STUDIES
OF
NATURE.

VOL. I.

Front the Title   Vol. I

PHILOCLES *in the Island of* SAMOS

H Newman sc.

PLATE II.

ATLANTIC HEMISPHERE:

with its Channel, its Ices, its Currents, & its Tides, in the Months of January & February

Vol. I. Page 188.

Serfogie Rajah 1808

STUDIES

OF

NATURE.

BY

JAMES-HENRY-BERNARDIN

DE SAINT-PIERRE.

....MISERIS SUCCURERE DISCO.

TRANSLATED BY

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IN FIVE VOLUMES.

VOL. I.

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MDCCXCVI.

PREFACE.

A MAN who has himſelf derived pleaſure, or inſtruction, from the peruſal of a Book, naturally wiſhes to have theſe advantages communicated to others; for we preſume, that what has ſingularly affected ourſelves, is likely to produce a ſimilar impreſſion on the reſt of Mankind. I have read few Performances with more complete ſatisfaction, and with greater improvement, than the *Studies of Nature*: in no one have I found the uſeful and the agreeable more happily blended. What Work of Science diſplays a more ſublime Theology, inculcates a purer Morality, or breathes a more ardent and more expanſive Philanthropy? *Saint-Pierre* has enabled

me to contemplate the Univerſe with other eyes, has furniſhed new arguments to combat Atheiſm, has eſtabliſhed, beyond the power of contradiction, the doctrine of an univerſal Providence, has excited a warmer intereſt in favour of ſuffering Humanity, and has diſcloſed ſources, unknown before, of moral and intellectual enjoyment. Unfettered by Syſtem, unawed by Authority, he looks immediately into Nature; he obſerves, he thinks, he reaſons for himſelf, and teaches his Reader thus to obſerve, think, and reaſon.

Like every one who has the courage to attack eſtabliſhed error, and to advance new truths, he has been treated, in his own Country, with affected contempt, has been traduced, has been ridiculed. But time, and farther obſervation and experience alone muſt determine,

mine, whether his, or the received Theory of the Tides, that great engine of Nature, be moſt conformable to the real order of the Globe. He no where diſcovers the ſpirit of an adverſary; he contends not for triumph, but for what he deems to be truth; he honours the virtues of thoſe whoſe opinions he finds himſelf conſtrained to oppoſe; for, with him, Goodneſs is ever in higher eſtimation than Science, and Probity than Talents.

He diſcovers more than one trait of reſemblance to his illuſtrious friend, and fellow-labourer in the field of Nature, *John-James Rouſſeau*; the ſame over acute ſenſibility, the ſame occaſional fits of queruloufneſs, the ſame irritability under the flea-bitings of anonymous criticiſm. *Saint-Pierre* ought to have known that his immortal Work was

to be transmitted for the instruction and delight of ages and nations unborn, long, long after the diurnal and menstrual effusions of anonymous journalists had sunk into everlasting oblivion. He ought to have held on the majestic "tenor of his way," equally regardless of their notice and of their neglect, of their censure and of their approbation, of their flattery and of their frown. What matters it to such a man, whether *Etudes de la Nature* be abused or extolled in the *Journal de Paris*? He has unwittingly conferred on his critics an immortality not their own. One *Homer* has formed ten thousand critics, but all the critics that ever existed could not constitute the ten thousandth part of one *Homer*.

It is a singular phenomenon in the History of the present Period, that the Author of *Studies of Nature*, the professed

professed Panegyrist and Pensioner of the ill-fated *Louis* XVI. should be caressed, should be respected, should be promoted to honour, by that very National Convention which degraded, dethroned, decapitated his patron and benefactor. Can a stronger testimony be borne to wisdom and virtue?

Unfortunately for the Translator, the times admitted not of opening a correspondence with the Author, by which he might have availed himself, for obtaining a solution of many difficulties and doubts that arose in the execution of his task, and by which he might have rendered the Translation less unworthy of the Original. The same cause forbade the gratification of a wish which he fondly entertained, that of presenting the English Reader with an engraved portrait of the form of the Man, with whose

whose mind he was endeavouring to make him acquainted. I have not even been able to discover whether a portrait of him actually exists; at any rate, the present state of things rendered impracticable every attempt to procure a copy of it.

After what the Author has himself said, in his advertisements, of the reception which his Book has met with on the Continent, it would be impertinent to trouble the Reader with any History of the Publication. The incense which has been offered to him, and the abuse he has sustained; the rapid sale of his own successive Editions, and the multiplied piratical depredations committed upon him, constitute together an irresistible proof of the merit of the Work. How it is to be relished by the English Public, must be submitted to the deter-

determination of time. The Tranſlator dares not to flatter himſelf with the belief, that the enthuſiaſm of the Reader of this Verſion is to keep pace with his own admiration of the Original; but if he may judge of the general mind from the ſentiments occaſionally expreſſed, by perſons of various deſcriptions, and of both ſexes, to whom a conſiderable part of the Book was ſubmitted, in the progreſs of Tranſlation, he is not deſtitute of hope that it may excite ſomething of that intereſt, and produce a part of that effect, in England, which have attended the ſeveral French Editions.

Saint-Pierre, Frenchman as he ardently profeſſes himſelf to be, omits no occaſion to do juſtice to the Engliſh Character. If he combats an aſtronomical Theory of our deſervedly boaſted *Newton*, he beſtows unreſerved praiſe on

on his real diſcoveries, and on what he prizes ſtill more highly, the great qualities of his heart and mind. If he ſeems to have acquired any advantage over the Prince of Philoſophers, he himſelf aſcribes it chiefly to the weapons furniſhed him by Engliſh Obſervers and Navigators, particularly *Dampier*, *Ellis*, *Anſon*, *Carteret*, *Byron*, *Cooke*, *Clerke*, *Wales*, and the great *Newton* himſelf. Thus, in a noble and liberal mind, candor and acuteneſs of inveſtigation walk hand in hand.

I have endeavoured to profit by all the foreign Editions which I was able to procure. The few notes which I have preſumed to introduce, are marked with my initials, to diſtinguiſh them from thoſe of the Author. With all my attention to the preſs, a few ſlips, I am ſorry to obſerve, have crept in. In the hurry

hurry of tranſcription, the proper name *Samos*, in Vol. I. page 104, has been inadvertently ſubſtituted in place of *Lemnos*, and in page 178, line 7, from the bottom, the words *do not* ought to have been omitted; and toward the concluſion of *Paul and Virginia*, in a reference to the *iſle of France*, or *Mauritius*, which is an African Iſland, inſtead of the general term *Colonies*, the phraſe *Weſt-India Iſlands* is improperly uſed. The names of ſeveral Tropical vegetables, fiſhes, quadrupeds, and birds, in a great meaſure unknown to Europe, are exactly tranſcribed, or tranſlated, according as the caſe required. I have, in a few inſtances, adopted the Author's orthography of certain names of Places, in preference to our own, becauſe it ſeemed more agreeable to the eye, and, at the ſame time, conveyed a more diſtinct ſound to the Ear. If I have failed

failed in doing juſtice to my great Original, it is to be imputed neither to want of zeal nor to wilful inattention: To what then?---capacity inadequate to an undertaking ſo arduous.

H. H.

Bethnal-Green-Road,
4th Nov. 1795.

CONTENTS

CONTENTS

OF VOL. I.

ADVERTISEMENT

RESPECTING

THE PRESENT EDITION,

AND

THE WORK IN GENERAL.

THE first Edition of this Work, publiſhed in December 1784, was nearly out of print in December 1785. It run it's natural courſe, in about the ſpace of a year, without my having employed any one trick of the trade to puff it off, to accelerate the ſale, or to ſend it abroad for a market: I may therefore flatter myſelf, that it has been graciouſly received in my own Country. It appears likewiſe to have been reliſhed by ſtrangers; for, within theſe ſix months, pirated impreſſions of it have appeared at Geneva and Avignon; and this literary plunder might have injured me, had not M. *Laurent de Villedeuil*, then Director-general of the Preſs, now Intendant of Rouen, and univerſally known for the ſtricteſt honour and probity of character, given, on my ſimple requeſt,

the moſt peremptory orders to prohibit the admiſſion of theſe pirated copies into the Kingdom *. Farther, the publication of this Work afforded an opportunity to Meſſrs. the Count *de Vergennes*, the Baron *de Breteuil*, and *de Calonne*, my ancient and illuſtrious ſubſcribers, at the ſolicitation of my reſpectable friends, Meſſrs. *Hennin* and *Meſnard*, of Conichard, of procuring for me, or for my family, ſome annual marks of the KING's benevolence.

This ſucceſs ought, undoubtedly, to have ſatisfied me; but I am no leſs ſo with the honourable profeſſions of friendſhip which have been tendered to me, by perſons of all conditions, and of both ſexes, moſt of whom are unknown to me. Some diſtinguiſhed me by their viſits; and others, by epiſtolary addreſſes the moſt affecting, conveying their thanks for my Book, as if, in giving it to the Public, I had conferred a perſonal obligation on themſelves. Several of them have invited me to

* I have been informed, that, within theſe four months, they had found their way to Lyons, to Marſeilles, to Toulon, and, undoubtedly, to other places; ſo that the bookſellers of thoſe cities have not been provided, for four months paſt, with copies of my Edition, by which the ſale of it has been conſiderably checked. An infringement ſo unjuſtifiable of the rights of property of Authors, and of their privileges, and ſo contrary to Royal authority, ought certainly to be diſcouraged. And I look for redreſs againſt theſe acts of injuſtice from the equity of the Magiſtrate who preſides over the Preſs.

take

take up my reſidence at their country-ſeats, and to enjoy thoſe rural ſcenes, of which, as they are pleaſed to ſay, I am ſo paſſionately fond. Yes, undoubtedly, I ſhould dearly love a country reſidence, but a reſidence which I could call my own, and not another man's.

I made the beſt acknowledgment in my power, to tenders of ſervice ſo flattering; but could avail myſelf only of the good-will which they breathed. Benevolence is the flower of friendſhip; and it's perfume always laſts while you let it remain on the ſtem, without gathering it. The afflicted father of a family has informed me, that my Studies were to him the ſweeteſt ſource of conſolation in his diſtreſs. An Atheiſt, of a city far diſtant from Paris, has paid me frequent viſits, ſtruck even to admiration, as he ſaid, at the harmonies of plants which I had indicated, and of which he had recognized the exiſtence in Nature.

Perſonages of real importance, and others who wiſhed to paſs for ſuch, have endeavoured to allure me to them, by holding out gilded proſpects of melioration of fortune: but as long as I can attain the rare felicity of being beloved, and, what is of ſtill greater importance to me, the power of being uſeful, ſo long ſhall I fly, if I can, the calamity ſo common, and ſo humiliating, of being under pro-

tection. I ſpeak not thus out of vanity, but to expreſs my gratitude, in the beſt manner I am able, as my cuſtom is, for the ſlighteſt marks of kindneſs ſhewn me, provided I can believe them ſincere.

I have reaſon to believe, then, from theſe concurring ſuffrages of perſons of character, that GOD has been pleaſed to bleſs my labours, though chargeable with manifold imperfections. I conſider it to be my duty to render the Work as worthy of the public eſteem as I can: accordingly, I have corrected, in this New Edition, the errors of the Preſs, the blemiſhes in point of ſtyle, and the obſcurities in point of meaning, which I remarked in the firſt; and this partly by myſelf, partly with the aſſiſtance of certain well-informed friends, without, however, retrenching any thing material, and this too in conformity to their wiſhes. I have only taken the liberty, for the ſake of perſpicuity, to make ſome tranſpoſitions in the notes. In the ſame view I have added ſome others, and among theſe, in the explication of the plates, a geometrical figure, which renders perceptible to the eye the miſtake of our Aſtronomers, reſpecting the flatneſs of the Earth at the Poles, and affords new proofs of the alternate and half-yearly courſe of the Atlantic Ocean, by the melting of the polar ices. Finally, I have employed a ſet of new and beautiful

beautiful types of the foundery of M. *Didot* the younger, that the reputation of this Artiſt might contribute it's ſhare toward the celebrity of the Work.

I ſhould have deemed myſelf happy to derive information reſpecting the ſubject of my Book, from the illumination, and candid deciſions, of literary Journaliſts. Gentlemen of this deſcription have been left, for this purpoſe, entirely to their own diſcretion; for I have neither by myſelf, or others, ſolicited approbation, or deprecated criticiſm; but they have, for the moſt part, confined themſelves to obſervations of no eſſential importance. That Journal which contains, of all others, the greateſt variety of articles, and which, from the great talents of the perſons engaged in conducting it, ſeemed moſt likely to inſtruct me, finds fault with me for having affirmed, That animals were not expoſed, by Nature, to periſh, like Man, by famine; and it has objected to me, the caſe of partridges and hares, in the vicinity of Paris, which ſometimes die of hunger in the Winter. But as, on the one hand, theſe animals are multiplied without end, all around Paris; and as, on the other, we mow down every thing, even to a blade of graſs, it neceſſarily muſt, ſometimes, happen, that they periſh with hunger, eſpecially if the Winter is ſomewhat long. The famine, there-

fore, which they endure in our fields, is occaſioned by the inconſiderateneſs of Man, not the improvidence of Nature. Partridges and hares do not die of hunger in the foreſts of the North, where the Winter laſts for ſix months together: they know well how to find under the ſnow, the herbage and fir apples of the preceding year, which Nature has buried there to ſerve them as a ſeaſonable ſupply.

The other objections raiſed, againſt ſome of my poſitions, by the Gentlemen Journaliſts, are neither more important, nor much better founded. Moſt of them treat as a paradox the cauſe of the flux and reflux of the Sea, which I aſcribe to the alternate fuſion of the polar ices; which ices, in the Winter proper to each Hemiſphere, are from five to ſix thouſand leagues in circumference, but in their Summer, are not above two or three thouſand. But as no one of them has produced a ſingle argument, either againſt the principles of my theory, or againſt the facts by which I ſupport them, or againſt the conſequences which I thence deduce, I have nothing to ſay in reply, unleſs that, as to the point in queſtion, they have pronounced a deciſion, without having examined into the merits of the cauſe; an expeditious, indeed, but not perfectly equitable, method of adminiſtering juſtice.

The

The Gentleman who has the greateſt number of ſupporters, and who, undoubtedly well merits that ſupport, for the taſte which he diſplays, in his daily criticiſms of literary productions, has objected to me, tranſiently, that I deſtroy the action of the Moon, which is in ſuch perfect harmony with the phenomena of the tides. It is evident, that he has not taken the trouble to inform himſelf, either reſpecting my new Theory, or the old one. I deſtroy nothing of the Moon's action on the Seas; but, inſtead of making her to act on the fluid Seas of the Equator, by an aſtronomical attraction, which produces not the ſlighteſt effect on the mediterraneans and lakes of the torrid Zone itſelf, I make her to act on the frozen Seas of the Poles, by the reflected heat of the Sun, acknowledged by the Ancients *, demonſtrated by the Moderns,

* "The Moon diſſolves ice by the humidity of her influ-"ence." Pliny's Natural Hiſtory, book ii. chap. 101. When the Moon ſhines, in the nights of Winter, in all her luſtre, it freezes, no doubt, very ſharply: becauſe that, in this caſe, the North wind, which occaſions this ſerenity of the air, checks the warming influence of the Moon; but if the wind is ſtilled ever ſo little, you ſee the Heavens covered with vapours which exhale from the Earth, and you feel the Atmoſphere ſoftened. I aſcribe, as Pliny does, to the light of that Star, a particular action on the frozen waters of the Earth and on the Air; for I have frequently ſeen, in the fine nights of the torrid Zone, all the clouds of the Atmoſphere diſperſe, in an aſcending direc-

Moderns, and which every man may experimentally demonstrate to himself, with a glass of water.

Besides, it is far from being true, that the phases of the Moon are, all over the Earth, in harmony with the movements of the Seas. The flux and reflux of the Sea, on our coasts, follow rather the mean, than the real motion of the Moon. In other places, they are subject to different laws, which obliged *Newton* himself to admit, "That there "must of necessity be, in the periodical return of "the Tides, some other mixed cause, hitherto

tion; which suggested the proverb in common use among sailors, *the Moon is eating up the clouds.*

Besides, our Naturalists contradict themselves, in supposing that the Moon moves the Ocean, while they refuse it all manner of influence, not only on the ices, but on plants, because, say they, it's heat does not make the fluid to ascend in the thermometer. I do not know, in fact, whether it does, or does not act, on spirit of wine: but what conclusion can be deduced from this? The igneous particles contained in pepper, cloves, pimento, caustics, &c. which have such a powerful action on the fluids of the human body, would they communicate to spirit of wine the slightest tendency to ascend, by making an infusion of them with that fluid? Fire, as well as the other Elements, undergoes combinations, which multiply it's action, in such and such an alliance, and reduce it to mere nothing in a different situation. We must not pretend, then, with our instruments of Philosophy, to arrive at the capability of determining the effects of natural causes.

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"undiscovered *." The explanation of these phenomena, which bid defiance to the Astronomic System, are in perfect harmony with my natural Theory, which ascribes to the alternate heat of the Sun, whether direct, or reflected by the Moon, on the ices of the two Poles, the cause, the variety, and the constant return, of the Tides; and, especially, of the general and alternate Currents of the Ocean, which are the immediate moving principles of these Tides. Our Astronomers, notwithstanding, have never attempted to give any account of the half-yearly versatility of these general Currents, so well known in the Indian Ocean; nay, they appear to have been hitherto ignorant, that there existed similar Currents in the Atlantic. This is, however, a fact which can no longer be called in question, after the new proofs which I exhibit at the end of the Fourth Volume of this Work.

I have advanced, then, no paradox, respecting causes so evident; but I have opposed to an astronomical system, totally destitute of physical proof, facts incontrovertible, deduced from all the kingdoms of Nature; facts which have a multitude of correspondencies in the flux and reflux of all rivers and lakes which are fed from icy mountains, and

* *Newton*'s Philosophy, chap. xxv.

which

which I could eaſily multiply, and exhibit in new lights, relatively to the Ocean itſelf, if there were occaſion, and if health permitted.

