhaps the stone might be of a harder nature than

cation of them was judged to be of great importance to mankind: and accordingly, in the year 1738, a proposal for raising 5000 l. by *voluntary* contributions, as a reward to Mrs. Stephens for discovering her

usual, and might not dissolve so kindly as in others; but by persisting in the medicines, the stone began to dissolve and come away in bits, and I was then more easy.

Mr. Binford and Mr. Holland both took the medicines at the same time I did; they each came to shew me what came from them, and to compare with me. I observed that the operation was the very same with them, having just such bits as I had, and at the last a larger hard stone, which appeared to be the kernel. They were so much alike that one would think they all came from the same person. The bits are perfect stone, only soft at coming away; but laid on a paper they soon dry to be perceived what they are. It is a surprising medicine, and would be of great use, and if known, a vast kindness to poor people, who are not able to give the price it now is. The manual operation is come to perfection; yet how must the poorer sort come at it in the country, when they cry out for some assistance?

Since my recovery to health and strength, some of the poor pit-men in pain and distress have been to inquire of me what I took. When I told them they complained lamentably of their affliction and poverty, not being able to pay the price of the medicines. Some are since dead. For while they strive to labour under such grievous pain, they perish for want of relief, and it is hoped all good and well-disposed Christians, who have any charity or benevolence for mankind, will consider and promote the noble design you have undertaken.

I have the honour to be, &c.

Mr. Underwood's case which he published is equally striking.

Dr.

her medicines, was presented before the public with her consent *.

As this proposal, however, did not meet with the expected success, she was advised, in the beginning of the year 1739, to apply to the *House of Commons*

Dr. Hartley having himself commenced Mrs. Stephens's medicine, voided in consequence many fragments of stone, and feeling less pain than before, and being better able to jumble over the pavement in London, he conceived a high opinion of the efficacy of Mrs. Stephens's remedy. He therefore collected and published 154 trials. Several of the cases were drawn up by the persons themselves, or written from their accounts. "If," says he, "I have flattered myself with false hopes, it is especially my interest to be undeceived, and my duty to acknowledge my error. But if, on the contrary, I have satisfactorily proved a dissolving power in the medicated urine, Mrs. Stephens will appear to you (the College of Physicians) in a different light from the common *pretenders to nostrums*, and you will not think the measures that have been taken by me to obtain the publication of her medicines, any encouragement of an *impostor*. Vide p. 53, par. 2.

* From April 1738 to February 1739, the subscription was open, and near 1,400l. was collected. Among the list of subscribers we note, with pleasure, the illustrious names of several eminent physicians.

Mrs. Stephens's proposals were,

- I. As soon as 5,000l. are raised by voluntary subscription, Mrs. Stephens shall discover her medicines, and they shall be made public.
- II. That time sufficient for the trial of her medicines shall be given, and she shall receive the 5,000l. contribution, if
it

mons for the above-mentioned reward, submitting her medicines, when discovered, to such examination as the House should think right, before the payment of the reward. This she did, and a bill was brought in for the purpose, which passed both Houses, and had the royal assent at the conclusion of the Sessions, June 14, 1738. She next presented a paper, containing her method of preparing and giving her medicines, to his Grace the Archbishop of Canterbury, June 16th following. Trials were made with the medicine thus discovered. They were found to produce the promised effects; the trustees named in the Act of Parliament met March 5, 1740, gave Mrs. Stephens the certificate required by that act, and she received the 5,000 l. reward at the Exchequer, March 17th following.

Extract from the Gazette, March 18, 1740.

1. Mr. Gardiner *, of Fetter-lane, aged 61, had the usual symptoms of a stone in the bladder, with

it shall appear to the Archbishop of Canterbury, the Duke of Richmond, the Earl of Pembroke, &c. that these medicines are able to dissolve stones in the bladder;—but if this does not clearly appear, the principal shall be returned to the contributors.

Surely no proposal could be more fair or honourable to one party. Dr. Hartley has emphatically marked in italics, among the list of subscribers, the names of but *two bishops* and *one surgeon*!

* These were the selected persons, on whom the medicines were tried, and who were examined by the House on oath.

violent pains for several years. He was searched by Mr. Nourse, surgeon, Dec. 30, 1738, when both he, and Mr. Wall, apothecary, felt a stone in the bladder. Mr. Gardiner took the medicines about eight months, voided many pieces of stone in that time, was freed from all his symptoms; and being searched again, first by Mr. Sharp, Sept. 14, 1739, and then on the 30th of November following by Mr. Nourse, Mr. Cheselden, Mr. Sainthill, and Mr. Belcher, surgeons, no stone could be found.

2. Peter Appleton, of Black-friars, aged 67, had the symptoms of a stone in the bladder for more than seven years, with excessive pains for the five last years of that time. He was searched July 6, 1739, by Mr. Sharp, and found to have a stone in the bladder, which stone was also felt by Dr. Pellet, Dr. Nesbit, Dr. Whitaker, and Dr. Hartley, and judged by all present to be a large one. He took the medicines for about five months, during which time he voided a very large quantity of stone in flakes and small fragments. He grew quite free from all his complaints, and was searched again, first by Mr. Sharp, Nov. 9, and afterwards by thirteen physicians and surgeons; but no stone could they find.

3. Henry Norris, of Leather-lane, aged 55, had the symptoms of a stone in the bladder for about a year and a half. August 17, 1739, he was searched by several physicians and surgeons, who all felt the
the

the stone. He took the medicines^e about four months, and voided only a thick sediment in that time, however he was free from all his symptoms; and being searched again, Dec. 14, by eight physicians and surgeons—no stone could be found.

4. William Brighty, of Colchester, aged 79, had the symptoms of stone in the bladder for more than three years. He was searched Sept. 8, 1739, by Dr. Gardiner and Mr. Sharp, and found to have a stone. He took the medicines for about four months, voided many pieces of stone during that time, became free from all his symptoms; and being searched again by Dr. Gardiner, Mr. Sharp, and Mr. Belcher—no stone could be found.