One Journal which, from the title it aſſumes, would ſeem deſtined to inform all Europe, as well as that which, from it's title, would be thought reſerved for the uſe of the learned, have thought proper to maintain a profound ſilence, not only with regard to natural truths ſo new, and ſo important, but even with reſpect to my whole Work. Others have oppoſed to me, as a complete refutation, the authority of *Newton*, who did not think as I do. I reſpect *Newton* for his genius and for his virtues, but I reſpect truth ſtill much more. The authority of great names ſerves but too frequently as a ſtrong hold to error. It is thus that, on the faith of a *Maupertuis*, and of a *Condamine*, Europe has till now believed, that the Earth was flattened at the Poles. I demonſtrate, after their own operations, in the *explication of the plates*, at the end of the firſt volume, that it is lengthened out at the Poles. What anſwer is it poſſible to give to the geometrical demonſtration which I produce of it? For my own part, I am perfectly convinced, that *Newton* himſelf would, at this day, renounce ſuch an erroneous opinion, though he was the firſt who broached it, if the truth muſt be told.

The

The Reader will be, undoubtedly, very much ſurprized, to find men, of ſuch celebrity, falling into contradiction ſo unaccountable; a contradiction adopted on their aſſertion, and publicly taught in all the Schools of Europe; and that no one ſhould have appeared to refute the error, and armed with ſufficient courage to maintain the truth. I was ſo aſtoniſhed at it myſelf, that I remained for ſome time under the belief that I, and not they, had, on this article, loſt every ſentiment of evidence. I dared not even to diſcloſe my thoughts to any perſon reſpecting this, any more than the other objects of theſe Studies; for ſcarcely have I met, in my progreſs through life, any but men ſold to the ſyſtems which have led to fortune, or to thoſe which promiſe to do ſo. Accordingly, the more I was in the right, being alone and not backed by puffers, the more diſadvantageous was the ground on which I had to combat them. Beſides, how is it poſſible to reaſon with perſons, who ſhroud themſelves in the clouds of equations, of metaphyſical diſtinctions, if you preſs them ever ſo little by the ſentiment of truth? When ſuch refuges fail, they overwhelm you with authorities innumerable, which have ſubjugated themſelves, without a proceſs of reaſoning; and by which they mean to ſubdue, in their turn, the man eſpecially who has not joined himſelf to any party.

What

What then could I have done in this crowd of men, vain and intolerant, to each of whom an European education says, from the days of infancy, *Be the firſt*; and among ſo many Doctors titled, and without titles, who have appropriated to themſelves the right to freedom of ſpeech, unleſs it were to ſhut myſelf up, as I frequently do, in my freedom of ſilence? * If I ſpeak there, it is of few things, or of things of ſlight importance.

In the ſolitary and unconſtrained paths, however, through which I followed truth, I recovered

* In ſuch ſociety, a man is not permitted to remain long in poſſeſſion of his right of ſilence; for they who ſpeak chuſe to have no hearers but ſuch as are diſpoſed to applaud.

I have remarked, that the degree of attention which the world pays to it's orators, is always in proportion to the degree of power, or of malignity, which it ſuppoſes them to poſſeſs. Truth, reaſon, wit itſelf, in that caſe, go for nothing. If you would make the world liſten to you, you muſt make yourſelf feared. Thoſe, accordingly, who ſhine in it, frequently employ turns of phraſeology which give you to underſtand, that they are powerful friends, or dangerous adverſaries. Every plain, modeſt, candid, good man, is, therefore, reduced to ſilence before them: it is in his power, however, to get deliverance from this ſtate of conſtraint, if he can bring himſelf to flatter his tyrants. But this would, in me, produce the diametrically oppoſite effect, for I can flatter only where I love.

Fly from the world, then, ye who will neither flatter nor malign; for you will loſe in it, at once, the good which you expected from it, and that which is the gift of your own conſcience.

my

my confidence, with the new rays which her light diffused; recollecting that the most celebrated scholars had been, in all ages, as much blinded by their own errors, as the illiterate are by those of other people. Besides, in order to detect the inconsequent reasoning of modern Astronomers, it was necessary to employ only some principles of Geometry, which are level to my capacity, and to that of all mankind. Accordingly, having full conviction, from a multitude of observations, meteorological, nautical, vegetable, and animal, that the waters of the polar ices had a natural proclivity southward as far as the Equator, and vexed at being contradicted by the operations, more celebrated than they deserve to be, of Geometricians, I had the courage to examine their results, and became convinced, that they ought to be the same with my own. In a former Edition, I presented both the one and the other to the Public: theirs remain without a defence, and mine stand unimpeached, though without declared partisans. In a second Edition, I have demonstrated their error on the principles of Geometry; I now expect a decision from the conscience of every candid Reader.

By the prejudices of education our Astronomers have been thus misled; those prejudices which, from infancy, attach us, without reflecting, to fashionable errors, that lead to fortune, and which

which engage us to reject ſolitary truths that lead to none. They have been ſeduced by the reputation of *Newton*, which has been objected to myſelf, and *Newton* had himſelf been ſeduced, as uſually happens, by his own ſyſtem. That ſublime Geometrician proceeded on the ſuppoſition, that the centrifugal force, which he applied to the motion of the Stars, had flattened the Poles of the Earth, by acting upon it's Equator. *Norwood*, a Mathematician of England, having found, by meaſuring the Meridian from London to York, the terreſtrial degree to be eight fathom greater than that which *Caſſini* had meaſured in France, "*Newton*," ſays *Voltaire*, aſcribed this ſmall exceſs of eight fathom, in a degree, to the figure of the Earth, which he believed to be that of a ſpheroïd flattened toward the Poles; and he concluded, that *Norwood*, having taken his Meridian in a region to the northward of our's, muſt have found his degree to be greater than that of *Caſſini*, as he ſuppoſed the curve of the Earth meaſured by *Norwood* to be the longer of the two." * It is evident that, the degree being greater, and the curve longer, toward the North, *Newton* ought to have concluded that the Earth was lengthened out at the Poles; but he deduced the directly oppoſite concluſion, namely, that it

* *Newton*'s Philoſophy, chap. xviii.

was

was flattened there. The truth is, his syſtem of the Heavens occupying all the faculties of his vaſt genius, prevented his detecting on the Earth a geometrical inconſequence: he adopted, therefore, without examination, an experiment which he thought favourable to his ſyſtem, not perceiving that it was diametrically oppoſite to him. Modern Aſtronomers have, in their turn, ſuffered themſelves to be ſeduced by the reputation of *Newton*, and by a weakneſs ſo apt to warp the human mind, that of attempting to explain all the operations of Nature by a ſingle law. *Bouguer* himſelf, one of their co-operators, in his *Treatiſe on Navigation*, book v. chap. v. §. 2. page 435, ſays expreſsly, that, "on this diſcovery of the flattening "of the Poles, the whole of Phyſics, almoſt, de-"pends."

Our Aſtronomers, then, have ſet out on a ramble to the extremities of the Earth, in queſt of phyſical proofs of a celeſtial ſyſtem, happy and luminous; and they were ſo dazzled with it beforehand, that they miſtook, in their turn, the truth itſelf, which, far from the prejudices of Europe, had, in deſerts, juſt ſought refuge under their wings. If the moſt illuſtrious of modern Geometricians, could fall into ſo groſs an error in his peculiar Science; and if Aſtronomers, in other reſpects, abundantly filled with a ſenſe of their

own

own ſagacity, have, under the influence of his name merely, deduced from their own operations a falſe concluſion in ſupport of that error; rejected the preceding experiments of their Schools, reſpecting the ſinking of the barometer in the North, with the other geographical obſervations which contradicted it; eſtabliſhed on it the baſis of all future phyſical knowledge; and have given it afterwards, by the weight of their own reputation, an authority which has not left, to the reſt of the Learned World, ſo much as the liberty of doubting; it behoves us, poor, ignorant, and obſcure men, to take good care of ourſelves, we who ſearch after truth ſingly for the happineſs of knowing it. Let us miſtruſt, then, in our reſearches after it, all human authority, as *Deſcartes* did, who, by doubting only, diſſipated the Philoſophy of the age in which he lived, which had ſo long concealed the laws of Nature from the eyes of all Europe, by means of the prejudice of the name of Ariſtotle, then held ſacred in every Univerſity: and let us aſſume as a maxim, that which led *Newton* himſelf to ſo many real diſcoveries, and after him the Royal Society of London, who have taken it for their motto: NULLIUS IN VERBA.

To return to literary Journals, if they have, as it were in concert, with-held their approbation from the

the natural objects of these Studies, one of them has advanced, as I am told, that I had borrowed my Theory of the Tides by means of the polar ices, from certain Latin Authors. This Theory is at last, it seems, gaining proselytes, since it is exciting envy.

To that imputation this is my answer. Had I known of any Latin Author who ascribed the Tides to the melting of the polar ices, I would certainly have named him, as a piece of justice, which the design of my Work, as well as every principle of conscience, demanded of me. I have not had, like so many Philosophers, the vanity of creating, at my ease, a World after my own fancy: but I have endeavoured, with no small labour, to collect the several pieces of the plan of that in which we live, dispersed among the men of all ages, and of all nations, who have observed it with the greatest care. Accordingly, I have taken my ideas of the allongation of the Earth at the Poles, from *Childrey*, *Kepler*, *Tycho-Brhaé*, *Cassini*.....and above all, from the operations of modern Astronomers; of the extent of the frozen Oceans which cover the Poles, from *Denis*, *Barents*, *Cook*, and all the Navigators of the North and South Seas; of the ancient deviation of the Sun from the Ecliptic, from Egyptian Traditions, Chinese Annals, and even from the Grecian Mythology; of the total fusion

of the polar ices, and of the universal Deluge which it produced, from Moſes and Job; of the heat of the Moon, and it's effects on ice and water, from *Pliny*, and from recent experiments made at Rome and at Paris; of the Currents and Tides which flow alternately from the Poles toward the Equator, from *Chriſtopher Columbus*, *Barents*, *Marten*, *Ellis*, *Linſchotten*, *Abel-Taſman*, *Dampier*, *Pennant*, *Rennefort*, &c. I have quoted all theſe Obſervers in terms of high approbation.

Had I known of any Latin Author, who aſcribed to the melting of the polar ices the cauſe of the Tides, in ſo much as any one part of the Ocean, I would have quoted him in like manner, reſerving to myſelf the glory of the Architect, that of combining, and arranging theſe detached obſervations; of allotting them to their peculiar ſeaſons and latitudes, in order to clear them of the apparent contradictions, which had hitherto prevented the deduction of any fair conſequence from them; and, in a word, to aſſign a cauſe, and evident means, for effects which, during ſo many ages, had been involved in myſtery. I have formed, then, one Whole of all theſe ſcattered truths, and have deduced from them the general harmony of the movements of the Ocean, of which the heat of the Sun is the firſt *cauſe*, the polar ices are the *means*, and the half-yearly and alternate Currents of

of the Seas, with the diurnal Tides on our coasts, are the *effects* *. Accordingly, if some persons before me, have affirmed, that the Tides are produced by the melting of the polar ices, which I am to this hour ignorant that any one ever did, I, at least, am the first who demonstrated it. Other Europeans, prior to *Christopher Columbus*, said that

* It will be a matter of some difficulty for many persons, to conceive how our Tides should possibly, in Summer, re-ascend toward the North Pole, at the very season when the Current which produces them is rushing down from that Pole. They may see a very sensible image of these retrograde effects of running waters, at the bridge of Notre-Dame, at the opening of the arch which is supported by the Quay Pelletier. The Current of the Seine, directed obliquely by a kind of dam, against a pile of that arch, produces there a counter-current, which constantly re-ascends against the course of the river, up to the very bubbling over of the dam. In like manner, the meltings of the northern ices descend, in Summer, from the bays adjacent to the polar Circle, going at the rate of from eight to ten leagues an hour, according to *Ellis*, *Linschotten*, and *Barents*; they flow toward the South, in the middle of the Atlantic Ocean; but coming to meet on their shores, almost in front, Africa and America, where they project on both sides, a violent reflux is produced, to right and left, along the coasts of both Continents, which is forced northward above the Capes Boïador and St. Augustin, which are rendered famous by their Currents. Now, as the sources from which they issue have an intermittent flux of acceleration and retardation, occasioned by the diurnal and nocturnal action of the Sun on the ices of the eastern and western Hemisphere of the Pole, their lateral counter-currents, that is, their Tides, have likewise a similar intermittent flux.

there was another World; but he was the first who landed upon it. If others, in like manner, had affirmed, that the Tides have their origin at the Poles, no one had believed them, because it was an affirmation destitute of proof.

Before it was possible for me to collect and to complete my proofs, and to render them perfectly luminous, it became necessary to dispel those thick clouds of venerable errors, such as Poles flattened, and washed with Seas clear of ice, which our pretended Sciences had spread between truth and us, and which were sufficient to involve all our Physics in an eternal night. Here, then, is the glory at which I aspire, that of assembling some of the harmonies of Nature, in order to form a concert of them, which should elevate Man toward the great AUTHOR of All: or, rather, I have aimed only at the felicity of knowing them myself, and of pointing them out to my fellow-creatures; for I am ready to adopt any other system, which shall present to the human understanding a higher degree of probability, and to the heart of Man a purer consolation.

To GOD alone glory is to be ascribed, and peace is Man's choicest possession, which is never so pure and so profound as in the perception and the feeling of that very Glory which governs the Universe.

Univerſe. My higheſt ambition is the delight of diſcovering ſome new rays of it, and, henceforward, my moſt ardent wiſh is to have the remainder of my days illuminated by it, to the excluſion, as far as I am perſonally concerned, of that vain, fantaſtical, unſatisfying, inconſtant glory, which the world gives and takes away at pleaſure.

I have been thus diffuſe on the right which I claim to the diſcovery of the cauſe of the Currents and Tides, from the melting of the polar ices, becauſe, having oppoſed to moſt of the received opinions on that ſubject, many obſervations which I challenge as my own, if each required a ſpecial manifeſto, to aſcertain my property in it, there would be no end to my advancing ſuch pretenſions. Beſides, if they ſhall acquire ſo much celebrity as to procure me, according to the ſpirit of the age in which we live, perfidious applauſe, underhand perſecution, affected commiſeration, all calculated to blaſt my uncertain, tardy, and hitherto hardly budding fortunes, I ſolemnly declare that, aſſociated with no party, and able to oppoſe no one but myſelf ſingly to every new adverſary, inſtead of cramming the public prints, as the cuſtom is, with recrimination, abuſe, complaint, lamentation, the waſte of time, I ſhall defend myſelf only on my own ground, and ſhall oppoſe to my enemies, whether ſecret or avowed,

Truth; and nothing but Truth. It's mirror ſhall be my Egis; and their image reflected from it, ſhall become to each a Medula's head. Or rather, may it be my lot, far remote from fickle and treacherous Man, under the roof of a ſmall ruſtic cot, which I can call my own, on the border of a wood, elicite the ſtatue of my Minerva from the trunk of her own tree, and place, at laſt, a whole Globe at her feet.

Farther, if the Gentlemen Reviewers have withheld from me their ſuffrages, reſpecting objects of ſo much importance to the progreſs of natural knowlege, and if others have got the ſtart of me, in precluding my claim to thoſe of the Public, I can already boaſt the concurrence of illuſtrious names, among all conditions of men. The Sorbonne, to whom I am perſonally unknown, has done me the honour of adopting the new proofs of the Univerſal Deluge, which I have deduced from the total fuſion of the polar ices: theſe proofs have been laid down as axiomatical, in one of it's theſes, maintained, for the firſt time, by the Abbé *de Vigueras*, in his academical exerciſe of the 6th July, 1785.

After all, ſuppoſing my friends the Reviewers to have expreſſed ſtill more reluctance to give an account of opinions, which contradict thoſe of Academies,

Academies, and ſtrange even to moſt of themſelves; and which muſt have had a ſuſpicious appearance, from their very novelty, they have made me moſt ample compenſation, in applauding me, far beyond my deſert, for moral qualities, infinitely beyond the value of phyſical diſcoveries, and which I ſhould deem myſelf ſingularly happy to attain *.

All that is left me, therefore, is to congratulate myſelf on the general intereſt, with which the Public has received the moral part of this Work. I have, however, left untouched the great objects of political and moral reform; the one, becauſe it was not permitted me to treat them as my conſcience would have directed; and the other, becauſe my plan could not comprehend them. I have reſtricted myſelf merely to abuſes, which it is in the power of Government to rectify: but there are others, as univerſal, which depend entirely on national manners. Such is, among others,

* I ought, undoubtedly, to diſtinguiſh, in the number of my panegyriſts, the two firſt Writers who have given an account of my Work. The one, notwithſtanding the ſmallneſs of his page, and his propenſity to find fault, has announced it in a manner the moſt flattering; and the other, devoted to the defence of morals and religion, has placed me by the ſide of a man, at whoſe feet I would have thought myſelf happy to ſit, had Providence beſtowed on me the bleſſing of being his contemporary.

the celibacy of moſt domeſtic ſervants. Had it been in my power to have enlarged on this topic, I could have demonſtrated, that the arrangements of Society never can contravene the laws of Nature; that it is the intereſt of maſters to have their domeſtics marry, becauſe they pay, let them do their beſt, the expenſe of the ſmuggled libertiniſm of ſervants, much more exceſſive, beyond all queſtion, than that of an honeſt ſettlement, for the ſtrumpet always will ſpend more than the woman of character.

I could have demonſtrated the pernicious influence which the bad morals of unmarried ſervants have on the children of their maſters. I could, likewiſe, have dilated on the harſhneſs of our pretended Fathers of families, who abandon their ſervants, on the firſt attack of ſickneſs, or the approach of old age, or when they become parents; on the obligations under which they lie, to provide for the neceſſities of theſe men, who are their natural friends, the victims of their ill temper, the witneſſes of their weakneſs, and the ſources of their reputation, whether good or bad. I could have inſiſted on the neceſſity of re-eſtabliſhing in, at leaſt, the firſt rights of humanity, the unfortunate wretches deprived of moſt of the privileges of citizens. I could have demonſtrated what an influence their happineſs has on the happineſs of families,

families, and on national felicity, from what I have ſeen in ſome Pruſſian families, where you find, in general, domeſtics zealous, affectionate, reſpectful, and attached to their maſters; for they are born, they marry, and they die in the houſe of the maſter; and you frequently find under the ſame roof a ſucceſſion of fathers and ſons, who have been maſters and ſervants for two or three centuries ſucceſſively.

Once more, if I have been ſomewhat diffuſe on the diſorders and intolerance of Aſſociations, I have reſpected States; I have attacked particular bodies of men, in the view of defending my country, and above all, in ſupporting the corps of HUMANITY. Of this we are all members in particular. But GOD forbid that I ſhould think of giving a moment's pain to any one individual poſſeſſed of ſenſibility: I who have aſſumed the pen, only to ſupport the motto prefixed to my Work; *Miſeris ſuccurrere diſco*; (*the experience of miſery has taught me to ſuccour the miſerable.*)

My dear Reader, whatever, then, may be your ſituation in life, I ſhall cheerfully ſubmit to your deciſion, if you judge me as a man, in a Work whoſe leading object is the happineſs of Mankind. If, on the other hand, I have attained the glory of communicating to you ſome new pleaſures, and

of

of extending your views into the unbounded and mysterious field of Nature, reflect that, after all, these are the perceptions but of a man; that they are a mere nothing compared to that which is; that they are the shadows only of that Eternal Truth, collected by one who is himself a shadow, and that a small ray of that Sun of intelligence which fills the Universe, has been playing in a drop of troubled water.

Multa abscondita sunt majora his: pauca enim vidimus operum ejus.

There are yet hid greater things than these be; for we have seen but a few of his Works. ECCLESIASTICUS xliii. 32.

EXPLA-

EXPLANATION of the PLATES.

FRONTISPIECE.

PLATE FIRST.

THE Frontiſpiece repreſents a ſolitude in the mountains of the Iſland of Samos. An attempt has been made, notwithſtanding the ſmallneſs of the field, to introduce, and to diſplay, ſome elementary harmonies, peculiar to iſlands and to lofty mountains. Clouds of ſand, formed by the winds on the ſhores of the Iſland, and of water, pumped up by the Sun from the boſom of the Sea, are wafted toward the ſummits of the mountains, which arreſt them by their foſſil and hydraulic attractions.

In the fore-ground of the landſcape are preſented ſome of the trees which thrive in cold and humid Latitudes, among others, the fir-tree and the birch. Theſe two ſpecies of tree, which, in ſuch ſituations, are almoſt always found in company, exhibit different contraſts in their colours, their forms, their port, and in the animals which they nouriſh. The fir raiſes into the air his tall pyramid, clothed with leaves ſtiff, filiform, and of a dark verdure: and the birch oppoſes to theſe a pyramidical form inverted, with leaves moveable, roundiſh, and of a light-green colour.

The

The ſquirrels are playing along the ſtem, and among the boughs of the fir; and the female of the heath-cock makes her neſt in the moſs which covers the roots. The beavers, on the contrary, have built their habitation at the foot of the birch; and a bird of that ſpecies which eats the buds, is fluttering round the branches. The fir accommodates it's quadruped in it's boughs, and the birch finds lodging for it's gueſt upon it's roots. The habits of their reſpective birds are equally contraſted. Among all theſe animals, however, the moſt perfect harmony ſubſiſts. The dog is looking quietly at their different employments, and expreſſes, by the liſtleſſneſs of his attitude, the profound peace which reigns among the inhabitants of this deſert.

At the entrance of a grotto formed in the ſide of the mountain, is repreſented a man buſied in carving a ſtatue of Minerva in the trunk of a tree. The figure of this Goddeſs, the ſymbol of Divine Wiſdom, and the ſubſtance out of which it is formed, here characterize the Supreme Intelligence manifeſted in the harmony of vegetables. This Philoſopher is Philocles. His hiſtory is to be found in TELEMACHUS, Books XIII. and XIV.

ATLANTIC

ATLANTIC HEMISPHERE.

PLATE SECOND.

Volume I. Page 188.

THIS Plate repreſents the Atlantic Hemiſphere, with it's Sources, it's Ices, it's Channel, it's Currents, and it's Tides, in the months of January and February.

Though I am under the neceſſity of here repeating ſeveral obſervations which have a place in the text, to theſe I am going to ſubjoin ſome others, worthy, I am bold to ſay, of the Reader's moſt ſerious attention.

Obſerve, in the firſt place, that the Globe of the Earth is not repreſented, here, after the manner of thoſe Geographers, who, in their maps of the World, exhibit it as a cavity, in order to give the retreating parts the appearance of being on a great ſcale. Their projection conveys a falſe idea of the Earth, by ſhewing the retiring parts of it's circumference, as the wideſt; and, on the contrary, the prominent parts of the middle, as the narroweſt. They preſent, not a convex Globe, but a concave. This figure repreſents it, ſuch as it would appear to an eye placed in the Heavens, when the Atlantic Ocean is turned to it, and in our Winter.

You may diſtinguiſh in it the ſources of the Atlantic Ocean, which iſſue, in Summer, from the North Pole; it's

it's channel formed by the projecting and retreating parts of the two Continents; and it's diſcharge comprehended between Cape Horn, and the Cape of Good Hope, by which this Ocean empties itſelf, in Summer, into the Indian Ocean.

The oppoſite ſide of this Hemiſphere, though ſtill, in a great meaſure, unknown to us, would preſent, as well as the Northern, a fluviatic channel with all the ſame acceſſories; ſources, ice, currents, and tides, formed, not by Continents, but by the projections of iſlands, and of it's ſteep beds, which direct, during our Winter, the courſe of the Southern polar-effuſions into the Indian Ocean. However intereſting theſe new projections of the Globe may be, it was impoſſible for me to make the expenditure neceſſary to procure engravings of them. It would have been extremely deſirable to have exhibited a repreſentation of both Hemiſpheres, each in it's Summer and in it's Winter, in order to ſee their different Currents at each ſeaſon, and to have preſented a bird's-eye view of the Poles themſelves, as well in Winter as in Summer, in order to convey an idea of the extent of the cupolas of ice which cover them, and the currents which iſſue from them, at the different ſeaſons of the year. Theſe different ſections would have required at leaſt eight plates on a ſcale greater than this, perceptibly to unfold the harmonies of this ſingle branch of my Studies of Nature. Beſides, this increaſe of charts would have led to more particular and more copious details, reſpecting the diſtributions of the Globe, which I did not mean to treat in this Work, except as the ſubject occaſionally preſented.

The

The ſimple aſpect of the Atlantic Hemiſphere, in the months of January and February, will be ſufficient to render intelligible what we have ſaid reſpecting the polar ices, and their periodical effuſions. We ſhall treat, in their order, of the ſources of the Atlantic, of it's ices, of it's channel, of it's currents, of it's tides, and even of it's diſcharge.

The Sources of the Atlantic Ocean, are, in Summer, at the North Pole. They are ſituated in the Baltic Sea, the bays of Baffin and Hudſon, at Waigats Strait, &c. It may be remarked on a Globe in relief, that theſe ſources, which conſtitute the origin of the Atlantic Canal, turn round the Pole in a winding courſe, nearly ſimilar to the circuitous current of a river round the mountain from which it deſcends; ſo that they collect, in this part, all the diſcharges of the rivers which empty themſelves to the North, and carry their waters along into the Atlantic Ocean. From this ariſes a preſumption, that there is, in proportion, much leſs polar effuſion in the part of the South Seas which is oppoſite to it. We ſhall farther ſee, that Nature has ſubjected to the Atlantic channel the extremities of the two general currents of the Poles, which there terminate, after having made the circuit of the Globe; and it is by way of oppoſition to the ſources from which theſe currents iſſue, that I give to the extremities of their courſes the name of mouth. But let us at preſent confine ourſelves to the ſubject of their ſources.

We conceive that the waters of theſe ſources muſt flow toward the Line, whither they are carried to replace thoſe which the Sun is there every day evaporating; but they have,

have, beſides, an elevation which facilitates their courſe. Not only are the ices from which they proceed very conſiderably elevated over the Hemiſphere, but the Poles have themſelves a great elevation of ſoil. I ground this aſſertion, in the firſt place, on the obſervations of *Tyeho-Brhaë* and *Kepler*, who ſaw the ſhadow of the Earth oval at the Poles, in central eclipſes of the Moon; and on the authority of *Caſſini*, who aſſigns fifty leagues more to the axis of the Earth, than to its diameter in any other direction. In the ſecond place, I have on my ſide authentic experiments, collected by the Academy of Sciences, but which have no longer been referred to ſince the opinion became prevalent, that the Earth was flattened at the Poles.

For example, it is well known, that in proportion as you aſcend on a mountain, the mercury on the barometer ſubſides: now, the mercury ſinks in the barometer, in proportion as you advance northward. It falls about one line, in our Climates, when you aſcend to an elevation of eleven fathom. According to the Hiſtory of the Academy of Sciences, for 1712, page 4, the weight of one line of mercury, at Paris, is equivalent to an elevation of ten fathoms and five feet, whereas, in Sweden, you have to aſcend only ten fathom, one foot and ſix inches, to make the mercury ſink one line. The Atmoſphere of Sweden, therefore, is not ſo high as that of Paris, and conſequently the ground of Sweden is higher.

To theſe obſervations may be farther ſubjoined, thoſe made by the Navigators of the North, who have always ſeen the elevation of the Sun above the Horizon greater, the nearer they approached to the Poles. It is impoſſible to

to aſcribe theſe optical effects to the ſimple laws of the refraction of the Atmoſphere. According to *Bouguer*, a well-known Academician, in his *Treatiſe on Navigation*, book iv. chap. 3. ſection 3. "Refraction elevates the ſtars "in appearance; and we are aſſured, by an infinite num-"ber of certain obſervations, that when they appear to us "in the Horizon, they are, in reality, 33 or 34 minutes "under it.....In regions where the air is more denſe, the "refractions muſt be ſomewhat ſtronger, and they are, "likewiſe, every thing elſe being equal, ſomewhat greater "in Winter than in Summer. In the practice of naviga-"tion that difference may be entirely neglected, and per-"petual recurrence may be had to the ſmall table placed "on the margin."

You ſee, in fact, at this part of his work, a ſmall table, in which he lays down the greateſt refraction of the Sun in the Horizon, at 34 minutes, for all the climates of the Globe. But how came it to paſs that *Barents* ſhould have ſeen the Sun above the Horizon of Nova Zembla, on the 24th of January, in the ſign of Aquarius, at five degrees, twenty-five minutes, whereas he ought to have been there, in ſixteen degrees, twenty-ſeven minutes, in order to be perceived in the ſeventy-ſixth degree of northern Latitude, where *Barents* then was? The refraction of the Sun, then, above the Horizon, was nearly two degrees and a half, that is, four times as great, nay, more than *Bouguer* ſuppoſes it to be, as he aſſigns only thirty-four minutes, or nearly, for every climate in general.

Barents, in truth, was very much aſtoniſhed to ſee the Sun fifteen days ſooner than he expected; and he could not be perſuaded that it actually was only the 24th of January,

but, by obſerving that very night the conjunction of the Moon and Jupiter, announced for the Latitude of Venice at one hour after midnight, in the ephemeris of *Joſeph Scala*, and which took place that very night, at Nova Zembla, at ſix of the clock of the morning, in the ſign of Taurus; which gave him, at once, the longitude of his hut in Nova Zembla, and the certainty that it muſt be the 24th of January.

A refraction of two degrees and a half is undoubtedly very conſiderable. We may, in my opinion, aſcribe one half of it to the apparent elevation of the Sun in the very refractive Atmoſphere of Nova Zembla, and the other half, to the real elevation of the Obſerver above the Horizon of the Pole. *Barents*, accordingly, obſerved, from Nova Zembla, the Sun in the Equator, juſt as a man ſees him earlier from the ſummit of a mountain, than at it's baſis. It is, beſides, a principle which admits of no exception, of the harmonic laws of the Univerſe, that Nature propoſes to herſelf no one end, without conſtraining all the elements to concur, at once, to the production of it. Of this we have adduced manifold proofs in the courſe of this Work. Nature, accordingly, having determined to indemnify the Poles for the abſence of the Sun, makes the Moon paſs toward the Pole, which the Sun abandons: She cryſtallizes, and reduces into brilliant ſnows, the waters which cover it; ſhe renders it's Atmoſphere more refractive, that the preſence of the Sun may be detained longer in it, and reſtored ſooner to it: and hence, alſo, there is reaſon to conclude, that ſhe has drawn out the Poles of the Earth themſelves, in order to beſtow on them a longer participation of the influence of the Orb of Day.

Certain

Certain celebrated Academicians have, it is true, laid it down as a fundamental principle, that the Earth was flattened at the Poles. Hear what the Academician, whom I last quoted, says on this subject. He had been employed, with some others, to measure a degree of the Meridian, near the Equator, which they found to contain 56,748 fathoms: "But," continues he, "what is well worthy of "attention, the terrestrial degrees have not been found of "the same length, in other regions, where similar operations "have been performed, and the difference is too great to "be ascribed to the unavoidable errors in observation. The "degree upon the polar Circle is found to be 57,422 fa-"thoms. Accordingly, it follows, beyond contradiction, "that the Earth is not perfectly round, and that it must be "higher toward the Equator, than toward the Poles, con-"formably to what other experiments indicate, which it is "not necessary here to detail. The curving of the Earth "is more sudden toward the Equator in the direction of "North and South, as the degrees are smaller there: and "the Earth, on the contrary, is flatter toward the Poles, "because there the degrees are greater." *Bouguer's Treatise on Navigation*, book ii. chap. 14. art. 29.

I deduce, without hesitation, a conclusion diametrically opposite, from the observations of these Academicians. I conclude that the Earth is lengthened out at the Poles, precisely for this reason, that the degrees of the Meridian are greater there than under the Equator. Here is my demonstration. If you place a degree of the Meridian, at the polar Circle, over a degree of the same Meridian at the Equator, the first degree, which is 57,422 fathoms, would exceed the second, which contains only 56,748 fathoms, by 674 fathoms, conformably to the operations of the

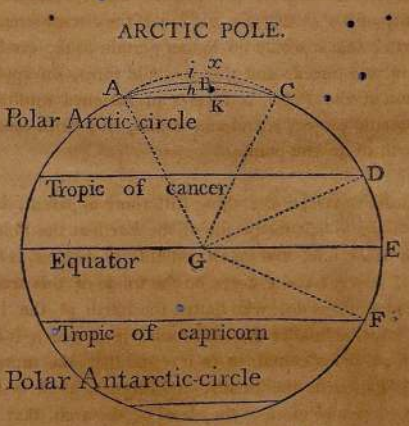
Academicians themſelves. Conſequently, if you were to apply the whole arch of the Meridian, which crowns the polar Circle, and which contains 47 degrees, to an arch of 47 degrees of the ſame Meridian, near the Equator, it would produce a conſiderable protuberance, it's degrees being greater. This polar arch of the Meridian could not extend, in length, over the equinoctial arch of the ſame Meridian, becauſe it contains the ſame number of degrees, and, conſequently, a chord of the ſame extent. If it extended in length, exceeding the ſecond at the rate of 674 fathoms for each degree, it is evident that it would, at the extremity of it's 47 degrees, get out of the circumference of the Earth; that it would no longer pertain to the circle on which it was traced, and that it would form, on applying it to one of the Poles, a ſpecies of flattened muſhroom, which would project round and round, it's brim touching the Earth in no one point.

In order to render the thing ſtill more apparent, let us always ſuppoſe that the profile of the Earth at the Poles, is an arch of a circle, and that it contains 47 degrees, is it not evident, if you trace a curve on the inſide of this arch, as the Academicians do, who flatten the Earth at the Poles, that it muſt be ſmaller than this arch within which it is deſcribed, as being contained in it; and that the more this curve is flattened, the ſmaller it becomes, as it will approach more and more to the chord of the arch, that is to a ſtraight line? Of conſequence, the 47 degrees, or diviſions, of this interior curve, will be, each in particular, as they are when taken together, ſmaller than the 47 degrees of the arch of the containing circle. But, as the degrees of the polar curve are, on the contrary, greater than thoſe of an arch of a circle, it muſt follow, that the whole curve

ſhould

ſhould, likewiſe, be of greater extent than an arch of a circle: now, it cannot be of greater extent, but, on the ſuppoſition of it's being more protuberant, and circumſcribed round this arch; the polar curve, of conſequence, forms a lengthened ellipſis.

I here preſent a figure of the Globe, which I have got engraved, in order to render the miſtake of our Aſtronomers perceptible to every eye.



Let x be the unknown arch of the Meridian comprehended above the arctic polar circle A B C, and let D E F be the arch of the ſame Meridian comprehended between

the Tropics. These two arches are, it is well known, each of 47 degrees. But though they both are subtended by equal angles, A G C and D G F, they are by no means of equal expansion: for, according to our Astronomers, a degree of the Meridian at the polar Circle is greater, by 674 fathoms, than a degree of the same Meridian near the Equator. It follows, therefore, that the unknown polar arch x of 47 degrees, exceeds, in extent, the equinoctial arch D E F, which likewise contains 47 degrees, by 47 times 674 fathoms, which amount to 31,678 fathoms, or twelve leagues and two thirds. The question now to be determined, then, is, whether this unknown polar arch x is contained within the circle, in the curve A b C, or coincides with it, as A B C, or falls without it's circumference, in the direction A f C.

The unknown polar arch x cannot be contained within the Globe, as A b C, as is pretended by our Astronomers, who will have it to be flattened there: for if it were contained, it would be evidently smaller than the spherical arch A B C, which surrounds it, conformably to this axiom, that the thing contained is smaller than what contains it; and the more this curve A b C shall be flattened, the less will be it's extent, as it will approach nearer and nearer to it's chord, that is, the straight line A K C.

On the other hand, this polar arch x cannot coincide with the spherical arch A B C, for it exceeds it by twelve leagues and two thirds. It must belong, therefore, to a curve which falls without the circumference of the Globe, as in the direction A f C. The Globe of the Earth, then, is lengthened at the Poles, as degrees of the Meridian are greater there than at the Equator. Astronomers have consequently

ſequently erred, in concluding, from the magnitude of thoſe degrees, that the Poles were flattened.