Out of 154 cases * published with a view to recommend Mrs. Stephens's remedy to the notice of the public, by the celebrated David Hartley, M. D. and which he addressed to the President and Fellows of the Royal College of Physicians, I shall only extract the case of Dr. Kirkpatrick, an eminent practitioner of physic in Ireland. Perhaps it might be serviceable to mankind, if physicians, attentive to the progress of science, and their own feelings, were, from time to time, to become martyrs to those diseases for which remedies are still wanting, or are but newly introduced.

* Vide note * p. 567.

Dr. KIRKPATRICK's Case.

For these sixteen years past I have been afflicted with the gravel in the kidneys, and after the usual paroxysms of vomiting, &c. the use of the warm bath, emollient clysters, &c. have passed divers stones. The last of these severe fits was in July 1737; I then passed a small stone, and have since that period been subject to violent attacks of strangury.

1738.

Oct. 17. I began Mrs. Stephens's medicines.

18. The urine smelt strong, and my pains were increased, which were almost continual. I passed one oblong angular bit of stone that day.

19. The urine full of white sediment, and continues so. Frequent stoppage. Great pain.

20. Frequent stoppage. Passed 1 angular broad flake of stone.

21. Less pain. Passed 3 flakes of stone.

22. Less pain. Passed many angular bits, but small. Extreme pain for half an hour.

23. Passed more than 12 white flakes of stone, and above 20 small angular bits. In my microscope, the flakes appear very distinctly like pieces of rotten rock rent asunder.

Oct.

Oct. 24. Passed as many flakes to-day as yesterday.

Some of them white on one side, and a little reddish on the other.

Observations. I apprehend the white side is that exposed to the medicated urine, and the other side is that which is broke off from the main stone, whose colour it may be supposed to have.

Since I have taken Mrs. Stephens's medicine my urine is become alkaline, that is, it turns syrup of violets green, and ferments with acid liquors. This I thought very remarkable when I first observed it, and began to hope, that urine, which was so different from common urine, might have different effects upon stones in the kidneys and bladder. And I have lately been informed, that even common urine, when it putrefies, that is, turns alkaline by being kept, will dissolve and take up the calculous incrustations upon the sides and bottoms of the urinals. I boiled different pieces of stones, which were taken from the human bladder, in my own alkaline urine, and common urine. The first were wasted considerably, and their surface turned white and soft:—but those in common urine had little effect produced on them.

I shall continue to send you an abstract of my diary, which I keep very exactly. I constantly confine myself to my chamber, that by a state of rest the medicated urine may lie longer upon the stone. I believe you will think this account as encouraging

as could be expected in nine days. I confess the event has much exceeded my expectations. Such as it is I have sent it, that I might do justice to Mrs. Stephens, and also to the public. I long much to know the state of the subscription, and whether you be able to make any probable calculation when it will be completed, that the public may have the knowledge of this glorious discovery *.

Oct. 25. Passed 37 *flakes* of stone, 3 thicker than usual, and one of them much larger than any of the former. Much white sediment, many angular bits.

26. Passed 68 *flakes* of stone, many of them equal to the largest of the former.

27. Passed 64 *flakes*.

28. Passed 90 *flakes*.

29. Passed 38 *flakes*, 2 of them a quarter of an inch broad.

30. Passed 34 *flakes*.

31. Passed 56 *flakes*.

Nov. 1. Passed 29 *flakes*.

Observation. All I have passed are convex and white on one side, concave and brown on the other.

2. Passed 6 *flakes*.

3. No flakes or bits.

4. }
5. } No flakes.
6. }

* Vide note * p. 567.

Observation.

Observation. There appears a kind of stop in the operation of the medicine, though my mode of living is the same, and I take my medicine regularly.

Perhaps the outward coat of the stone is come away, and the internal coat is much *harder*, and requires more time in being dissolved and broken down.

I have had throughout *great pain* in passing my water, but especially these last four days. Having gathered a large tea spoonful of the *white sediment*, and drained off the urine from it as well as I could, I left it three days in the open air, and found the urine evaporated, and the sediment grown into a *solid calculous mass*, which I broke into pieces. These had the same appearance in my microscope as *the flakes of stone* which I had passed. I think this seems to prove that *the white sediment* is really a part of the stone, resolved into an impalpable powder.

Nov. 7. Passed 1 *flake*, and 1 *angular bit*.

8. Passed 1 *flake*.

9. Passed 2 *bits* of the same substance with the *flakes*, but softer.

10. Passed 2 *flakes*, pretty large, one of them having the surface of a sphere, or like the top of a brass nail, with a convexity and concavity; also 1 *bit* of stone,

stone, of a dirty colour, with *veins of white*.

- | | | |
|-----|---|---|
| 11. | } | Passed no flakes, but <i>divers angular bits</i> ,
with much <i>white sediment</i> ,—pellucid
mucus, and very great pain. |
| 12. | | |
| 13. | | |
| 14. | | |
| 15. | | |

My pains have been great throughout, but *most* when *this mucus* passes from me. Sometimes I imagine this mucus is no more than *the mucus* secreted from the glands of the bladder and urethra, contrived by provident nature to sheath the acrimonious salts of the urine, that they might not offend the tender parts through which they pass; and that the alkaline medicated urine is so *very deterfive* as to wear off and scour away this mucus, leaving the bladder and adjoining parts exceeding bare, and consequently obnoxious to pains raised by the stony particles, angular bits, and coarser parts of the sediment while passing*.

Besides the disagreeable taste of Mrs. Stephens's

* We will break off the relation of this case here, not to tire our readers with a repetition of the same story, observing, at the same time, that Mrs. Stephens's medicines, when once begun cannot be left off, however strong the indications to desist from their use; for the stone, having become *corroded* and *softened* by the medicated urine, ceases to irritate the bladder; but if the medicines are left off, it soon returns to a state of hardness, and the rugged surface occasions then the most lancinating pains.

solvent, and its frequently nauseating the stomach, its caustic and irritating effects on the animal system, and the urinary passages in particular, were great discouragements to its liberal use.

Mrs. Stephens's *medicines*, notwithstanding the great relief they had afforded to many, were therefore soon laid aside. They were, however, laid aside *with regret*, since this inference seemed to be warranted by the whole sum of facts, that *much benefit* might be derived from them, provided their collateral bad effects could be obviated. Could *these inconveniences* be removed by any combination, that would still leave *the alkaline salt* at liberty to unite with *the acid*, which is supposed to contribute to the formation of these calculi, the purpose of *preventing their being generated*, or of *dissolving them when formed*, would probably be in a good measure answered. It was reserved for a respectable member of the medical profession, still living *, to engage the modern chemistry in the service of medicine, and realize a project, which now seemed to be relinquished in despair. This gentleman's reflections were quickened by his own feelings, and in 1778, after having been for *eighteen* years subject to severe paroxysms, began to take a solution of fixed vegetable alkali, supersaturated with carbonic acid (*charcoal and oxygen*). This gentleman thought

* Benjamin Colborne, Esq.

that by this means *the alkaline salt* would be rendered less disagreeable, and at the same time milder, without losing its well known *lithontriptic quality*; for, as Mr. Scheele and Sir Torbern Bergman had proved, that the human calculi in the bladder were made up of *an acid* and *an earth*, a *double elective attraction* might possibly take place,—the acid of *the calculus* having a stronger attraction for the alkaline basis of *this neutral salt*, would unite with *the alkali* of the neutral salt,—while the carbonic acid, being disengaged from *the neutral salt*, might, in its turn, unite also with the earth of the calculus.—He found also, that by infusing pieces of calculi in the urine of such persons as were taking the aqua mephitica alkalina, it exhibits a considerable *lithontriptic quality*, and having put a fragment of a calculus, weighing 51 grains, into the alkaline neutralized solution, at the end of 31 days it was found to have lost 36 grains of its original weight. This medicine very soon relieved his symptoms, and, as it will appear from the account of his case, has kept him *free from pain for ten years*, one slight attack excepted, which is ascribed to *the discontinuance of the medicine for several weeks*. As this case is extremely interesting we will give it.

BENJAMIN COLBORNE'S CASE.

Mr. Colborne, apothecary, of the city of Bath, in the year 1760, was attacked with a violent nephritic

tic paroxysm, which, after continuing seven or eight days, and being treated with anodyne, oily; and mucilaginous medicines, and bleeding, terminated in the discharge, by urine, of a red stone larger than a vetch or tare, after which he continued tolerably well for eight or ten months; often, however, observing small calculous concretions to come away, attended with irritation of the urinary passages.

In about ten months after the first attack, he had another, but neither so violent or of so long duration, which terminated like the first, in the discharge of a stone of a similar colour to the foregoing, but of a smaller size.

The nephritic paroxysm again returned in about five or six months, but not so violent as at first. During this time he was in a course of taking mucilaginous and lubricating remedies.

After this he made trial of Mrs. Stephens's remedy, as prepared by Dr. D'Eschernay, of which he took about an ounce in a day, once or twice a week.

After this, he continued free of nephritic complaints about a year and half. That medicine, however, agreed so ill with his stomach, producing nausea, indigestion, and crudities, that he was obliged to leave it off.

About three or four months afterwards he had
another

another attack, which returned upon him every ten or twelve weeks.

In the year 1766, he made a trial of Blackrie's Lixivium (or Chittick's remedy), and thought it agreed with him rather better than soap; yet it was so caustic and irritating to the mouth and throat, and produced such painful sensations in his stomach, *that he was obliged to leave it off*; after which his nephritic paroxysm returned every eight or ten weeks as before.

On March 27, 1778, he had an attack of the gout, which continued on him until the 14th of April, when he was taken with a violent vomiting, attended with pain in the left kidney. By the help of the warm bath and bleeding, he passed another calculus. After this he had a second attack of the gout, which continued a few days.

As soon as it was over he began the use of the *alkaline medicine with fixed air*, as above described. *During the use of this he parted with no gravel, his urine deposited no sediment whatsoever, or discoloured the vessel, though if it was omitted even for a few days these appearances took place, and small bits of gravel were perceived in his water.*

From this time he continued in perfect health, and free of all nephritic complaints, until the 26th of August 1783, when, about three in the morning, he was taken with an irritation in the urinary passages, which prevented his sleep, his urine however

was not high coloured; about seven in the morning he had two purging stools; he had but little pain in the kidney, but a heavy obtuse sensation over the os pubis, which continued with some sickness till about two o'clock, when the stone seemed to enter the bladder. From that time he became perfectly easy.

In order to discharge the stone from the bladder, he drank large quantities of mucilaginous liquors, and retained his urine as long as possible. About six in the evening *he discharged a red calculus*, smaller than what he had before done.

It is proper to observe, *that he had been at Harrowgate about four or five weeks before this happened*, and drank the Harrowgate water, which, as it acted not only as a purgative, but as a diuretic also, he was induced to think he might *safely omit* the alkaline solution. It appeared however, to his great disappointment, that the calculus was generated *during that interval*. From that time to the present he has never, for *two days successively*, omitted taking the saturated alkaline solution, and *has never since felt the smallest uneasiness; no grains of sand or other precipitation in the urine, nor any discoloration of the vessel, except when the medicine is omitted for a day*. But, upon taking the solution again, the urine made afterwards *dissolves the former discoloration*, and still continues perfectly clear. During the time he was subject to nephritic paroxysms, his urine was subject to

to putrefy very soon, but since he has taken the solution it will keep three or four days in the warmest weather without shewing any signs of that disposition. His health, strength, and spirits, are all perfectly good; and, as he thinks, better than they were twenty years ago*.