I ſhall conclude this demonſtration by an image more trivial indeed, but equally ſenſible. If you divide the two circumferences of an egg, in length and in breadth, each into 360 degrees, would you conclude that this egg was flattened toward it's extremities, becauſe the degrees of it's circumference in length, were greater than the degrees of it's circumference in breadth? What is very ſingular here, is, that Academicians employ the ſame figure nearly, to deduce reſults which flatly contradict each other. They repreſent the Globe of the Earth like a Dutch cheeſe. They take it for granted that the Globe is very elevated over the Equator. "The curve of the Globe," ſays *Bouguer*, in the paſſage above quoted, "is more ſudden toward the "Equator, in the direction of North and South, becauſe "the degrees there are ſmaller: and the Earth, on the "contrary, is flatter toward the Poles, becauſe the degrees "there are greater. One would imagine that the Equator "was diſtinguiſhed only by the greateſt rapidity of motion "performed in the ſpace of twenty-four hours; but it is "marked by a diſtinction ſtill more real, namely, a con-"tinued elevation, which muſt be about ſix marine leagues "and a half quite round the Earth, and every where at an "equal diſtance from both Poles."

We here ſee the ſtrange conſequence deduced, at once, from the flattening of the Earth at the Poles, and from the magnitude of the degrees of the Meridian at that part, which neceſſarily give to the polar circle a projection beyond it's circumference: thoſe which may be deduced from the elevation and more ſudden curve of the Equator, would

be no leſs extraordinary. They are preciſely theſe, if both the one and the other exiſted, there would be no Sea under the Equator; becauſe the courſe of the waters would be in this caſe determined, by the elevation of ſix leagues and a half, and by the more ſudden curvature of that part of the Earth, to withdraw from it, and, by the power of gravity, to flow toward the flattened Poles, nearer to the centre, and there to re-eſtabliſh the ſpherical ſegment which the Academicians have cut off. Accordingly, on this hypotheſis, the Seas would cover the Poles, and would there be of a prodigious depth, whereas we ſhould have nothing but elevated Continents under the Line. But Geography demonſtrates the direct contrary; for it is around the Line that we find the greateſt Seas, and a great quantity of Land barely up to their level; and, on the contrary, elevated countries and lofty beds of water are very frequent, eſpecially toward the North Pole.

Let us now proceed to conſider the polar ices. Though they are here repreſented, preciſely in the fugitive, and leaſt viſible, parts of the Globe, it is eaſy to form a judgment of their very conſiderable extent from the arch of the Meridian which embraces them. At the South Pole, where they are in a ſmaller quantity, having juſt undergone all the ardor of the Summer of that Hemiſphere, they ſtill extend from that Pole to the 70th degree of ſouthern Latitude at the leaſt. They there form, accordingly, a cupola, of an arch of more than 40 degrees, which, at the rate of twenty-five leagues, at leaſt, to a degree, for degrees at this part of the Globe, conformably to the experience of our Academicians, are greater than toward the Equator, give a breadth of more than a thouſand and twenty leagues, or a circumference of more than three thouſand. It is impoſſible to call

call in queſtion theſe dimenſions, for they are taken from the laſt obſervations of Captain *Cook*, who made the tour of this cupola during their Summer.

The ices of the North Pole are much more extenſive, becauſe they are repreſented in their Winter. On both the one and the other, a creſt is expreſſed, of about twenty leagues of elevation, at the Poles. I ſhall not here repeat what I have already ſaid reſpecting the height of theſe ices which are diſcovered floating at the extremities of their cupolas, the elevation of which extends to twelve, nay, to fifteen hundred feet. I was exceedingly deſirous of procuring a repreſentation, around theſe ices, of an irradiation, or kind of *Aurora Borealis*, which might have rendered perceptible their circular extent, and have heightened the picturesque effect of the Globe, by rendering it's Poles radiant; for the South Pole, too, emits nocturnal coruſcations, as *Cook* obſerved; and it appears that theſe glories owe their origin to the ices. But M. *Moreau* the younger, who made the drawings for the plates of this Work, and particularly thoſe under review, with all the intelligence and complaiſance which characterize him, made me ſenſible that the Chart had not a field ſufficiently ample. He has, in other reſpects, rendered theſe polar ices abundantly luminous, to make them diſtinguiſhable, without eclipſing the contours of the iſlands, and of the Continents which they cover.

As to the Atlantic channel, you can eaſily diſtinguiſh in it, the prominent and the retreating parts of the two Continents, in correſpondence with each other. If to this you add the ſinuoſity of it's ſource to the North, which ſeems to purſue a ſerpentine progreſs round our Pole, and it's wide and

and divergent mouth, formed by Cape Horn on the one ſide, and the Cape of Good-Hope on the other, by which it diſcharges itſelf, for ſix months, into the Indian Ocean, as we ſhall preſently ſee, you will perceive in it all the proportions of a fluviatic canal. As to it's declivity, in taking it's departure from the Pole, to empty itſelf even in the Indian Ocean, and South-Sea, by the Cape of Good-Hope, I believe it to be, as I have ſaid in the text, nearly the ſame with that of the courſe of the Amazon.

Let us now conſider the courſe of the polar effuſions, produced by the action of the Sun on the ices of the Poles. There iſſues every year, a general Current from that which is heated by the Sun: and as that great Luminary viſits them alternately, it follows that there muſt be two general oppoſite currents, which communicate to the Seas their movement of circulation, and which are known in India by the name of the eaſterly and weſterly monſoons, or Winter and Summer.

This being laid down, let us examine the effuſions of the South Pole, which is here repreſented in it's Summer. The general Current, which iſſues from it, divides into two branches, the one of which ſets in toward the Atlantic Ocean, and penetrates even to it's northern extremity. When this branch comes to force it's way between the prominent part of Africa and America, finding itſelf ſtraitened on paſſing from a wider to a narrower ſpace, it forms, on the coaſt, two counter-currents, or *vortices*, which proceed in contrary directions. The one of theſe counter-currents runs to the Eaſt, along the coaſts of Guinea, up to the fourth degree South, according to the teſtimony of *Dampier*. The other takes it's departure from Cape St. Auguſtin, proceeds

proceeds to the South-Weſt, along the coaſts of Braſil, up to Maires-Strait incluſively. This effect is the reſult from a law in Hydraulics, the operation of which is generally known: it is this, that as often as a current paſſes from a wider channel into a narrower, it forms on the ſides two counter-currents. The truth of this may be aſcertained, by obſerving the current of a brook, to the paſſage of the water of a river under the arches near the abutment of a bridge, &c. Accordingly, the current bears to the Eaſt, along the coaſts of Guinea, and to the South-Weſt, along the coaſts of Braſil, during the Summer of the South-Pole. But in the middle of the Atlantic Ocean, and beyond the ſtrait of the two Continents, it puſhes on to the North in full force, and advances to the very northern extremities of Europe and of America, bringing us twice every day, along our coaſts, the tides of the South, which are the half-daily effuſions of the two ſides of the South Pole.

The other branch, which iſſues from the South Pole, takes a direction to the weſtward of Cape Horn, ruſhes into the South Sea, produces in the Indian Ocean the Eaſtern monſoon, which takes place in India during our Winter; and having made the tour of the Globe by the Weſt, comes to the Eaſt, to unite itſelf by the Cape of Good-Hope, to the general Current which enters into the Atlantic Ocean. It is poſſible, partly, to trace on the Chart this general Current of the South Pole, with it's two principal branches, it's counter-currents and it's tides, by the arrows which indicate it's direct, oblique, and retrograde movements.

Six months after, that is, in our Summer, commencing toward the end of March, when the Sun, at the Line, begins

begins to forſake the South Pole, and proceeds to warm the North, the effuſions of the South Pole are ſtayed; thoſe of our Pole begin to flow, and the Currents of the Ocean change in all Latitudes. The general Current of the Seas then takes it's departure from our Pole, and divides, like that of the South, into two branches. The firſt of theſe branches derives it's ſources from Waigats, Hudſon's-bay, &c. which then flow, in certain ſtraits, with the rapidity of a ſluice, and produce, to the North, tides which come from the North, from the Eaſt, and from the Weſt, to the great aſtoniſhment of *Linſchotten*, *Elis*, and other Navigators, who had been accuſtomed to ſee them come from the South along the coaſts of Europe.

This Current, formed by the fuſion of moſt of the ices of the North of America, of Europe, and of Aſia, which, at that ſeaſon, preſent a circumference of almoſt ſix thouſand leagues, deſcends through the Atlantic Ocean, paſſes the Line, and finding itſelf confined at the ſame Strait of Guinea and Braſil, it forms on it's ſides, two lateral counter-currents, which ſet in northward, as thoſe formed, ſix months before, by the Current of the South Pole, ſet in ſouthward. Theſe counter-currents produce, on the coaſts of Europe, the tides which always appear to come directly from the South, though they actually come, at that ſeaſon, from the North.

The branch which produces them advances afterward to the South, doubles the Cape of Good-Hope, takes it's courſe eaſtward, forms, in the Indian Ocean the weſterly monſoon; and having encompaſſed the Globe, even to the South-Sea, it proceeds to Cape Horn, re-aſcends along the coaſt of Braſil, and there produces a current which terminates

nates at Cape St. Auguſtin, and is oppoſed to the principal Current, which deſcends from the North.

The other branch of the Current, which, in Summer flows from our Pole, on the oppoſite ſide of our Hemiſphere, iſſues through the paſſage called the North-Strait, ſituated between the moſt eaſterly extremity of Aſia, and the moſt weſterly of America. It deſcends into the South-Sea, where it is re-united to the firſt branch, which then forms, as has been ſaid, the weſterly monſoon of that Sea. Beſides, this branch, which iſſues by the North-Strait, receives much leſs of the icy effuſions than that of the Atlantic Ocean, becauſe the deep bays which are at the ſources of that Ocean, and the contours of theſe ſame ſources, which ſurround the Pole ſpirally, receive, as we have ſeen, the greateſt part of the icy effuſions of the North Pole, and pour them into the Atlantic Ocean.

The Ocean, accordingly, flows, twice a year round the Globe, in oppoſite ſpiral directions, taking it's departure alternately from each Pole, and deſcribes on the Earth, if I may venture to ſay ſo, the ſame courſe which the Sun does in the Heavens.

This Theory, I confidently affirm, is ſo luminous, that, by means of it, a multitude of difficulties may be reſolved, which involve in much obſcurity the journals of our Navigators. *Froger*, for example, ſays, that in Braſil the Currents come in conformity to the direction of the Sun; that is, they run northward, when he is in the northern ſigns of the Zodiac, and ſouthward, when he is in the ſouthern ſigns. It is impoſſible, aſſuredly, to explain this verſatile effect,

effect, from the preſſure, or the attraction of the Sun and of the Moon between the Tropics, as theſe two Luminaries never tranſcend their bounds, and always proceed in one direction, from Eaſt to Weſt: but here is the ſolution, When this Current of Braſil runs to the South in our Winter, it is the general counter-current of the South Pole, which is then ſetting in to the North; and when this Braſilian Current runs to the North in our Summer, it is the extremity of this ſame general Current, which returns by Cape Horn.

The ſame thing does not take place reſpecting the Current in the Gulf of Guinea, which is oppoſite, and which runs always to the Eaſt, though it be in preciſely the ſame ſituation; for, in our Winter, this Current in the Gulf of Guinea, is the extremity of the general Current of the South Pole, which returns by the Cape of Good-Hope, and which, at that ſeaſon, ſets in to the North, along the coaſts of Africa, from the thirtieth degree of South Latitude, as far as to the fourth degree of the ſame Latitude, according to the teſtimony of *Dampier*. But this extremity of the general Current which ſets in to the North, and which then takes it's departure from the fourth degree South, to join the general Current, does not enter into the Gulf of Guinea, becauſe of the prodigious retreat of that Gulf; ſo that, in this part only, the Sea flows always to the Eaſt, conformably to the obſervation of all African Navigators.

I ſhall ſupport the principles of my Theory by well-authenticated facts, ſupplied by Navigators of the higheſt credit. Hear what *Dampier* ſays of the Currents of the Ocean, in his *Treatiſe of Winds*, pages 386 and 387.

" Beſides,

" Beſides, it is certain, that, univerſally, Currents change " their courſes at certain ſeaſons of the year: in the Eaſt-" Indies, they run from Eaſt to Weſt one part of the year, " and from Weſt to Eaſt the other part. In the Eaſt-" Indies, and in Guinea, they change only about the time " of full Moon. But this is to be underſtood of the parts " of the Sea which are at no great diſtance from the coaſt: " not but that there are, likewiſe, very powerful Cur-" rents, in the great Ocean, which are not ſubjected to " theſe laws; but that is not common.

" On the coaſt of Guinea the Current ſets in to the " Eaſt, except at full Moon, or about it. But to the South " of the Line, from Loango up to 25 or 30 degrees, it " runs with the wind from South to North, except toward " full Moon.

" To the Eaſt of the Cape of Good-Hope, from the " thirtieth degree to the twenty-fourth South Latitude, the " Current ſets in to the Eaſt, from the month of May to " October, and the wind blows during that period from " Weſt-South-Weſt, or South-Weſt; but from October to " May, when the wind is between Eaſt-North-Eaſt, and " Eaſt-South-Eaſt, the Current ſets in to the Weſt; and " this is to be underſtood of five or ſix leagues diſtance from " land, up to fifty, or thereabout; for at five leagues from " land, there is no Current, but we have a tide; and be-" yond fifty leagues from land, the Current entirely ceaſes, " or becomes imperceptible.

" On the coaſt of India, to the North of the Line, the " Current runs with the monſoon. But it does not change " quite ſo ſoon, ſometimes by three weeks or more; after " that,

" that, it changes no more till the monſoon is fixed in the " oppoſite direction. For example, the weſtern monſoon " commences about the middle of April, but the Current " does not change till the beginning of May; and the eaſ- " tern monſoon commences about the middle of September, " but the Current changes not till October has begun."

Dampier ſeems to aſcribe the cauſe of theſe Currents to the winds, which he calls Monſoons. But this is not the proper place for inveſtigating the cauſe of the atmoſpheric revolution, which, however, likewiſe depends on the Poles, whoſe Atmoſpheres are more or leſs dilated in Winter and in Summer, and whoſe revolutions muſt precede thoſe of the Ocean. I ſhall confine my attention, at preſent, to the retardation of the weſterly Current, which does not affect the Indian Ocean till the month of May, in order to demonſtrate, that it is the ſame which takes it's departure from our Pole, in the month of March, and which takes place in various regions of India at eras proportional to the diſtance of the point from which it ſets out.

This Current arrives, then, toward the month of April, at the Cape of Good-Hope; and this it is which renders the paſſage round the Cape ſo difficult to veſſels returning from India in Summer. I ſhall once more ſupport myſelf, on this ground, by the authority of *Dampier*, in his *Voyage round the World*, vol. ii. chap. 14. This was on his return from India to Europe.

" We loſt time in trying to reach the Cape, which we " could not make till the month of October or November; " and it was now only the end of March. In fact, it is " not uſual to make the Cape after the tenth of May."

In

In addition to this, the Dutch East-India Company do not permit their ships to remain there later than the month of March, because from that period the Winds and the Currents steadily set in from the West, which drive the shipping on the coast: hence we see, that this Current, which comes from the West, in doubling the Cape, arrives there in the month of April.

From the preceding passage, in *Dampier's Treatise on Winds*, we have seen that this westerly Current reached the coasts of India toward the middle of May: I shall produce another authority to prove that it reaches, about the middle of June, the island of Tinian, which is much farther to the East. I extract it from *Anson's Voyage*, chap. 14; in the year 1742, on the subject of the island of Tinian. "The "only good anchoring ground for large ships is off the South-"West part of the island. The bottom of this road is "filled with rocks of coral, very sharp pointed. It is unsafe "to anchor there from the middle of June to the middle of "October, which is the season of the *westerly monsoons*; "and the danger is farther increased by the extraordinary "rapidity of the current of the tide which *sets in to the* "*South-West*, between this island and that of Agnigan. "During the other eight months of the year, the weather "there is steady." Observe, by the way, that while the monsoon, or the current, comes from the West, the tide bears in a contrary direction between those two islands; which is a confirmation of what we have said, that tides are, for the most part, only the counter-currents of general Currents forced through narrow straits.

It is, accordingly, evident that this Current, which leaves our Pole in March, reaches the Cape of Good-Hope in

April, the coaſt of India in May, the iſland of Tinian by the middle of June; and that it traces round the Globe, the ſpiral line which I have indicated. It might be poſſible to calculate the velocity, by the time employed in running over theſe ſeveral diſtances, and in reaching the other points of Latitude, till it gets up with Cape Horn, from which it ſets in to the North, as far as Cape St. Auguſtin, where it meets the general Atlantic Current toward the end of July. But the detail of ſo many curious circumſtances would carry me too far.

In no one reſpect is it poſſible to aſcribe the general Currents of the Indian Ocean, which, as has been ſaid, ſets in, for ſix months, to the Eaſt, and ſix months to the Weſt, to the attraction or preſſure of the Sun and of the Moon, between the Tropics; for theſe Orbs move invariably in one direction, and their action is the ſame at all times, within the extent of that Zone to which their motion is reſtricted. Beſides, if their action were the cauſe of it, when the Sun is to the North of the Line, the weſterly monſoon ought to be felt on the coaſts of India, as early as the month of March, for the Sun is then nearly in the Zenith of the Indian Ocean; but it becomes not perceptible till ſix weeks after, that is, till the month of May.

On the contrary, when the Sun is to the South of the Line, and at the greateſt diſtance from the Indian Ocean, the monſoon takes place there a little after our autumnal Equinox, that is, in the month of October. Hence it is evident, that theſe revolutions of the Indian Ocean have not their focuſes under the Equator, but at the Poles; and that the revolution of the month of March, which proceeds from the North by the Weſt, takes ſix weeks to render itſelf perceptible

perceptible in India, becauſe of the vaſt circuit which it is obliged to make round the Cape of Good-Hope; whereas that of the South Pole, which commences in the month of September, arrives much ſooner, becauſe it has no circuit to make: and, finally, that the era of theſe verſatile revolutions commences preciſely at the Equinoxes, that is, the very moment when the Sun withdraws from the one Pole, on his way to warm the other.

It is manifeſt, therefore, that the half-yearly and alternate Currents of the Indian Ocean derive their origin from the half-yearly and alternate fuſion of the ices of the North and South Poles; and that their direction from Eaſt to Weſt, and from Weſt to Eaſt, is determined, in this Ocean, by the very projection of the Continent of Aſia.