Experience

* It is to Benjamin Colborne that Dr. Beddoes dedicates his Observations on the Nature of Calculus, &c. His words are, " Sir, It has been frequently with great confidence affirmed, that our acute pains are of short duration. A very slight acquaintance, however, with the tremendous catalogue of human maladies, will satisfy us that this is the vain aphorism of a sophist, more anxious to place words in opposition, than to observe the course of nature. Our excruciating diseases are, if I do not compute very much amiss, remarkable for length of paroxysms, and for frequency of recurrence; while in those of a different character, languor and depression are scarce less intolerable than the most intense pain.

" I hope, and I believe, that this mighty mass of evil will be gradually diminished, and finally disappear from the face of the earth. We are just beginning to catch a glimpse of the laws of animal nature; and now, when the human mind seems, in so many countries, about to be roused from that torpor, by which it has been so long benumbed, we may reasonably indulge the expectation of a rapid progress in this, the most beneficial of all the sciences.

" Much as you have contributed, by the frank and disinterested communication of your discovery, to obliterate one of the darkest shades from the prospect of life, your name is, I suspect, scarce known beyond the narrow circle of the practitioners of medicine, except, perhaps, to a few among those who are indebted to you for ease and health. Such is

Experience has since amply confirmed the virtues of a medicine, which, I apprehend, may be *freely taken without danger*, and even *without inconvenience* (except in a few rare instances), and which seems to have deserved the singular praise of *equalling* the expectations raised by the person who first proposed it. But when we consider the high price and brittleness of Newt's apparatus, and the care that must be used in conducting the process, and the necessity there is of constantly *continuing* the medicine, a *remedy seemed still wanting adapted to the condition of the poor, who are by no means exempted from calculous disorders.*

In the year 1787, a person belonging to the medical profession, and much afflicted with the gravel, complained to Dr. Beddoes that he was unable to persevere in the use of the aqua mephitica alkalina, on account of the great dizziness it always occasioned with him. I was led, says this benevolent physician, from this intimation to reflect upon the subject, and after some time fell upon a formula, of which I think myself fully warranted in asserting, that it is *extremely beneficial* in calculous complaints,

the inattention of mankind to their best benefactors! and so entirely have fatal illusions perverted our moral sentiments! I cannot hope to add much to your reputation; but by attempting to diffuse more widely the benefit for which mankind are originally indebted to you, I shall certainly afford you gratification."

and

and that it may, *without injury*, be taken in very large quantities, and continued for a great length of time. Its simplicity and its cheapness are its great recommendations. It is SAL SODA, OR NATRON, made into the form of pills with soap, or any other cement. Bark and aromatics may be occasionally added. The trials that have been already made of *this remedy* sufficiently prove it to be at the same time both efficacious and harmless; and this invention may be truly ranked among the many very useful discoveries that have been made by this excellent and truly philanthropic physician.

PRACTICAL OBSERVATIONS.

S E C T. XCIII.

THE TREATMENT OF THE GOUT.

WHEN an opinion in respect to the origin of any disease is supported by probable circumstances, and strengthened by coincidence with every practical deduction, much advantage may arise from it. There are few diseases in respect to the sources of which the evidence is so complete, as we shall endeavour to give concerning those under consideration. Our most important conclusions will be drawn from chemical facts, not too refined for being made the ground of just inference, but obvious and unambiguous. It has been proved, that in the general fluids of the body, or in particular portions of these, there is a peculiar matter of the acid kind, which in its common state is combined with a matter that keeps it suspended, and in a state of solution.—This is in many cases redundant, sometimes perhaps from too great a portion

tion being produced by the animal operations, but more commonly hurtful from a precipitation of it by a stronger acid, which may be one of the native acids, or an acid conveyed from the alimentary canal.—

That, losing its combinations with alkali or earth, it appears in the urine as a preternatural sediment under various shapes; and, when the proportion is greater in any situation of the body than can be retained in solution by the fluids of the part, a concretion of particles takes place so as to form, in the urinary passages, gravel and calculi—in other places, but especially in tendons and ligaments, from circumstances in their nature and circulation pre-inclining to the effect, a depomite which becomes the cause of gout.

To predominating acidity these diseases are to be ascribed—to acidity which sometimes may have its origin in the vessels themselves: it may be the production of the general habit, or perhaps may proceed from the morbid operations of a part—to acidity which more frequently is generated in the stomach—and not uncommonly to acidity introduced by the mouth.

That acids are greatly instrumental towards the production of gout, is an opinion which was founded upon observation, and has long been maintained. The disease, as well as gravel, has in many cases been attributed to an excessive use of acids. It has likewise been regarded as intimately connected with
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that state of the stomach, in which there is an almost perpetual generation of acids. At the same time, however, a variety of circumstances of a different kind have been enumerated as sources of it. If we examine with attention the condition of many in whom gout makes its appearance, we shall generally find, that those other circumstances have chiefly been productive of it, when they have had the previous effect of impairing the digestive faculties, and causing a consequent tendency to the generation of acid. Of this nature are infobriety, luxury, indolence, and voluptuousness. The disease frequently attends upon a habit of drinking, on account of the acids conveyed into the body by means of it. The tendency of different liquors to produce it, is not so much in proportion to their strength, as to the quantity of acid in their composition. This assertion is warranted by the experience of ages; the liquors in which acid predominates having been invariably considered, by the best authorities, as peculiarly predisposing to gout. Shallow of observation must be the man, who, accustomed to endure the pains of gout, has not become acquainted with the injury of acids. By immoderate indulgence in intoxicating compounds of any kind, by a life of luxury, by a state of indolence, and by an inordinate pursuit of pleasures, the powers requisite for the process of digestion are at last brought into disorder, and the contents of the stomach permitted to run
into

into common fermentation. These and other circumstances, which tend to vitiate the action of the stomach, and conduce, by reason of derangement, to the formation of acid, may be looked upon as remote causes of gout and of gravel.