The Atlantic Ocean has, in likemanner, two half-yearly and alternate Currents, which have the ſame origin, but one natural direction from North to South, and from South to North, though with ſome deviation from Weſt to Eaſt, and from Eaſt to Weſt, by the very projection of the Atlantic channel. Our Navigators go on the ſuppoſition that, in this channel, there is but one perpetual Current, which, in our Hemiſphere, always runs from South to North. Into this miſtake they have been led by the courſe of the tides, which, in fact, always do ſet in to the North along our coaſts, and thoſe of Bahama; but eſpecially, by our Aſtronomical ſyſtem, which aſcribes all the movements of the Ocean to the action of the Moon, between the Tropics.

How many errors may one ſingle prejudice introduce into the elements of human knowledge! It blinds even the moſt enlightened of Mankind, to ſuch a degree, as to make them

them reſiſt the cleareſt evidence, and to reject, for a long ſeries of ages, the experience which every year is accumulating.

I have collected from a multitude of Sea Voyages, and principally from thoſe which Captain *Cook* performed round the World, with equal ſagacity and intelligence, a great variety of nautical obſervations, which demonſtrate, that the Currents of the Atlantic Ocean are alternate and half-yearly, like thoſe of the Indian Ocean. Notwithſtanding, the very perſons who made and who relate theſe obſervations, miſled by the prejudice, that the action of the Moon between the Tropics alone communicates motion to the Seas, and unable to reconcile their Currents with the courſe of that Luminary, deduced only this concluſion, that they were naturally irregular, and their cauſe inexplicable.

Hade they adhered to their own experience, which aſſured them that theſe Currents changed twice every year; that, in the Indian Ocean, they run for ſix months in the ſame direction with the courſe of the Moon, and ſix months directly oppoſite to it; and, in the Atlantic Ocean, in directions which have no relation whatever to the courſe of that Star; that they are much more rapid as you approach the Poles, than between the Tropics, under the very gravitation of the Moon; and, finally, that they diverge from the Pole that is heated by the Sun, toward that which he has deſerted; they would then have referred the cauſes of theſe variations to the Summer and Winter of each Hemiſphere; and they would have diſſipated, in part, that cloud of error, with which our pretended Sciences have veiled the operations of Nature.

Though

Though these nautical observations are decisive as to myself, for they have been made by enlightened partisans of the Astronomical System which they totally subvert, while they confirm the truth of my theory, I shall, however, quote two still more curious, more authentic, and more impartial than all the others, because they have not been picked up by men bred to the Sea, and who, consequently, have neither the prejudices nor the systems of the profession. The one has the inhabitants of a whole kingdom to vouch for him; and the other, one of the most terrible epochas of the naval History of Europe: and both of them wonderfully confirm one of the most agreeable harmonies of the vegetable History of Nature, the elements of which I have presented in the emigration of plants.

From the first of these observations, we shall demonstrate, that the Atlantic Current comes, in fact, from the South, and sets in northward, as Navigators believe, but this only during our Winter. It is, accordingly, produced, in this direction, by the effusions of the ices of the South Pole, which, in our Winter, flow toward the North; and not by the action of the Moon between the Tropics, according to our Astronomers, because, at that very season, the Navigators of the Southern Hemisphere have found, beyond the Tropics, this same Current coming from the South, which assuredly could not take place, if this Current were produced by the action of the Moon on the Equator; for, on this hypothesis, it would flow in a contrary direction in the Southern Hemisphere. But this is by no means the case, as I am able to prove, by the Journals of *Abel Tasman*, of *Dampier*, of *Frafer*, of *Cook*, &c. who found beyond the Tropics, in the Southern Hemisphere, this Current setting in from the South, but only during our Winter.

By the fecond of theſe obſervations we ſhall demonſtrate, that the Atlantic Current comes from the North, and ſets in ſouthward in our Hemiſphere, contrary to the opinion of Navigators, but only during Summer. Of conſequence, it then proceeds directly from the effuſions of the ices of the North Pole, which, in our Summer, flow toward the South; and it evidently deſtroys, by this direction toward the Equator, the pretended action of the Moon between the Tropics, which, according to our Aſtronomers, impreſſes on the Ocean a motion toward both Poles.

The firſt of theſe obſervations is related by Mr. *Thomas Pennant*, a well-informed Engliſh Naturaliſt, unfettered by prejudice and by ſyſtem, at leaſt as far as this important ſubject is concerned. It is extracted from his Voyage, in 1772, to the Hebrides, ſmall iſlands on the Weſt of Scotland*. "But," ſays this enlightened Traveller, "what "is more real, and more worthy of attention, is this, that "there are frequently found here (on the Iſland of Ilay) on "the coaſts of all the Hebrides and Orkney Iſlands, the ſeeds "of the plants which grow in Jamaica, and the adjacent "Iſlands; ſuch as thoſe of the *dolichos urens*, *guilandina* "*bonduc*, *bonducetta*, the *mimoſa ſcandens* of LINNÆUS. "Theſe ſeeds, which are here called Molucca beans, grow "on the banks of the rivers of Jamaica; and thence wafted "along by the weſterly winds and currents, which predo-"minate for two-thirds of the year, in that part of the At-"lantic, they are driven even to the ſhores of the Hebrides. "The ſame thing ſometimes happens to the turtles of

* Printed at Geneva in 1785, in a Collection of Voyages and Travels to the Mountains and Iſlands of Scotland; Paris, Nyon ſenior, 2 vols. 8vo. vol. i. page 216 and 217.

"America,

" America, which are caught alive on theſe coaſts; and " this is put beyond the reach of doubt, ſince there was " found, on the coaſt of Scotland, a part of the maſt of the " *Tilbury* man of war, which took fire, and was burnt near " Jamaica."

Mr. *Pennant* has neglected to inform us at what ſeaſon thoſe ſeeds, and thoſe turtles, reach the weſtern coaſt of Scotland. Such omiſſion of dates is an eſſential defect, though very common with Travellers, who frequently neglect thoſe of even their own particular obſervations. It is only, however, by means of theſe dates, that we are enabled to take a glimpſe of the combined harmonies of Nature. What ſhall we think, then, of the taſte of our Compilers of Voyages and Travels, who retrench theſe as tedious and unimportant circumſtances? It is eaſy to ſee, notwithſtanding, in the preſent caſe, that the ſeeds from the rivers of Jamaica, and the turtles of America, arrive in Winter on the coaſts of the Hebrides and of the Orkneys, being driven thither, according to Mr. *Pennant*, by the " weſterly " winds and currents," which " predominate there," ſays he, " two-thirds of the year."

Now, it is well known that the weſterly winds blow there all the Winter through; which is confirmed, in this relation, by it's own proper teſtimony, and, in the ſame Collection, by other Travellers to Scotland. After all, it cannot poſſibly be the Weſt-wind which wafts theſe ſeeds and theſe tortoiſes ſo far from Jamaica northward. The winds have no hold of bodies level with the ſurface of the water; and, aſſuredly, thoſe from the Weſt could not drive them to the North. Nay, Currents from the Weſt could not poſſibly produce this effect, for they would hurl

them to the East; and as Jamaica is about 18 degrees to the North of the Line, these seeds and tortoises would be driven ashore on the coast of Africa of the same Latitude, and not in the 59th degree North, on the coasts of the Hebrides and Orkneys, where, in fact, they do come ashore.

The Current, therefore, which wafts them along, proceeds in a northern direction, tending a little toward the East, precisely as the Atlantic channel itself does, in that part of it. Accordingly, the important observations of the inhabitants of Scotland, on the subject of the grains of the Island of Jamaica, of the turtles of America, and of a fragment of the mast of the *Tilbury*, thrown upon their coasts, incontestably prove that the Atlantic Current comes from the South, and sets in to the North, as Navigators are disposed to believe. But it has this direction only in our Winter; for I am going to demonstrate by another observation, no less curious, that in Summer, and in the same Latitudes, the Atlantic Current comes from the North, and sets in to the South, in direct opposition to the pretended action of the Moon between the Tropics, and contrary to the opinion of Navigators. But I ought not to say *opinion*, for they have not a well-informed opinion on the subject.

We have already produced the testimony of the most respectable northern Navigators, who unanimously bear witness, that the Atlantic Current comes from the North, and sets in to the South in Summer, in it's northern extremity: such are those of *Ellis*, of *Barents*, of *Linschotten*, &c. who, having navigated, in Summer, toward the vicinity of the arctic polar Circle, attest that the Currents, and even the tides have a southerly direction, and descend from the North, or,

at

at moſt, from the North-Weſt, or North-Eaſt, according to the bearing of the bays into which they have penetrated.

We have beſides adduced, in ſupport of this important truth, the teſtimony of the Navigators of North-America, quoted by *Denis*, Governor of Canada, who atteſt that the Currents of the North annually convey, in Summer, toward the South, long banks of floating ices, of a very conſiderable depth and elevation, which run a-ground ſo far to the South as the banks of Newfoundland: and, finally, we have quoted the obſervation of *Chriſtopher Columbus*, who, in a much more ſouthern Latitude, nay, approaching to the Tropic of Cancer, found, by experience, in September, that the middle of the Atlantic channel run ſouthward, and, conſequently, deſcended from the North. To theſe authorities we might ſubjoin thoſe of a multitude of other Navigators, who paid attention only to the driving of their ſhips, and were convinced, in Summer, of the exiſtence of this northern Current, without daring to admit it, or venturing to oppoſe their own experience to an Aſtronomical Syſtem, which had got into vogue.

But that I may omit nothing relating to a ſubject ſo eſſential to Navigation, and to the ſtudy of Nature, and to remove every poſſibility of doubt as to the exiſtence of this northern Current in Summer, we ſhall confine ourſelves to a ſingle obſervation, but connected with a well-known hiſtorical event. This obſervation is the leſs liable to ſuſpicion, that it is related without an intention to favour any one Syſtem, by a Traveller, who was neither Mariner nor Naturaliſt, and who deduced no other conſequences from it, except thoſe which concerned his fortune and his liberty.

It

It is that of *Souchu de Rennefort*, Secretary to the Supreme Council of Madagascar, on leaving the Azores, the 20th of June, 1666, at that time on his return to Europe. *History of the East-Indies.* Book iii. chap. 5.

"From 40 degrees," says he, "up to 45, we saw "broken masts, sail-yards, and round-tops of ships, which "awakened an apprehension that some dreadful naval dis- "aster had taken place. We were not a little afraid that these "fragments might have run foul of one of our convoy, a "vessel of considerable burden, called the Virgin, an old "crazy ship, and very leaky. It has been since ascer- "tained, that this wreck was occasioned by the naval com- "bat which took place between the French and Dutch on "one side, and the English on the other. It would have "been a happiness to those concerned to have known this "sooner."

In fact, the vessel on board of which *Rennefort* was, and to whom it was unknown that France and England were at war, had the misfortune to be taken and sunk by an English frigate, as far up the channel as Guernsey, ten days after this observation, that is the 8th of July.

This horrible devastation, scattered over the Ocean, through a space of three degrees, or 75 leagues, was the effect of the most obstinate and bloody combat that ever took place on that element, between the English and the Dutch. It begun the 11th of June, and lasted four days. The English fleet consisted of 85 ships of war, and the Dutch fleet of 90, commanded by *De Ruyter*. There were 21 thousand men nearly on each side, and 4,500 pieces of cannon. In that engagement the English lost 23 ships, most of

of which were burnt or ſunk, and the Dutch only 4; but there was ſcarcely a ſhip which did not loſe her maſts in whole, or in part. Nine thouſand men, nearly, periſhed on both ſides. The Hiſtorians of each Nation, as uſual, exalted the glory of their own fleet up to the ſkies. One thing is certain, that nine thouſand human bodies, mutilated and half burnt, given up to ſharks and ſea-dogs, preſented, to the monſters of the deep, the ſpectacle of a ferocity which has no example, except in the annals of the Human Race; and that this prodigious number of round-tops, ſail-yards, and maſts, floating about, mixed with flags bearing red croſſes and white croſſes, muſt have conveyed ſome information to the Barbarians of all the Southern regions of the Atlantic Ocean, in what manner the Powers, who pretend to be ſubjected to the laws of JESUS CHRIST, ſettle their quarrels *.

Theſe

* Theſe wrecks were, undoubtedly, carried farther than the Azores. It is probable that, at this ſeaſon, a conſiderable part of them floated as far as the coaſts, and the weſtern iſlands of Africa. Now the ground of this quarrel between England and Holland was preciſely the African Slave-Trade. Thoſe Powers had commenced hoſtilities the year before, on the coaſts of Guinea, and at the Cape-de-Verd Iſlands, to the ruin of theſe Countries. I ſuppoſe, therefore, that thoſe awful monuments, of the battle off Oſtend, muſt have paſſed through the Cape-de-Verd Iſlands, and near to that of St. John, which is ſo little frequented by Europeans, that the Portugueze call it *Brava*, or ſavage. It's good and hoſpitable inhabitants, according to an Engliſh Navigator, of the name of *Roberts*, who had a moſt delightful opportunity of putting theſe amiable qualities to the teſt, are ſo humble, that they look on men of their own colour as ſubjected, by the authority of GOD himſelf, to the yoke of white men. In this opinion they are confirmed by obſerving the balance of European commerce, one of the beams of which preſents to Europe benefits only, while the other, weighed down by calamities, continually preſſes on wretched Africa.

But

Theſe wrecks, ſcattered over 75 leagues of Sea, came from about twelve miles to the North-weſt of Oſtend, where this naval combat was fought, and were carried as far

But when from the ſummit of their rocks, under the ſhade of their cotton-trees, and of their plantains, they beheld, along their peaceful ſhores, this frightful train of maſts, yards, galleries, poops, prows, half burnt, ſtained with human blood, and intermingled with European ſtandards, they then ſaw the ſcale, loaded with the miſeries of Africa, riſe for a moment, and the other, in it's turn, ſink with an oppreſſive weight on Europe: and from this re-action of calamity, they, undoubtedly, perceived that an univerſal Juſtice governs, by equal laws, all the Nations of the Globe.

A King of France, it has been ſaid, ordered the bodies of malefactors to be thrown into the river, marked with this diſmal inſcription: *Let the King's Juſtice paſs.* The Chineſe and Japaneſe puniſh, in the ſame manner, the pirates who infeſt the navigation of their rivers. Thus the wrecks of theſe ſhips of war, which had ſo often ſcattered terror over the Atlantic Ocean, were hurried along by it's Currents; and their enormous bulging hulks, blackened by the fire, reddened with human blood, and become a ſport to the billows of Africa, ſpoke much more diſtinctly than any inſcription could, to the oppreſſed inhabitants of thoſe ſhores: *Behold now, O, ye black men! the glory of the Whites, and the Juſtice of* GOD, *paſſing along.*

It would be a calculation worthy, I do not ſay of our modern Politicians, who no longer ſet a value on any thing in the World, except gold and power, but of a friend of humanity, to aſcertain, Whether the Negro Slave-trade has not occaſioned as many woes to Europe as to Africa; and, What are the benefits of which it has been productive to theſe two diviſions of the Globe.

In the firſt place, it would be neceſſary to take into the account, of the calamities of Africa, the wars which it's Potentates wage with each other, in order to find a ſupply of ſlaves to anſwer the demand of European traders; the barbarous deſpotiſm of it's Sovereigns, who, for the attainment of this object, deliver up their own ſubjects; the unnaturally degraded character of their ſubjects, who, after their example, frequently drag to theſe inhuman markets their wives and their children; the

far as the Azores, which *Rennefort's* ſquadron was leaving, when he fell in with them. Oſtend is about 51 degrees North; and the Azores about 40, and far to the Weſt.

The

the depopulation of moſt of the maritime countries of Africa, reduced to a deſert, by the emigration of their inhabitants, who have been ſweeped away into ſlavery; the mortality of a very conſiderable proportion of theſe wretches, who periſh on their paſſage to America and the Weſt-Indies, by unwholeſome food and the ſcurvy, exceſſive labour, ſcantineſs of proviſions, the mercileſs whippings, and other puniſhments which they are doomed to endure in our Colonies, and which deſtroy the greateſt part, with miſery, mortification and deſpair.

Here, undoubtedly, is a ſad detail of tears and bloodſhed, on the African ſide of the account. But it is balanced, at leaſt, by an equal train of evils on that of Europe: if you ſtate on this ſide, the very navigation of the coaſt of Africa, the corrupted air of which carries off the ſeamen of our trading veſſels by whole crews at once, as well as the garriſons of our ſettlements on the coaſt, and up the country, by the dyſentery, the ſcurvy, putrid fevers, and eſpecially by a fever peculiar to the coaſt of Guinea, which brings the ſtouteſt man to his grave in three days. To theſe phyſical evils may be added, the moral maladies of Slavery, which deſtroy, in our American Colonies, the very firſt feelings of humanity; becauſe, wherever there are ſlaves, tyrants ſpring up, together with the influence of this moral depravation upon Europe. Add to the evils of this quarter of the World, the reſources, in the field-employments of America, from which our own commonalty and peaſantry are excluded, multitudes of whom are languiſhing at home, in wretchedneſs, for want of employment, and the means of ſubſiſtence; the wars which the Slave-trade kindles among the maritime Powers of Europe, their ſettlements taken, and retaken; their naval engagements, which ſweep away nine thouſand men at a ſtroke, without reckoning thoſe who are maimed for life; their wars which, like a peſtilence, are communicated to the interior of Europe, by their alliances, and to the reſt of the World by their commerce; when all theſe are taken into the ſtatement, it muſt be allowed that the amount of European evils is a complete balance to thoſe of Africa.

As

The firſt of theſe wrecks were put in motion, from the North-weſt of Oſtend, on the 11th of June, which is the date of the beginning of the engagement, conformably to *De Ruyter*'s letter, and the Hiſtory of France, and they were found near the Azores by the 20th of the ſame month at fartheſt, as muſt be concluded from the relation of *Rennefort*, though the date of every day, in particular, is not inſerted. The Currents from the North had, accordingly, wafted them along, in nine days, more than 275 leagues to the South; without taking into the account, the conſiderable progreſs which had been made to the weſtward, on the whole amounting to much more than 34 leagues a day.

As to the balance of benefits, it is reduced, on both ſides, to a very narrow compaſs. It is impoſſible, with a good conſcience, to enumerate among the bleſſings which the inhabitants of Africa derive from the ſale of their compatriots, our iron ſabres, with which they mangle each other, our wretched firelocks, with which they contrive to knock one another on the head, and our ardent ſpirits, which deſtroy their reaſon and their health: the whole then is reduced, in their favour, nearly, to a few paltry mirrors and tinkling-bells.

With reſpect to the benefits derived from this trade to Europe, there is ſugar, coffee, and cotton, with which America and it's Iſlands ſupply us, by means of the labour of negro ſlaves; but theſe rude and formleſs productions can ſtand no manner of compariſon with the perfected manufactures, and the crops of every kind, which might be derived from the ſame fields, by free, happy, and intelligent, European cultivators.

It appears to me, that, if this balance of evils ſo oppreſſive, and of benefits ſo trivial, were preſented to the maritime and Chriſtian Powers of Europe, they would diſcover, at length, that it is not ſufficient to have baniſhed Slavery from their own territories, in order to render their ſubjects induſtrious and happy; but that they muſt likewiſe proſcribe it in their Colonies, for the ſake of theſe very ſubjects themſelves, for that of the Human Race, and for the glory of their Religion.

It

It was not the wind, surely, which hurried those fragments toward the South-West with so much rapidity: the prevailing wind, at that season, was contrary to them. *Rennefort*'s squadron, which had just met them, were sensible of no other wind, but that which was carrying them to the North-East; and *De Ruyter*, in his dispatches, makes mention only of the South-West winds, which blew during the engagment. Besides, as has been formerly observed, what hold could the winds have of bodies, level with the water? Much less could they have been carried southward, by the tides, which then set in to the North, on our coasts: it must have been, therefore, a direct Current from the North which carried them to the South, even in opposition to the tides, and somewhat to the West, by the direction of the Atlantic channel. The Atlantic Current, therefore, sets in to the South, in Summer, notwithstanding the pretended action of the Moon between the Tropics, and it's course, at that season, can be ascribed only to the melting of the northern polar ices.

These two observations, so authentic, farther confirm a position elsewhere laid down, that islands are placed at the extremities of currents. *Linschotten*, who had sojourned at the Azores, remarks, that the fragments of most of the shipwrecks suffered in the Atlantic Ocean are thrown upon their coasts. The same thing happens on the shores of the Bermudas, on those of Barbadoes, &c. These floating bodies are wafted to prodigious distances, regularly and alternately, as the Currents of the Ocean themselves are. The seeds of the island of Jamaica are, accordingly, conveyed, in Winter, as far as the Orkneys, that is more than 1060 leagues from South to North, and a distance of more than 1800 leagues, by the flux of the South Pole; and, beyond a doubt,

a doubt, the fluviatic ſeeds of the Orkneys are carried along, in Summer, to the ſhores of Jamaica, by the flux of the North Pole.

Theſe ſelf-ſame correſpondencies muſt ſubſiſt between the vegetables of Holland and of the Azores. I am not acquainted with any of the ſeeds peculiar to the rivers of Jamaica; but I am abſolutely certain, that they poſſeſs the nautical characters which I have obſerved in thoſe of all fluviatic plants. Here, then, is a new confirmation of the vegetable harmonies of Nature, founded on the emigration of plants. It may be likewiſe applied to the emigration of fiſhes, which purſue ſuch long and winding directions through the open Sea, guided, unqueſtionably, by the floating ſeeds of fluviatic plants, for which they have, in all countries, a decided preference of taſte, and which Nature produces on the banks of rivers particularly, with a view to their nouriſhment.

It appears to me poſſible for Mankind, by means of the alternate Currents of the Ocean, to maintain a regular mutual correſpondence, free of all expenſe, over all the maritime countries of the Globe. It might, perhaps, be poſſible, by theſe means, to turn to very good account thoſe vaſt foreſts which cover the northern diſtricts of Europe and of America, conſiſting moſtly of fir, and which rot on the face of thoſe deſerted lands, without producing any benefit to Man. They might be committed, in Summer, in well-compacted floats, firſt to the current of the rivers, and afterward to that of the Ocean, which would convey them, at leaſt, to the Latitude of our coaſts which are ſtripped of planting, as the courſe of the Rhine pours every year into Holland, prodigious rafts of oak, felled in the foreſts of Germany. The

wrecks

wrecks of the naval engagement off Oſtend, conveyed with ſuch rapidity as far as the Azores, diſcover, in ſome degree, the extent of the reſources which Nature offers to ſupply in this way.

Geography might, likewiſe, make this a ſource of many future uſeful and important diſcoveries. To the effects of thoſe Currents is *Chriſtopher Columbus* indebted for the diſcovery of America. A ſimple reed of foreign growth, thrown on the weſtern coaſts of the Azores, ſuggeſted to that great Man, the probability of the exiſtence of another Continent to the Weſt. He farther thought of availing himſelf of the Currents of the Ocean, on his return from his firſt voyage to America; for, being in imminent danger of periſhing in a ſtorm, amidſt the Atlantic Ocean, without having it in his power to inform Europe, which ſo long ſlighted his ſervices, and derided his enlightened theory, that he had actually, at length, found out a New World, he incloſed the Hiſtory of his diſcovery in a caſk, which he committed to the waves, confident that, ſooner or later, it would reach ſome ſhore.

A common glaſs bottle might preſerve ſuch a depoſit for ages on the ſurface of the Deep, and waft it repeatedly from Pole to Pole. It is not for the ſake of our haughty and unfeeling Academicians, who refuſe to ſee any thing in Nature, which they have not imagined in their cloſet, it is not for them that I thus dwell on the detail, and the application of theſe oceanic harmonies; no, it is for your ſake, unfortunate mariners! It is from the mitigation of the woes to which your profeſſion expoſes you, that I one day expect my nobleſt and moſt durable recompence. One day, perhaps, a wretched individual of your deſcription, ſhip-

wrecked on a defert iſland, may intruſt to the Currents of the Seas, the ſad taſk of announcing to the habitations of Men, the news of his diſaſter, and of imploring aſſiſtance. Some Cëyx, perhaps, periſhing amidſt the tempeſts of Cape Horn, may charge them to waft his expiring farewel; and the billows of the Southern Hemiſphere ſhall ſpeed the tender ſigh to the ſhores of Europe, to ſoothe the anguiſh of ſome future Alcyone.

After the facts which I have juſt detailed, it is no longer poſſible to doubt, that the Indian and Atlantic Oceans have their ſources in the half-yearly and alternate fuſions of the ices of the South and North Poles; as they have half-yearly and alternate Currents perfectly correſponding to the Summer and Winter of each Pole. Theſe Currents, it may well be believed, flow with much greater velocity, than the floating bodies on their ſurface. There is produced, at the Equinoxes, a retrogreſſive impulſion in the whole maſs of their waters at once, as appears, at theſe eras, from the univerſal agitation of the Ocean in all Latitudes. This total, and almoſt inſtantaneous ſubverſion cannot poſſibly be produced by the operation of the Moon and of the Sun, which proceed always in one direction, and are conſtantly confined within the Tropics: but, as I have again and again repeated, it is produced by the heat of the Sun, which then paſſes almoſt inſtantaneouſly from the one Pole to the other, melts the frozen Ocean which covers it, communicates, by the effuſion of it's ices, new ſources to the fluid Ocean, oppoſite directions to it's currents, and inverts the preceding preponderancy of it's waters.

Much leſs is it poſſible to deduce, as has been done, the cauſe of the tides, from the action of the Sun and of the Moon

Moon upon the Equator; for, if this were ſo, they muſt be much more conſiderable between the Tropics, near to the focus of their movements, than any where elſe: but this is by no means the caſe. Hear what *Dampier* ſays, reſpecting the tides on the coaſts of India, near the Equator, in his *Treatiſe on the Winds*, page 378.

"From Cape Blanc, on the coaſts of the South-Sea, "from the third to the thirtieth degree of South Latitude, "the flux and reflux of the Sea is only a foot and a half, "or, at moſt, two feet.....The tides in the Eaſt-Indies riſe "very little, and are not ſo regular as with us, that is, in "Europe:.....They riſe," ſays he, in another place, "to "four, or, at moſt, five feet." He afterwards informs us, that the higheſt tide which he ever obſerved on the coaſt of New Holland, did not take place till three days after the full, or new Moon.

The weakneſs, and the very conſiderable retardation of theſe Tides, between the Tropics, evidently demonſtrate, therefore, that the focus of their movements is not under the Equator; for if it were ſo, the tides would be tremendous on the coaſts of India, which are in it's vicinity, and parallel to it: but their origin is near the Poles, where they riſe, in fact, from twenty to twenty-five feet, near Magellan's Strait, according to the Chevalier *Narbrough*, and to a height equally conſiderable at the entrance of Hudſon's-Bay, if we may believe *Ellis*.

Let us make a brief recapitulation. The tides are the half-daily effuſions of the ices of one of the Poles, juſt as the general Currents of the Ocean are it's half-yearly effuſions. There are two general oppoſite Currents annually,

becauſe the Sun warms by turns, in the courſe of one year, the ſouthern and northern Hemiſpheres; and there are two tides every day, becauſe the Sun warms, by turns, every twenty-four hours, the eaſtern and the weſtern ſide of the Pole that is in fuſion. The ſame effect exactly is viſible in many lakes ſituated in the vicinity of icy mountains, which have currents, and a flux and reflux in the day-time only. But it cannot admit of doubt, that, if the Sun warmed, during the night, the other ſide of thoſe mountains, they would produce, likewiſe, another flux and reflux in their lakes, and, conſequently, two tides in twenty-four hours, like the Ocean.

The retardation of the tides of the Ocean, which is about twenty four minutes the one from the other, ariſes from the daily diminution of the diameter of the icy cupola of the Pole in fuſion. Accordingly, the focus of the tides is removing farther and farther from our coaſts. If their intenſity is ſuch, according to *Bouguer*, that our evening tides are the ſtrongeſt in Summer, it is becauſe they are the diurnal effuſions of our Pole, produced by the heat of the day in the ſultry ſeaſon. If, at that ſeaſon, they are leſs ſtrong in the morning than in the evening, it is becauſe they are the nocturnal effuſions which come from the other part of the Pole, and diſcharge themſelves into the ſources, in the ſpiral direction of the Atlantic Ocean, but in a ſmaller quantity.

If, on the contrary, at the end of ſix months, the ſtrongeſt tides, that is, thoſe of the evening, become the weakeſt; and the weakeſt, that is, thoſe of the morning, become the ſtrongeſt: it is becauſe they are then produced by the action of the Sun on the South Pole, and the cauſe being oppoſite, the effects muſt be ſo likewiſe. If the tides are ſtronger

ſtronger one day and a half, or two days after the full Moon, it is becauſe that Luminary increaſes by her heat the polar effuſions, and, conſequently, the quantity of water in the Ocean. The Moon poſſeſſes a degree of heat which not only evaporates water, as was aſcertained by recent experiments at Rome and at Paris, but which melts the ices, as *Pliny* relates, in conformity to the obſervations of Antiquity. "The Moon produces thaw, reſolving all ices and "froſts by the humidity of her influence." *Natural Hiſtory*, Book ii. chap. 101. Finally, if the tides are more conſiderable at the Equinoxes than at the Solſtices, it is becauſe, as has been obſerved, at the Equinoxes, there is the greateſt poſſible maſs of water in the Ocean, for the greateſt part of the ices of one of the Poles is then melted, and thoſe of the oppoſite Pole then begin to diſſolve.

We are not to imagine that every tide is a polar effuſion of the particular day when it happens; but it is an effect of that ſeries of polar effuſions which perpetually ſucceed to each other; ſo that the tide which takes place to-day on our coaſts, is, perhaps, part of that which takes place, it may be for ſix weeks together; and it's motion is kept up by thoſe which flow every day in it's ſeries. Thus in a row of balls placed on a billiard table, the firſt which receives an impulſion, communicates it to the next, and that one to the following, and ſo through the whole ſeries, and the laſt only is detached from the row with what remains of the moving force. But here, too, we muſt admire that other harmony which pervades the moſt remote effects of Nature: it is this, that the evening and morning tides take place on our coaſts, as if they iſſued that very day from the higher and lower part of our Hemiſphere; and that the tides of Sum-

mer are precisely opposite to those of Winter, as the Poles themselves from which they flow.

I could support this new theory by a multitude of facts, and apply it to most of the nautical phenomena which have hitherto been deemed inexplicable; but the time and the space left me forbid it. It is sufficient for me to have deduced from it the principal movements of the Seas. I was under the necessity of tracing the windings of this labyrinth with an application and labour of which the Reader cannot easily form an idea. I have shewn him it's entrance and outlet, and present him with the clew. He will be able, undoubtedly, to go much farther without my assistance. I can venture to assure him, that, by taking advantage of these principles, in perusing journals and Sea voyages, that pretend to any thing like exactness in dates and observations, such as those of *Abel Tasman*, of *Hugues*, of *Linschotten*, of General *Beaulieu*, of *Froger*, of *Frafer*, of *Dampier*, of *Ellis*, &c. he will find a new light diffused over those passages of marine journals, which are, for the most part, so dry, and so obscure.

Had time and means been granted me to unfold this part of my subject, and to display it in all the luminous simplicity of which it is susceptible, I have the vanity to think that I could have rendered it, in many other respects, highly interesting. I would have procured a representation, on two large solid globes, of the two general Currents of the Ocean, in Winter and in Summer, with arrows which should have expressed the exact intervals between one tide and another; and of their counter-currents, lateral to the passage of all straits, which produce on different shores the counter-

counter-tides, half-daily, daily, weekly, lunary, half-yearly. Theſe counter-tides ſhould have produced others, on the return, at the paſſage of iſlands; ſo that the Ocean would have been repreſented as a vaſt fluid iſſuing from each Pole, to make the circuit of the Globe, and forming, on it's ſhores, a multitude of counter-currents, and counter-tides, all dependant on the effuſions of one Pole ſingly. I ſhould have employed for this purpoſe the beſt authenticated marine Journals.

It would, then, have been evidently clear, that the bays of Continents, and even of Iſlands, are ſheltered from the general Currents; and I would have demonſtrated, on the contrary, that the courſe and the direction of all rivers are adapted to thoſe Currents and thoſe tides of the Ocean, in order to accelerate them in certain places, and to retard them in others, juſt as the courſe of brooks and rivulets is itſelf adapted to the current of rivers, and for the ſame end.

I would have done more; in order to vindicate Geograpy from the charge of dryneſs, and to unite the graces which all the kingdoms of Nature communicate to each other, inſtead of arrows, I ſhould have illuſtrated my ſubject by figures more analogous to the Seas, and have added new proofs to the theory of thoſe polar effuſions, by a repreſentation of ſeveral ſpecies of fiſhes of paſſage, which, at certain ſeaſons of the year, reſign themſelves to their currents, in order to paſs from the one Hemiſphere to the other.

This much is certain, that the principal point of their union, as well from the one Pole as from the other, pre-

ciſely is at the ſtrait formed by Guinea and Braſil, where, as has been ſaid, are formed thoſe two great lateral counter-currents which return toward the Poles. There is the rendezvous of the fiſhes from the North Pole, and from the South. Herrings, whales, and mackarel, are, in Summer, found in great abundance on thoſe ſhores. The whales of the North have formerly been ſo common at Braſil, that, according to the report of Navigators, the fiſhery on it's coaſts was farmed out, and produced a conſiderable revenue to the King of Portugal. I know not how it may be at preſent: perhaps the noiſe of European artillery may have chaced them away from thoſe coaſts. A very productive cod-fiſhery was likewiſe carried on there, known all over America by the name of the Braſil cod.

On the other hand, according to the teſtimony of *Boſman*, a Dutch Navigator, who has publiſhed a very good account of Guinea, the whales of that ſpecies which is called *North-caper* are found in great abundance on the coaſts of Guinea. He alleges that they reſort thither to bring forth their young: *Artus* has favoured us with a catalogue of the fiſhes of paſſage which appear on that coaſt during the different months of the year. Though it is very imperfect, we are enabled by it to diſtinguiſh the fiſhes which are peculiar to each Pole. In the months of April and May, it is a ſpecies of ray which riſes to the ſurface of the water: in June and July, a ſort of herring, in ſuch quantities that the Negroes, on throwing among them a ſimple leaden weight, at the extremity of a long line, furniſhed with hooks, always draw up a conſiderable number at every throw. During the ſame months they catch a great many lobſters, ſimilar, ſays *Artus*, to thoſe of Norway.

In

In September, innnmerable legions, and various ſpecies, of mackarel arrive there. At that ſeaſon, too, appears a kind of mullet, which, unlike all other fiſhes, who delight in ſilence, flock to noiſe. The Negros avail themſelves of this inſtinct as the means of catching them. They tie to a piece of wood ſurrounded with hooks, a ſort of cornet with it's clapper; thus furniſhed, it is thrown into the ſea; and the motion of the waves toſſing about the cornet, produces a certain noiſe, which attracts the fiſh in queſtion, ſo that, in attempting to lay hold of the piece of wood, they are thus themſelves caught. Kind Nature, accordingly, thus furniſhes to the poor Negroes a fiſhery adapted to their capacity and induſtry.

This ſpecies of mullet appears, from it's inſtinct, deſtined to travel through turbulent ſeas, and at noiſy ſeaſons, for he is viſible only about the autumnal Equinox, at the revolution of the ſeaſons. But in the months of October and November, thoſe ſhores are crouded with fiſhes, whoſe names and manners are unknown to Europe, and which ſeem to appertain to the South Pole, whoſe Currents are then in a ſtate of activity. Such are, a ſea pike or jack, the teeth of which are extremely ſharp, and the bite very dangerous: a ſpecies of ſalmon, with white fleſh, and of an exquiſite flavour: another called the ſtar of the ſea: a ſpecies of ſea-dog, which has a very large head, and the throat in form of a warming-pan; it is marked on the back with a croſs: ſome of them grow to ſuch a ſize, that a ſingle one is ſufficient to load two or three canoes. In December arrive vaſt quantities of the korkofedo, or moon-fiſh; they appear likewiſe in June. The korkofedo ſeems to regulate his progreſs by the ſolſtices. He is as broad as long; and is caught by a bit of ſugar-cane fixed on a hook. The taſte

which

which this fiſh has for the ſugar-cane is another proof of the harmonies eſtabliſhed between fiſhes and vegetables. Finally, in the months of January, February, and March, may be ſeen, on the coaſt of Guinea, a ſpecies of ſmall fiſh with large eyes, which *Artus* ſuppoſes to be the *oculus*, or *piſcis oculatus* (eyed-fiſh) of *Pliny*. This, too, is an inhabitant of the boiſterous equinoctial Seas, for he friſks and jumps about with a great deal of noiſe.