Gout is one of the diseases which has the appearance of being transmitted by parents to their offspring. This circumstance may be advanced as an argument against its proceeding from the introduction of acids, but on reflection will be found to give weight to that opinion. In the multitude of affections depending upon peculiarities of habit, there is not one more uniform in its occurrence than that disposition to stomach derangement which is the source of much disorder in the system. The features of the face, the propensities of genius, the nature of the passions, or the disposition of the mind, have not greater resemblance in consanguinity than the condition of the stomach. A constitutional imperfection in the digestive faculties, or that condition of stomach in which a part of the food is perpetually running into these fermentations which produce acidity, is a great hereditary source of gravel and gout.

A defect in the digestive process frequently succeeds to irregularity, to intemperance, and to unavoidable exposure, under many situations, to circumstances that are the occasion of debility and disease. In a great number of habits, however, there

is

is original and constitutional imperfection, which may be marked even in the earliest periods of life before any morbid temperament has been contracted, and is found in the advanced stages to become greater with increase of years.

When an opinion in respect to the origin of any disease is supported by probable circumstances, and strengthened by coincidence with every practical deduction, much advantage may arise from it. There are few diseases in respect to the sources of which the evidence is so complete, as we have endeavoured to supply concerning these under consideration. Our most important conclusions are drawn from chemical facts, not too refined for being made the ground of just inference, but obvious and unambiguous. It has been proved, that in the general fluids of the body, or in particular portions of these, there is a peculiar matter of the acid species, which in its common state is combined with something that keeps it suspended, and in a state of solution.—That this matter is in many cases redundant, sometimes perhaps from too great a portion being produced by the animal operations, but more commonly from a precipitation of it by a stronger acid, which may be one of the native acids, or an acid conveyed from the alimentary canal.—That losing its combination with alkali or earth, it appears in the urine as a preternatural sediment under various shapes; and, when the proportion is greater in any
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situation of the body than can be retained in solution by the fluids of the part, a concretion of particles takes place so as to form, in the urinary passages, gravel and calculi—in other places, but especially in tendons and ligaments, from circumstances in their nature and circulation pre-inclining to the effect, a depomite which becomes the cause of gout.

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Bosc D'ARTIC, in his *Memoire sur les differens Etats de l'Acide dans l'Economie Animale*, conceives the acid of the stomach to be phosphoric, and goes the length of asserting that it does not form with alkalis the compounds that would result from their union with vegetable acid. “ *Il n'est pas rare que les hypochondriaques, les femmes hystériques, les femmes anciennes éprouvent des aigreurs dans l'estomac et dans l'asophage, et rendent meme par le bouche une liqueur tres-acide. Un léger purgatif, en emportant la surabundance de cet acide, les délivre, du moins pour quelque temps, de cette incommodité. Cet acide ne faisant pas effervescence avec les alkalis aérés, et ne formant avec*
l'alkali

l'alkali fixe du tartre, ni de la terre foliée, ni du tartre tartarifé, ne feroit être regardé comme un acide végétale."

The prevention of acidity from fermentation in the stomach is to be effected by regard to diet; by avoiding every circumstance that might contribute to disorder, and by increasing the proper faculties of digestion. To a stomach in the right exercise of its powers, cautious selection of diet is not necessary; the assimilating process extends equally over the matter of animals and vegetables, to the production of fluids for the nourishment of the body. A diet purely vegetable would not give occasion to preponderating acid, nor would inconvenience be endured from the putrescent bias of an animal regimen; but we before remarked, that an imperfection in the digestive functions is an original error of many habits, which are frequently in other respects of great apparent strength. A great proportion of the people in this country, and perhaps over the globe, are constitutionally deficient in the assimilating process. Digestion, which when complete does not admit of common fermentation in the first passages, is but half performed, and acidity or putrefaction, with their extended train of evils, are perpetually taking place. To stomachs of this description—and such are the stomachs which may be termed the hot-beds of gravel, of gout, and of biliary affections, the greatest circumspection is necessary

fary in respect to the quality and quantity of every thing received*.

A variety of medicines may be employed for promoting the action of the stomach. Bitters have long been distinguished for this effect: chalybeates are of great avail. Aromatics, the medicines termed anti-spasmodic, and warm resinous substances, may be turned to good account. The greatest caution, however, is necessary in the use of such articles—they are active engines, by means of which much good or evil may be achieved: they should never be employed at random, but ought in all cases to be under judicious regulation and management, by which their operation may be pointed to a secure and salutary issue. They are powerful in correcting a disposition to acidity; but in respect to these and similar medicines it may be observed, that they are only to be occasionally called to the assistance of the stomach. The greatest misfortunes have arisen from their long continued use. There cannot be a practice more pernicious, than the constant employment of any medicine which maintains artificial exertion, until the habit of natural action is lost, and in the end the powers are exhausted.

We are inclined, then, to reprobate the practice of daily taking tansey tea, tincture of bark, and

* For many judicious remarks relative to the diet proper for gouty subjects, we refer the reader to the life of Dr. Brown, Vol. I. Page 148.

rhubarb, with other bitters. For a means of cure which has sometimes been pursued, not so much by obviating the cause, as by counteracting its operation upon the system, is attended with infinite danger. By large doses of bitters and astringents, the fits were prevented from taking place, but the functions of the system became impaired; accumulation, the natural error of gouty habits, increased to the production of universal disorder, or destructive plethora; and the œconomy was precluded from the general relief which a paroxysm of gout would have ensured. It is not strange, that in such cases fatal affections of the brain and of the viscera should have occurred, or that indolent rigidity, unsusceptibility of impression, and muscular inaction, should have produced a miserable condition of helpless infirmity, even if dropical diseases have not before closed the unhappy life of the sufferer*.