Had time permitted, I would have extended theſe elementary concords to the different inhabitants of the departments of the Ocean. We ſhould have ſeen, for example, the cauſe of the alternate tranſition of turtles, which, for ſix months of the year, take up their abode in certain iſlands, and which are found again, ſix months after, in other iſlands, ſeven or eight hundred leagues diſtant, putting it beyond the power of imagination to conceive how an amphibious animal, ſo ſluggiſh and unwieldy, ſhould be able to make a paſſage ſo immenſe toward places which it is impoſſible ſhe ſhould perceive. We ſhould have ſeen their heavy-ſailing ſquadrons committing themſelves, almoſt without motion, in the night-time, to the general Current of the Ocean, coaſting by moon-light the gloomy promontories of iſlands, and ſeeking, in their deſerted creeks, ſome ſandy and tranquil bank, where, far from din, they may undiſturbedly depoſit their eggs.

Others, ſuch as the mackarel, never fail to arrive, at the accuſtomed ſeaſon, on other ſhores, conveyed by the ſame Currents, becauſe then they are blind. "When the macka-"rel come to the coaſts of Canada," ſays *Denis*, formerly Governor of that country, "they have not the leaſt "glimmering of ſight. They have a ſpeck on their eyes, "which

"which does not fall off till toward the end of June; "thenceforward they ſee, and are caught by the line *." His teſtimony is confirmed by other Navigators, though there was no neceſſity for it.

Other fiſhes, ſuch as herrings, expoſe their ſilvery legions to glitter in the Sun on the northern ſtrands of Europe and America, ſhaded with firs, and advance forward and forward, till they reach even the palm-groves of the Line, forcing their way along the ſhores, in oppoſition to the tides of the South, which are continually ſupplying them with freſh paſture.

Others, as the thunny, make their way, by favour of theſe very tides, and enter, in the Spring, into the Mediterranean, of which they make a complete circuit; and, though they leave no trace on their watery way, they do not fail to render themſelves viſible in the darkeſt night, by means of the phoſphoric lights which their motion excites. It is by thoſe ſame gleams of light that we perceive, in the night-time, the turtle with their duſky colour, on the ſurface of the waters. You would imagine that theſe animals, ſurrounded by light, had flambeaus affixed to their fins and tails. The phoſphoric qualities, accordingly, of the ſea-water, are in uniſon even with the nocturnal voyages of fiſhes.

The Sun is the grand mover in all theſe harmonies. Arrived at the Equinox, he abandons one Pole to Winter, and gives to the other the ſignal of Spring, by the fires with which he environs it. The heated Pole pours out, in every

* Natural Hiſtory of North-America, chap. ii.

direction,

direction, torrents of water, and of melted ices, into the Ocean, to which it ſupplies new ſources. The Ocean then changes it's courſe; it draws into it's general Current moſt of the fiſhes of the North toward the South; and by it's lateral counter-currents, thoſe of the South toward the North. It attracts others even from the Continent, by the alluvions of the land, which the rivers diſcharge: ſuch are the fiſhes with ſcales, as ſalmon, which love, in general, to make their way upward againſt the courſe of rivers.

Theſe floating legions are attended by innumerable cohorts of ſea-fowls, which quit their natural climates, and hover around the fiſhes, to live at their expenſe. It is then that we find the ſea-fowls of the South flocking to the ſhores of the North, as the pelican, the flamingo, the heron, the ſtork: and thoſe of the North finding their way to the South, as the lomb, the burgomaſter, the cormorant. It is then that ſands and ſhallows the moſt deſerted, are crouded with inhabitants, and that Nature preſents new harmonies on every ſhore.

If the voyages of the inhabitants of the Seas would have diffuſed new light on the Currents of the Ocean, theſe ſame Currents would have furniſhed us with new light reſpecting the forms and manners of fiſhes, which have to us ſuch an uncouth appearance. Moſt of theſe fiſhes caſt their ſpawn in ſuch abundance, that the Sea is frequently covered by it for ſeveral leagues together. The Currents carry off this ſpawn to prodigious diſtances, and while the fathers and mothers unconcernedly indulge in the dalliance of love, on the coaſts of Norway, their fry are hatching on thoſe of Africa or Braſil.

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We ſhould have ſeen their categories, ſo wonderfully varied, of a configuration perfectly adapted to the different ſites of the Ocean: ſome, cut out into long ſword-blades, like the African fiſh which bears that name, take pleaſure in penetrating into the narroweſt crevices of rocks, and in ſtemming the moſt rapid currents: others, equally flat, are cut into a circular form, with two long horns, like ſail-yards, iſſuing from the head, and inverted behind, to ſerve them as a helm, as the ſilvery moon-fiſh of the Antilles. Theſe moon-fiſh are continually ſporting among the billows which break upon the rocks, without a ſingle inſtance being known of any one thrown aſhore. Other fiſhes of a triangular ſhape, and cut into the form of the cheſt whoſe name they bear, advance into the very middle of the ſhelfy ground upon the ſhore, where there is ſcarcely any water, and diſplay, in the boſom of the duſky rocks their blue ſhining robes, beſpangled with ſtars of gold.

While ſome, perpetually reſtleſs, ſcratch and ſcrape into every chink along the beach, in queſt of their prey; others, in perfect tranquility reſpecting their proviſion, remain immoveable, on a fixed ſtation, expecting it. Some, incruſted in lumpiſh habitations of ſtone, pave the ground of the ſhores, as the *helmet*, the *lambi*, and the *thuilée*; others, attached by threads to little pebbles, ride at anchor at the mouths of rivers, as the muſcle; others glew themſelves to each other, as the oyſter; others fix themſelves as the heads of nails to the rocks, to which they cling by ſuction, as the *limpit*; others bury themſelves in the ſand, as the *harpe*, the cockle, the knife-handle; and moſt of the ſhell-fiſh whoſe exterior garments are clear and brilliant; others, as the lobſter and the crab, armed with bucklers and corſlets, lie in

in ambuſh among the ſtones, where they preſent to view only the extremities of their horns and their great claws.

Had it been in my power, I would have ſtudied the contraſts which thoſe innumerable families form on the ſlime and on the rocks, where their ſhells ſparkle with the fires of *Aurora*, and with the luſtre of purple and of the *lapis-lazuli*. I would have deſcribed thoſe ſea-covered regions, clothed with plants of an infinite variety of forms, which never receive the rays of the Sun but through the medium of water. Their very valleys, where the currents guſh with the rapidity of ſluices, produce plants elaſtic, and perforated, ſuch as the leaves of the ſea-peacock, through the apertures of which the waves paſs as through a ſieve. I would have repreſented their rocks, riſing from the depth of the abyſs, like mounds incapable of being moved, with cavernous ſides, preſenting briſtly beds of madrépores, and feſtooned with moveable garlands of *fucus*, *alga-marina*, and other ſea-weeds of all colours, which ſerve as ſhelter, and bedding, for the calves and horſes of the Sea.

During ſtorms, their dark baſes are covered with clouds of a phoſphoric light; and ſounds unutterable, iſſuing from their untraceable mazes, invite to the prey the ſilent legions of the inhabitants of the mighty Deep. I would have endeavoured to force my way into thoſe palaces of the Nereïds, in order to unveil myſteries hitherto concealed from the human eye, and to contemplate from afar the footſteps of that infinite Wisdom which are impreſſed on the oozy bottom of the Ocean. But reſearches ſo laborious, though ſo delightful; of ſuch importance to our fiſheries, and ſo fertile of materials for natural Hiſtory, far tranſcend the fortunes and the exertions of a Solitary.

I have

I have the confidence, however, to flatter myſelf with the belief, that the new Theory which I have preſented, reſpecting the cauſes of the general Currents, and of the Tides of the Ocean, may be rendered uſeful to Navigation. It appears to me, that a veſſel taking her departure hence in the month of March, with the courſe of our polar effuſions, and keeping in the middle of the Atlantic channel, might proceed, in Summer, all the way to the Eaſt-Indies, continually favoured by the current. This I am able even to prove by the experience of various Navigators. It is true that, during the ſeaſon which is the Winter of the South Pole, the weathering of the Cape is dangerous, becauſe the weſterly monſoon, which then predominates, in thoſe Seas, excites in them frequent ſtorms, as well as on the coaſts of India, which are oppoſed to it; but I believe theſe inconveniencies might be avoided, by ſtretching out into a higher Latitude.

The ſame veſſel might return from the Eaſt-Indies, ſix months afterwards, during our Winter, aided by the effuſions of the South Pole. Advantage might be taken, on the contrary, of the counter-currents of the general Currents, or of their lateral Tides, to go or return, at the intermediate ſeaſons, by coaſting along the Continents. It is eaſy to deduce from this theory other means of information for the navigation of all Seas: for example, aſſiſtance might be derived from thoſe currents for the diſcovery of new iſlands; for every iſland is ſituated at the extremity, or at the confluence of one or more currents, as every volcano is placed in a counter-tide.

Here I cloſe theſe nautical diſquiſitions, in which there are undoubtedly, inaccuracies of ſtyle, and manifold imperfections

perfections of various kinds; but determined by particular circumstances to bring this Work, without delay, before the tribunal of the Public, I have hastened to present my Country with this last testimony of my attachment. I reckon on the indulgence of the really intelligent, and presume to hope they will have the goodness to rectify my mistakes.

STUDIES

STUDIES
OF
NATURE.

STUDY FIRST.

IMMENSITY OF NATURE: PLAN OF MY WORK.

SOME years have elapſed, ſince I formed the deſign of compoſing a general Hiſtory of Nature, in imitation of *Ariſtotle*, *Pliny*, Chancellor *Bacon*, and ſeveral illuſtrious modern Authors. The field appeared to me ſo vaſt, that I could not believe the poſſibility of it's being entirely pre-occupied. Beſides, Nature invites to the cultivation of herſelf, perſons of every age and country; and if ſhe promiſes the golden harveſt of diſcovery, only to men of genius, ſhe reſerves ſome gleanings, at leaſt, for the ſimple and unlearned; for ſuch, eſpecially, as, like myſelf, are making a pauſe every ſtep they advance, tranſported at the beauty of her divine productions.

I was farther prompted to the execution of my great deſign, in the view of rendering an accept-

able ſervice to my fellow creatures, and of meriting their approbation; particularly that of *Louis* XVI. my illuſtrious benefactor, who, after the example of *Titus* and *Marcus-Aurelius*, devotes his whole attention to the felicity of mankind.

In Nature herſelf alone we muſt expect to find the laws of Nature; and we plunge into difficulty and diſtreſs, only in proportion as we deviate from theſe laws. To ſtudy Nature, therefore, is to act the part of a good ſubject, and of a friend to humanity. I have employed, in my reſearches, all the powers of reaſoning I poſſeſs; and, though my means may have been ſlender, I can ſay, with truth, that I have not permitted a ſingle day to paſs, without picking up ſome agreeable, or uſeful, obſervation.

I propoſed to begin the compoſition of my Work, when I had ceaſed from obſerving, and when I ſhould have collected all the materials neceſſary to a Hiſtory of Nature; but I found myſelf in the condition of the child, who, with a ſhell, had dug a hole in the ſand, to hold the water of the Ocean.

Nature is of unbounded extent, and I am a human being, limited on every ſide. Not only her general Hiſtory, but that of the ſmalleſt plant, far tranſcends

tranſcends my higheſt powers. Permit me to relate, on what occaſion I became ſenſible of this.

One day, in Summer, while I was buſied in the arrangement of ſome obſervations which I had made, reſpecting the harmonies diſcoverable in this Globe of ours, I perceived, on a ſtrawberry plant, which had been, accidentally, placed in my window, ſome ſmall winged inſects, ſo very beautiful, that I took a fancy to deſcribe them. Next day, a different ſort appeared, which I proceeded, likewiſe, to deſcribe. In the courſe of three weeks, no leſs than thirty-ſeven ſpecies, totally diſtinct, had viſited my ſtrawberry plant: at length, they came in ſuch crowds, and preſented ſuch variety, that I was conſtrained to relinquiſh this ſtudy, though highly amuſing, for want of leiſure, and, to acknowledge the truth, for want of expreſſion.

The inſects, which I had obſerved, were all diſtinguiſhable from each other, by their colours, their forms, and their motions. Some of them ſhone like gold, others were of the colour of ſilver, and of braſs; ſome were ſpotted, ſome ſtriped; they were blue, green, brown, cheſnut coloured. The heads of ſome were rounded like a turban, thoſe of others were drawn out into the figure of a cone. Here it was dark as a tuft of black velvet, there it ſparkled like a ruby.

There was not leſs diverſity in their wings. In ſome they were long and brilliant, like tranſparent plates of mother-of-pearl; in others, ſhort and broad, reſembling net-work of the fineſt gauze. Each had his particular manner of diſpoſing and managing his wings. Some diſpoſed theirs perpendicularly; others, horizontally; and they ſeemed to take pleaſure in diſplaying them. Some flew ſpirally, after the manner of butterflies; others ſprung into the air, directing their flight in oppoſition to the wind, by a mechaniſm ſomewhat ſimilar to that of a paper-kite, which, in riſing, forms, with the axis of the wind, an angle, I think, of twenty-two degrees and a half.

Some alighted on the plant to depoſit their eggs; others, merely to ſhelter themſelves from the Sun. But the greateſt part paid this viſit from reaſons totally unknown to me: for ſome went and came, in an inceſſant motion, while others moved only the hinder part of their body. A great many of them remained entirely motionleſs, and were like me, perhaps, employed in making obſervations.

I ſcorned to pay any attention, as being already ſufficiently known, to all the other tribes of inſects, which my ſtrawberry plant had attracted; ſuch as the ſnail, which neſtles under the leaves; the butterfly, which flutters around; the beetle, which digs

digs about it's roots; the ſmall worm, which contrives to live in the *parenchyme*, that is, in the mere thickneſs of a leaf; the waſp and honey-bee, which hum around the bloſſoms; the gnat, which ſucks the juices of the ſtem; the ant, which licks up the gnat; and, to make no longer an enumeration, the ſpider, which, in order to find a prey in theſe, one after another, diſtends his ſnares over the whole vicinity.

However minute theſe objects may be, they, ſurely, merited my attention, as Nature deemed them not unworthy of her's. Could I refuſe them a place in my general Hiſtory, when ſhe had given them one in the ſyſtem of the Univerſe? For a ſtill ſtronger reaſon, had I written the hiſtory of my ſtrawberry plant, I muſt have given ſome account of the inſects attached to it. Plants are the habitation of inſects; and it is impoſſible to give the hiſtory of a city, without ſaying ſomething of it's inhabitants.

Beſides, my ſtrawberry plant was not in its natural ſituation, in the open country, on the border of a wood, or by the brink of a rivulet, where it could have been frequented by many other ſpecies of living creatures. It was confined to an earthen pot, amidſt the ſmoke of Paris. I obſerved it only at vacant moments. I knew nothing of the inſects

which viſited it during the courſe of the day; ſtill leſs of thoſe which might come only in the night, attracted by ſimple emanations, or, perhaps, by a phoſphoric light, which eſcapes our ſenſes. I was totally ignorant of the various ſpecies which might frequent it, at other ſeaſons of the year, and of the endleſs other relations which it might have, with reptiles, with amphibious animals, fiſhes, birds, quadrupeds, and, above all, with Man, who undervalues every thing which he cannot convert to his own uſe.

But it was not ſufficient to obſerve it, if I may uſe the expreſſion, from the heights of my greatneſs; for, in this caſe, my knowledge would have been greatly inferior to that of one of the inſects, who made it their habitation. Not one of them, on examining it with his little ſpherical eyes, but muſt have diſtinguiſhed an infinite variety of objects, which I could not perceive without the aſſiſtance of a microſcope, and after much laborious reſearch. Nay, their eyes are inconceivably ſuperior even to this inſtrument; for it ſhews us the objects only which are in it's focus, that is, at the diſtance of a few lines; whereas they perceive, by a mechaniſm of which we have no conception, thoſe which are near, and thoſe which are far off. Their eyes, therefore, are, at once, microſcopes and teleſcopes. Beſides, by their circular diſpoſi-

tion

tion round the head, they have the advantage of viewing the whole circuit of the heavens at the same instant, while those of the Astronomer can take in, at most, but the half. My winged insects, accordingly, must discern in the strawberry plant, at a single glance, an arrangement and combination of parts, which, assisted by the microscope, I can observe only separate from each other, and in succession.

On examining the leaves of this vegetable, with the aid of a lens which had but a small magnifying power, I found them divided into compartments, hedged round with bristles, separated by canals, and strewed with glands. These compartments appeared to me similar to large verdant inclosures, their bristles to vegetables of a particular order; of which some were upright, some inclined, some forked, some hollowed into tubes, from the extremity of which a liquid distilled; and their canals, as well as their glands, seemed full of a brilliant fluid. In plants of a different species, these bristles, and these canals, exhibit forms, colours, and fluids, entirely different. There are even glands, which resemble basons, round, square, or radiated.

Now, Nature has made nothing in vain. Wherever she has prepared a habitation, she immedi-

ately peoples it. She is never ſtraitened for want of room. She has placed animals, furniſhed with fins, in a ſingle drop of water, and in ſuch multitudes, that *Leewenhoek*, the natural Philoſopher, reckoned up to thouſands of them. Many others after him, and, among the reſt, *Robert Hook*, have ſeen, in one drop of water, as ſmall as a grain of millet, ſome 10, others 30, and ſome as far as 45 thouſand. Thoſe who know not how far the patience and ſagacity of an Obſerver can go, might, perhaps, call in queſtion the accuracy of theſe obſervations, if *Lyonnet*, who relates them in *Leſſer*'s Theology of Inſects *, had not demonſtrated the poſſibility of it, by a piece of mechaniſm abundantly ſimple. We are certain, at leaſt, of the exiſtence of thoſe beings whoſe different figures have actually been drawn. Others are found, whoſe feet are armed with claws, on the body of the fly, and even on that of the flea.