Salt of steel decomposed by an alkali, with a predominating proportion of the latter, and added by the active resin of myrrh, is a remedy at present in just repute, on account of its peculiar efficacy in cases where stomach and biliary affection is seldom absent, and where prevailing acidity is, in common, at least a concomitant symptom†.

* Vide the effects produced by the Portland Powder, Sect. XXIV. Page 107. Vol. IV.

† For the formula, vide Vol. III. Page 618. at the bottom.

We come now to alkalies. Cullen, speaking of them, says, "Another remedy which has had the appearance of preventing the gout, is an alkali in various forms, such as the fixed alkali both mild and caustic, lime-water, soap, and absorbent earths. Since it became common to exhibit these medicines in nephritic and calculous cases, it has often happened that they were given to those who were at the same time subject to the gout; and it has been observed, under the use of these medicines, gouty persons have been *longer free* from the fits of their disease. That, however, the use of these medicines has entirely prevented the returns of gout, I do not know; because I never pushed the use of those medicines for a long time, being apprehensive that the long continued use of them might produce a hurtful change in the state of the fluids."

"Some remarkable cases, however, have lately occurred in this city of the efficacy of aerated alkaline water, in preventing the returns of the paroxysms of the gout. It requires to be taken for a great length of time, to insure success; but the patient is encouraged to persevere in its use, in consequence of a speedy removal of some of the most troublesome symptoms."

The method of making it is described by several authors; but, for the sake of those readers who are unacquainted with the process, I shall give an abstract of it.

Qq 2

Dissolve

Dissolve three ounces, Troy weight, of good salt of Tartar in a gallon and a half of rain water, or good soft spring water; filter the solution, and put as much of it into the middle glass of Nooth's machine as will completely fill the vessel, reserving the remainder for a subsequent making. The effervescing materials must then be put into the lower vessel, and a gentle stream of fixed air must be made to pass through the liquor, till it tastes evidently acidulous, which will probably require forty-eight or sixty hours, or in summer more.

The method of managing the effervescence is of considerable consequence; for, if it is too violent at first, much air escapes through the vessels without effect. Ascertain, by previous experiment, how much of the vitriolic acid, which you have procured, for it is of very different strengths in the shops, will saturate a drachm of the chalk. Put four ounces of dry powdered chalk into the lower vessel, and shake it to one side; under that side put a wedge, so as to raise it about an inch and an half from the table. With a long funnel, which reaches to the bottom of the vessel, pour in the quantity of vitriolic acid necessary for the saturation, which will run down to the other side of the vessel, and not come into contact with the chalk: through the same funnel, pour very slowly as much water as will be sufficient to cover about a fourth part of the chalk as it then lies. The vessel being gently shaken

Shaken occasionally, the effervescence will go on very slowly, and the alkaline liquor will be sooner and more effectually saturated, than if the effervescence had been too violent. If the materials are not sufficient for giving an acidulous taste to the liquor, the lower vessel must be washed, and fresh chalk and acid again put into it.

The dose of this water is half a pint about noon, and another in the evening. In urgent cases half a pint has been given morning, noon, and night, for a considerable time together, without disagreeing with the stomach, or injuring the appetite or general health of the patient. If it prove flatulent, a tea-spoonful or two, but not more, of spirituous cinnamon water may be taken in each dose. If it inflame, or too violently irritate the urinary passages, five or ten, or in urgent cases, twenty drops of laudanum may be taken with each dose of the water, or it may be given in milk *.

Where the expence of the aerated alkaline water is more than can be conveniently supported, *Lime water* may be employed as a substitute.

Lime-water enters the vessels by absorption, and carries its effects over the system. By such additions as are often made to the lime-waters, it may

* The mephitic alkaline water is best prepared by Swepps, Margaret Street, Cavendish Square.

be rendered not an ungrateful liquid, and might, in some cases, be substituted for every other fluid. Tea made with lime-water might soon, perhaps, be thought more offensive in colour than in taste. In a work of just celebrity and esteem, Dr. Blane's valuable Treatise upon the Diseases of Seamen, lime is recommended for preventing the contamination of water, and lime-water employed for culinary purposes, is regarded not merely as devoid of prejudice towards the system, but conducive to the prevention of dangerous bowel affections: it stands acquitted of pernicious effects, upon an authority of nice observation and accurate discernment. With superior advantage it may be admitted where the morbid inclination of the habit is to redundant acidity.

Volatile alkali, which excites the operation of the stomach, and is an agreeable stimulant to the system, may be made very beneficial in cases of languor and inaction. It rouses to requisite exertion the exterior arrangement of an indolent habit. This, and alkaline medicines of every kind, may be occasionally combined with purgatives, with bitters, with resins, with aromatics, with chalybeates, or with any remedy that may appear suited to the individual. For it is not our design to enter minutely into the methods of carrying these intentions into effect, but merely to touch upon general principles, of
which

which the proper application to individual cases must be accommodated to multiplied varieties of constitutional temperament, customary habit, and particular conveniency, which can alone be learnt by experience.

PRACTICAL OBSERVATIONS:

SECT. XCIV.

GALL-STONES.

THE calculi formed in the liver and gall-bladder differ entirely from those of the urinary passages, and appear to consist principally of the resin of the bile. They are most commonly soluble in alkalis. They melt in the fire, and are inflammable. In general properties they agree with the matter that is precipitated from bile by acids: a question then arises, whether or not the separation even in the body may not be effected by an acid? It is certain that habits, in which they commonly occur, are those in which acid is redundant. The formation of gall-stones is generally accompanied with great derangement in the functions of the stomach. The symptoms, which pass under the denomination of bilious, and proceed from vitiated digestion, are seldom wanting.

Close

Close observance of the circumstances under which they are generated, affords the strongest presumption of the influence of acids, received into the stomach, or formed in the body by a morbid process of fermentation, in producing them. It may be asserted, without much risque of contradiction, that gall stones are seldom present when acidity in the first passages has not abounded. This being the case, and the alteration corresponding exactly with the effects of acids upon the bile, we are induced to suppose that the acid of the stomach is conveyed to the liver.

When biliary calculi are said to consist of the resinous part of the bile, it is not to be inferred that they are in every instance the resin pure and entire. In many cases there may be a mixture of animal mucilage, or of any other matter that may be blended with the bile when the condition of the liver is disordered. Sometimes lithifac acid may form a part. In schirrosities of the liver, the obstructing matter that pervades the substance of that gland, looks frequently like the resin of the bile in conjunction with that kind of glutinous substance which is yielded by glands under scrophulous affection. The basis however of gall-stones is that matter which appears in a solid consistence when acids are mixed with the bile. It is a requisite of which they are sometimes entirely composed,
and

and without a portion of which they are never formed.

The source of this affection with that of gout is nearly the same; the means of prevention will be the same; and must principally consist in guarding against acidity, and counteracting or diminishing the operation of acids.

As the gall-stone in its passage produces a painful spasm of the gall duct, opiates have been freely given, the warm bath prescribed, and bladders of warm water placed over the pit of the stomach. Glysters have been often ordered, but castor oil produces a more beneficial effect.

..PRACTICAL OBSERVATIONS.

S E C T. XCV.

CURE OF THE RHEUMATISM.

HAVING given it as my opinion, that gout and rheumatism have the same proximate cause, I now proceed to the cure, which in some measure applies to both diseases.

Whatever difficulty may occur with respect to the explanation given above, this remains certain, that in acute rheumatism, at least in all those cases which do not arise from direct stimuli, there is an inflammatory affection of the parts, and a phlogistic diathesis in the whole system; and upon these is founded the method of cure, which frequent experience has approved of.

The cure thereof requires, in the first place, an antiphlogistic regimen, and particularly a total abstinence from animal food, and from all fermented or
spirituous

spirituous liquors; substituting a vegetable or milk diet, and the plentiful use of bland diluent drinks.

Upon the same principle, at least with perhaps the same exception as above, blood-letting is the chief remedy of acute rheumatism.

To avoid that debility of the system, which general bleedings are ready to occasion, the urgent symptom of pain may be often relieved by topical bleedings; and, especially when any swelling and redness have come upon a joint, the pain of it may be very certainly relieved by such bleedings*.

In the acute rheumatism applications to the pained parts are of little service. Fomentations, in the beginning of the disease, rather aggravate than relieve the pains. The rubefacients and camphire are more effectual in relieving the pains; but generally they only shift the pain from one part into another, and do little towards the cure of the general affection. Blistering, applied to the pained part, may also be very effectual in removing the pain from it; but will be of little use, except where the pains are much confined to one part.

It will be necessary to keep the body soluble. Aloetics, rhubarb, magnesia alba, or flowers of sulphur, may be employed, as the one or the

* These are best performed by leeches, four or five of which ought to be applied at once over the inflamed part.

other may happen to be best suited to particular persons *.

The

* The following formulæ may be used in particular cases:

R Aloes Socotorin. dr. 2.

Gum. guaiac. dr. 3.

Tinct. Rhei cum Aloe, q. s.

M. f. massa, in pilulas equales lxxv. dividenda;
quarum sumat iii. vel iv. pro re nata.

That is, take of

Socotrine aloes—two drachms.

Gum guaiacum—three drachms.

Tincture of rhubarb with aloes—as much as is sufficient.

Make into seventy-five pills, of which three or four are to be taken at bed time, occasionally.

R Pulv. Rad. Rhei, dr. 3.

Magnes. alb. dr. 4.

Gum. guaiac. dr. 2.

Confect. aromat. dr. 2.

Syrup. comm. q. s.

M. f. Elect. cujus sumat magnitudinem juglandis
mane et vespere, vel pro re nata.

That is, take of

Powdered rhubarb—three drachms.

Magnesia—four drachms.

Gum guaiacum—two drachms.

Aromatic confection—two drachms.

Simple syrup—as much as is sufficient.

To be made into an electuary, of which the size of
an acorn is to be taken night and morning, as
occasion may require.

This

The several remedies mentioned above moderate the violence of the disease, and sometimes remove it entirely; but they sometimes fail in this, and leave the cure imperfect. The attempting a cure by large and repeated bleedings is attended with many inconveniences, and the most effectual and safe method of curing this disease, is, after some topical bleedings for taking off, or at least diminishing, the phlogistic diathesis, to employ sweating, conducted by the rules before laid down*.

Opiates,

This last medicine has been extremely beneficial in removing costiveness, and in giving a tone to the stomach.

An ounce, or an ounce and a half, or two ounces of the Vinum Aloes of the London Pharmacopœia, is also a good purge for gouty persons.

The Tinctura Sennæ of the Edinburgh Pharmacopœia, is likewise a good medicine where we cannot use aloetic purges, as in cases of piles. In these cases also we may use sulphur; of which the following form is very convenient:

℞ Flor. sulphuris, unc. 2.

Elect. e fen. unc. 2.

Pulv. rad. jalap. dr. 2.

———— Zinzib. dr. 2

Syr. simpl. q. s.

M. f. Elect. cujus sumat quantitatem juglandis pro re nata.

* Sweating is most effectual in this disease, when produced by Dover's powder, or as it is called in our Pharmacopœias, Pulvis Ipecacuanhæ compositus. The dose of it is twelve or fifteen

Opiates, except where they are directed to procure sweat, always prove hurtful in every stage of this disease *.

The Peruvian bark has been supposed a remedy in some cases of this disease; but we have seldom found it useful, and in some cases, hurtful. It appears to me to be fit in those cases only, in which the phlogistic diathesis is already much abated, and

fifteen grains, repeated at intervals, of two or three hours, till a sweat be produced. Diluent drinks are to be used with it; and it may be necessary to observe, that they ought to be such as are bland, and by no means stimulating; viz. barley water, linseed tea, thin water gruel, &c.

* Notwithstanding this caution, many practitioners use opiates, especially when joined with camphor, to procure sweats in acute rheumatism. This compound never fails to increase the phlogistic diathesis, and consequently must be hurtful. In the chronic rheumatism, indeed, camphor and opium together form a valuable medicine. The dose is the following bolus:

R \bar{x} Camphor. gr. vi.
 Sp. vini, gutt. x.
 Opii, gr. i.
 Kali vitriol. gr. xv.
 Syr. q. s. M. f. bolus.

That is, take of

Camphor—six grains.
 Spirits of wine—ten drops.
 Opium—a grain.
 Vitriolated kali—fifteen grains.

Syrup—as much as is sufficient for a bolus.

where,

where, at the same time, the exacerbations of the disease are manifestly periodical, with considerable remissions interposed.

Calomel, and some other preparations of mercury, have been recommended in the acute rheumatism; but I believe they are useful only in cases of the chronic kind, or at least in cases approaching to the nature of these.

Having now treated fully of the cure of the acute rheumatism, I proceed to treat of the cure of the chronic, which is so frequent a sequel of the former.

The phenomena of the purely chronic rheumatism, mentioned before, lead me to conclude, that its disposing cause is an atony, both of the blood vessels and of the muscular fibres of the part affected, together with a degree of rigidity and contraction in the latter, such as frequently attends them in a state of atony.

Upon this view of the disposing cause, the general indication of cure must be, to restore the activity and vigour of the vital principle in the part; and the remedies for this disease, which experience has approved of, are chiefly such as are manifestly suited to the indication proposed.

These remedies are either external or internal.

The external are, the supporting the heat of the part, by keeping it constantly covered with flannel; the increasing the heat of the part by external heat, applied

applied either in a dry or a humid form; the diligent use of the flesh-brush, or other means of friction; the application of electricity in sparks or shocks; the application of cold water by affusion or immersion; the application of essential oils of the most warm and penetrating kind; the application of salt brine; and, lastly, the employment of exercise, either of the part itself so far as it can easily bear it, or of the whole body by riding or other mode of gestation.

The internal remedies are, 1. Large doses of essential oil drawn from resinous substances, such as turpentine *; 2. Substances containing such oils, as guaiacum †; 3. Volatile alkaline salts; 4. These,
or

* Turpentine is an extremely heating oil, as indeed are all the essential oils: its use therefore requires the greatest caution. The dose is from eight to fifteen drops on a piece of sugar. Venice turpentine may be more conveniently given in the form of an emulsion, by dissolving it in water by means of yolks of eggs. Two scruples of turpentine is the ordinary dose; and when given in this liquid and diluted state, is much preferable to the oil.

† The officinal preparations of guaiacum, are an extract of the wood, a solution of the gum in rectified spirit, and another in volatile alkali. The gum may be given in the quantity of fifteen or twenty grains for a dose, either in a bolus, or made into an emulsion with yolk of egg and an ounce or two of water: in larger quantities it is too purgative. The Tinct. guaiac. ammonat. of the Edinburgh Pharmacopœia is an excellent form, as the volatile spirit promotes

or other medicines directed to procure sweat, and lastly, Calomel, or other preparation of mercury, in small doses, continued for some time, or sublimated mercury.

These

the medicinal virtue of the guaiacum. The dose of it is from a drachm to half an ounce, morning and evening, in any convenient vehicle; a tea-cupful of milk is the best, as it sheathes in some measure the purgency of the medicine.

The following are excellent formulæ.

℞ Guaiac. gum. res. gr. 15.

Syr. zingib. q. s. F. bolus horâ somni sumend.

That is, take of

Guaiacum, the gum resin—fifteen grains.

Syrup of ginger—as much as is sufficient for a bolus, to be taken at bed time.

℞ Guaiac. pulv.

Sapon. aa dr. 1.

F. pil. 24 cap. pil. 4 bis die.

That is, take of

Guaiacum in powder, soap, equal parts a drachm.

Make twenty-four pills, four pills are to be taken twice a day.

R Guaiac. gum. res. scr. 1.

Sal. cornu cervi. gr. 4.

Conf. ros. q. s. F. bolus horâ somni sumend.

That

These are the remedies successfully employed in the purely chronic rheumatism; and there are still others recommended.

The diet in the cure of chronic rheumatism ought to be generous and full. In many cases, especially among people in poor circumstances, good living, with two or three glasses of sherry in the day, has cured the disease without any medicines. One material circumstance ought not to be omitted, viz. that the cure is much impeded by costiveness: if, therefore, the guaiacum does not procure two motions in the day, it will be necessary to give along with it some warm laxative. The vinum aloes of the London Pharmacopœia, is a proper

That is, take of

Guaiacum—a scruple.

Salt of hartshorn—four grains.

Conserve of roses—as much as is sufficient for a bolus, to be taken at bed time.

R Guaiac. gum refin.

Confect. aromatic. aa gr. 15.

Terantur simul, et syrupo aliquo fiat bolus, omni nocte capiendus.

That is, take of

Gum guaiacum.

Aromatic confection—of each fifteen grains.

Let them be rubbed together, and made into a bolus with any syrup, to be taken at bed time.

medicine

medicine in these cases: its dose is from one to two ounces: as is also the Tinct. Rhei cum Aloë of the Pharmacopœia of the Edinburgh College: its dose may be from a drachm to half an ounce, as occasion may require.

END OF THE SECOND VOLUME.