It is credible, then, from analogy, that there are animals feeding on the leaves of plants, like the cattle in our meadows, and on our mountains; which repoſe under the ſhade of a down imperceptible to the naked eye, and which, from goblets formed like ſo many funs, quaff nectar of the colour of gold and ſilver. Each part of the flower

* Book II. chap. 3. See the laſt note.

muſt

muſt preſent, to them, a ſpectacle of which we can form no idea. The yellow *antheræ* of flowers, ſuſpended by fillets of white, exhibit to their eyes, double rafters of gold in equilibrio, on pillars fairer than ivory; the *corolla*, an arch of unbounded magnitude, embelliſhed with the ruby and the topaz; rivers of nectar and honey; the other parts of the flowret, cups, urns, pavilions, domes, which the human Architect and Goldſmith have not yet learned to imitate.

I do not ſpeak thus from conjecture: for having examined, one day, by the microſcope, the flowers of thyme, I diſtinguiſhed in them, with equal ſurprize and delight, ſuperb flagons, with a long neck, of a ſubſtance reſembling amethyſt, from the gullets of which ſeemed to flow ingots of liquid gold. I have never made obſervation, of the *corolla* ſimply, of the ſmalleſt flower, without finding it compoſed of an admirable ſubſtance, half tranſparent, ſtudded with brilliants, and ſhining in the moſt lively colours.

The beings which live under a reflex thus enriched, muſt have ideas, very different from ours, of light, and of the other phenomena of Nature. A drop of dew, filtering in the capillary, and tranſparent, tubes of a plant, preſents, to them, thouſands of caſcades; the ſame drop, fixed as a wave on

on the extremity of one of it's prickles, an Ocean without a ſhore; evaporated into air, a vaſt aërial Sea. They muſt, therefore, ſee fluids aſcending, inſtead of falling; aſſuming a globular form, inſtead of ſinking to a level; and mounting into the air, inſtead of obeying the power of gravity.

Their ignorance muſt be as wonderful as their knowledge. As they have a thorough acquaintance with the harmony of only the minuteſt objects, that of vaſt objects muſt eſcape them. They know not, undoubtedly, that there are men, and, among theſe, learned men, who know every thing, who can explain every thing, who, tranſient like themſelves, plunge into an infinity on the aſcending ſcale, in which they are loſt; whereas they, in virtue of their littleneſs, are acquainted with an oppoſite infinity, in the laſt diviſions of time and matter.

In theſe ephemerous beings, we muſt find the youth of a ſingle morning, and the decrepitude of one day. If they poſſeſs hiſtorical monuments, they muſt have their months, years, ages, epochs, proportioned to the duration of a flower; they muſt have a chronology different from ours, as their hydraulics and optics muſt differ. Thus, in proportion as Man brings the elements of Nature near him, the principles of his Science diſappear.

Such,

Such, therefore, must have been my strawberry plant, and it's natural inhabitants, in the eyes of my winged insects, which had alighted to visit it; but though I had been able to acquire, with them, an intimate knowledge of this new world, I was still very far from having the History of it. I must have, previously, studied it's relations to the other parts of Nature; to the Sun which expands it's blossom, to the winds which sow it's seeds over and over, to the brooks whose banks it forms and embellishes. I must have known, how it was preserved in Winter, during a cold capable of cleaving stones asunder; and how it should appear verdant in the Spring, without any pains employed to preserve it from the frost; how, feeble and crawling along the ground, it should be able to find it's way, from the deepest valley, to the summit of the Alps, to traverse the Globe from north to south, from mountain to mountain, forming, on it's passage, a thousand charming pieces of chequered work, of it's fair flowers, and rose-coloured fruit, with the plants of every other climate; how it has been able to scatter itself from the mountains of Cachemire to Archangel, and from the *Felices*, in Norway, to Kamschatka; how, in a word, we find it, in equal abundance, in both American Continents, though an infinite number of animals is making incessant and universal war upon it, and no gardener is at the trouble to sow it again.

Supposing

Suppoſing all this knowledge acquired, I ſhould ſtill have arrived no farther than at the hiſtory of the *genus*, and not that of the *ſpecies*. The varieties would yet remain unknown, which have each it's particular character, according as they have flowers ſingle, in pairs, or diſpoſed in cluſters; according to the colour, the ſmell, and the taſte of the fruit; according to the ſize, the figure, the edging, the ſmoothneſs, or the downy clothing of their leaves. One of our moſt celebrated botaniſts, *Sebaſtian le Vaillant* *, has found, in the environs of Paris alone, five diſtinct ſpecies, three of which bear flowers, without producing fruit. In our gardens, we cultivate at leaſt twelve different ſorts of foreign ſtrawberries; that of Chili, of Peru; the Alpine, or perpetual; the Swediſh, which is green, &c. But how many varieties are there, to us totally unknown! Has not every degree of latitude a ſpecies peculiar to itſelf? Is it not preſumable, that there may be trees which produce ſtrawberries, as there are thoſe which bear peaſe and French-beans? May we not even conſider as varieties of the ſtrawberry, the numerous ſpecies of the raſpberry and of the bramble, with which it has a very ſtriking analogy, from the ſhape of it's leaves; from it's ſhoots, which creep along the ground, and replant themſelves; from the roſe-

* Botanicon Pariſienſe.

form

form of it's flowers, and that of it's fruit, the ſeeds of which are on the outſide? Has it not, beſides, an affinity with the eglantine and the roſe-tree, as to the flower; with the mulberry, as to the fruit; and with the trefoil itſelf, as to the leaves; one ſpecies of which, common in the environs of Paris, bears, likewiſe, it's ſeeds aggregated into the form of a ſtrawberry, from which it derives the botanic name of *trifolium fragiferum*, the ſtrawberry-bearing trefoil? Now, if we reflect, that all theſe ſpecies, varieties, analogies, affinities, have, in every particular latitude, neceſſary relations with a multitude of animals, and that theſe relations are altogether unknown to us, we ſhall find, that a complete Hiſtory of the ſtrawberry-plant would be ample employment for all the Naturaliſts in the world.

What a taſk, then, would it be, to write the Hiſtory, in like manner, of all the ſpecies of vegetables, ſcattered over the face of the whole Earth? The celebrated *Linnæus* reckoned up from ſeven to eight thouſand of them; but he had not travelled. The famous *Sherard*, it is ſaid, was acquainted with ſixteen thouſand. Another Botaniſt ſwells his catalogue up to twenty thouſand. Finally, one ſtill more modern, boaſts of having himſelf made a collection of twenty-five thouſand; and he eſtimates the number of thoſe which he has not ſeen, at four or five times as many. But all theſe enumerations

enumerations muſt be extremely defective, if it is conſidered, as has been remarked by this laſt Obſerver himſelf, that we know little or nothing of the interior of Africa; of that of the three Arabias, and even of the two Americas; very little of New Guinea, New Holland and Zealand, and of the innumerable iſlands of the South Sea, the greateſt part of which are themſelves ſtill undiſcovered. We know hardly any thing of the Iſle of Ceylon, except a little of the coaſt; of the great iſland of Madagaſcar; of the immenſe archipelagos of the Philippines and Moluccas, and of almoſt all the Aſiatic iſlands. As to that vaſt Continent, with the exception of ſome great roads in the interior, and ſome parts of the coaſt reſorted to by the traffick of Europe, we may affirm that it is wholly unknown to us.

How many immenſe diſtricts are there in Tartary, in Siberia, and even in many of the kingdoms of Europe, where the foot of Botaniſt never trod! Some, indeed, have given us a herbal of Malabar, Japan, China, &c. but if we reflect, that, in theſe countries, their reſearches never penetrated beyond the ſea-coaſt, and were generally confined to one ſeaſon of the year, when a part only of the plants, peculiar to each climate, appear; that they have viſited only the narrow regions adjoining to our European factories; that they have never dared

to

to plunge into deſerts, where they could have found neither ſubſiſtence nor guide; nor ventured themſelves among the numerous tribes of barbarous Nations, whoſe language they did not underſtand; we ſhall find reaſon to conclude, that their boaſted collections, however valuable, are ſtill extremely imperfect.

In order to be convinced of this, we have only to compare the time employed by them, in making their collections of plants, in foreign countries, with that which it coſt *Le Vaillant* to collect thoſe of the vicinity of Paris only. The learned *Tournefort* had already made this a particular ſtudy; and, after a maſter ſo indefatigable had completed his Work, all the Botaniſts of the capital, it was thought, might have gone to reſt. *Le Vaillant*, his pupil, had the courage to walk over the ſame ground after him, and diſcovered ſuch a conſiderable quantity of diſtinct ſpecies, overlooked by *Tournefort*, that he doubled, at leaſt, the catalogue of our plants. He made it amount to fifteen or ſixteen hundred. And even then, he did not include in this enumeration, thoſe which differ only in the colour of the flowers, and the ſpots of the leaves, though Nature frequently employs ſuch ſigns as theſe, in the vegetable world, to diſtinguiſh the ſpecies, and to form their true characters. Hear what

what *Boerhaave*, his illuſtrious Editor, ſays of his laborious reſearches:

Incubuit quippe huic labori ab anno 1696, *uſque in Martium* 1722; *toto quidem tanti decurſu temporis in eo occupatus ſemper, nullum præteriens unquam, cujus plantas haud excuteret, angulum: vias, agros, valles, montes, hortos, nemora, ſtagna, paludes, flumina, ripas, foſſas, puteos, undequaque luſtrans. Contigit ergo, crebro, ut detegeret maximi quæ* Tournefortii *intentiſſimos oculos effugerant**. (Preface to the *Botanicon Pariſienſe*, page 3 and 4.)

Sebaſtian le Vaillant, accordingly, employed no leſs than twenty-ſix whole years, in his own country, and with the aſſiſtance of his pupils, in completing his botanical deſcription of the plants of a few ſquare leagues; whereas the perſons who pretend to give us the Botany of many foreign coun-

* He devoted his whole attention to this laborious undertaking, from the year 1696 to March 1722. During a period of ſuch length, he was conſtantly and unweariedly employed in it, never paſſing by the ſmalleſt corner without examining what plants it contained. With the eye of an Obſerver, he pried into every place, the roads, fields, vallies, mountains, gardens, foreſts, pools, moraſſes, rivers, their banks, ditches, wells: hence he had, frequently, the good fortune, to diſcover many things which eſcaped even the eager eyes of the great *Tournefort*.

tries,

tries, were alone and unaſſiſted, and diſpatched the buſineſs in a few months. But, though his ſagacity and perſeverance ſeem to have left us nothing more to wiſh for, I have my doubts, whether he has made a complete collection of all the gifts which Flora ſcatters over our plains; and whether he has ſeen, if I may uſe the expreſſion, to the bottom of her baſket. Pliny obſerved plants, in places not comprehended in *Boerhaave*'s enumeration, and which grow on the tiles that cover our houſes, on rotten ſieves, and the heads of ancient ſtatues. It is, undoubtedly, certain, that we are, from time to time, diſcovering ſome, at no great diſtance from Paris, which have no place in the *Botanicon* of *Le Vaillant*.

For my own part, if I might be permitted to hazard a conjecture, reſpecting the number of the diſtinct ſpecies of plants, ſpread over the Earth, ſuch is my idea of the immenſity of Nature, and of her ſubdiviſions, that I am diſpoſed to believe, there is not a ſquare league of earth, but what preſents ſome one plant peculiar to itſelf, or, at leaſt, which thrives there better, and appears more beautiful, than in any other part of the world. This makes the number, of the primordial ſpecies of vegetables, amount to ſeveral millions, diffuſed over as many millions of ſquare leagues, of which the ſurface of our Globe conſiſts. The farther ſouth

we advance, the more their variety increaſes within ſpaces of the ſame dimenſion. The Iſle of Taïty, in the South Sea, was found to have a botany peculiar to itſelf, and which had nothing in common with that of the places in Africa and America, which are ſituated in the ſame latitude; nay, totally different from that of the adjacent iſlands. And if we now reflect, that each plant has ſeveral different names, in it's own country; that every Nation impoſes particular denominations, and that all theſe names, at leaſt the greater part, are varying every age, what difficulties does not the vocabulary alone oppoſe to the ſtudy of Botany?

All theſe preliminary notions, however, would ſtill form only a uſeleſs Science, did we even know, in the moſt complete detail, all the parts of which plants are compoſed. It is the combination of theſe parts, the attitude of the plants, their port, their elegance, the harmonies which they form, when grouped, or in contraſt with each other, which it would be intereſting to determine. I do not know that any thing has been ſo much as attempted on this ſubject.

As to their virtues, it may be affirmed, that they are, for the moſt part, unknown, or neglected, or abuſed. Their qualities are often perverted, in making cruel experiments on innocent animals, while

while they might be uſefully employed as miraculous remedies, to counteract the ills of human life. We have preſerved, for example, in the Royal Cabinet at Paris, arrows more formidable than thoſe of Hercules, though dipped in the blood of the ſnake of Lerna. Their points are impregnated with the juice of a plant ſo venemous, that, though expoſed to the air for many years, they can, with the ſlighteſt puncture, deſtroy the moſt robuſt of animals, in a few minutes. The blood of the creature, be the wound ever ſo trifling, inſtantly congeals. But if the patient, at the ſame inſtant, is made to ſwallow a ſmall quantity of ſugar, the circulation is immediately reſtored. Both the poiſon and the antidote have been diſcovered by the ſavages which inhabit the banks of the Amazon; and it is of importance to obſerve, that they never employ in war, but only in the chace, this murderous method of deſtroying life.

Wherefore do not we, who pretend to ſo much humanity and illumination, endeavour to aſcertain, by experiment, whether this poiſon might not be rendered medicinal in caſes of a ſudden diſſolution of the blood; and ſugar, in caſes of ſudden coagulation? Alas! how is it to be expected we ſhould apply to the preſervation of Mankind, the malignant and deſtructive qualities of a foreign vegetable, we who are continually

abuſing, for mutual deſtruction, the precious gifts which Nature has beſtowed, in the view of rendering human life innocent and happy? The elm and the beech, under the ſhade of which our ſhepherds and their mates delight to dance, are hewn down into carriages, for mounting the thundering ordnance. We intoxicate our ſoldiers into madneſs, that they may kill each other, without hatred, with that very juice of the vine which Providence has given to be the means of reconciliation among enemies? The lofty fir-trees, planted by the benignant hand of Nature, amidſt the ſnows of the North, to ſhelter and warm the inhabitants, are converted into maſts, for the veſſels of Europe, to carry the flames of devouring fire againſt the peaceful inhabitants of the Southern Hemiſphere; and the canvas, deſigned for the humble clothing of the village-maid, becomes a ſail for the plundering corſair, to extend his ravages to remoteſt India. Our crops, and our foreſts, are wafted over the Ocean, to ſpread deſolation over both the Old and New Worlds.

But let us drop the hiſtory of Man, and reſume that of Nature. If, from the vegetable, we make a tranſition to the animal kingdom, a field of incomparably greater extent preſents itſelf. An intelligent Naturaliſt, at Paris, ſome years ago, announced, that he was in poſſeſſion of more than thirty

thirty thouſand diſtinct ſpecies of animals. I know not whether the King's magnificent Cabinet may not contain more; but I know well, that his Herbals contain only eighteen thouſand plants, and that about ſix thouſand are in a ſtate of cultivation in the Royal Botanic Garden. This number of animals, however, ſo ſuperior to that of vegetables, is a mere nothing, in compariſon with what exiſts on the Globe.

When we recollect, that every ſpecies of plant is a point of union for different genera of inſects, and that there is not, perhaps, a ſingle one, but which has, peculiar to itſelf, a ſpecies of fly, butterfly, gnat, beetle, lady-bird, ſnail, &c. that theſe inſects ſerve for food, to other ſpecies, and theſe exceedingly numerous, ſuch as the ſpider, the dragon-fly, the ant, the formicaleo; and to the immenſe families of ſmall birds, of which many claſſes, ſuch as the wood-pecker, and the ſwallow, have no other kind of nouriſhment; that theſe birds are, in their turn, devoured by birds of prey, ſuch as kites, falcons, buzzards, rooks, crows, hawks, vultures, &c. that the general ſpoil of theſe animals, ſweeped off by the rains, into the rivers, and thence to the Sea, becomes the aliment of almoſt innumerable tribes of fiſhes, to the greateſt part of which the Naturaliſts of Europe have not hitherto given a name; that numberleſs

legions of river and ſea-fowls prey upon theſe fiſhes: we ſhall have good ground for believing, that every ſpecies of the vegetable kingdom ſerves as a baſis to many ſpecies of the animal kingdom, which multiply around it, as the rays of a circle round its centre.

At the ſame time, I have not included in this ſuperficial repreſentation, either quadrupeds, with which all the intervals of magnitude are filled, from the mouſe, which lives under the graſs, up to the camelopard, who can feed on the foliage of trees, at the height of fifteen feet; or the amphibious tribes; or the birds of night; or reptiles; or polypuſes, of which we have a knowledge ſo ſlender; or ſea inſects, ſome families of which, ſuch as the crab-fiſh, ſhrimp, and the like, would be alone ſufficient to fill the greateſt cabinets, were you to introduce but a ſingle individual of every ſpecies. I do not include the madrépore, with which the bottom of the ſea is paved between the Tropics, and which preſent ſo many different ſpecies, that I have ſeen, in the Iſle of France, two great halls filled with thoſe which were produced in the immediate vicinity of that Iſle, though there was but a ſingle ſpecimen of each ſort.

I have made no mention of inſects of many kinds, as the louſe and the maggot, of which every animal

animal ſpecies has its particular varieties, proper to itſelf; and which triple, at leaſt, the kingdom of creatures exiſting by reſpiration. Neither have I taken into the account, that infinite number of living things, viſible and inviſible, known and unknown, which have no fixed determination, and which Nature has ſcattered about, through the Air, over the Earth, and along the depths of the Ocean.

What an undertaking, then, would it be, to deſcribe each of theſe beings, with the ſagacity of a *Reaumur*? The life of one man of genius, would be ſcarcely ſufficient to compoſe the Hiſtory of a few inſects. However curious may be the memoirs tranſmitted to us, after the moſt careful reſearch, reſpecting the manners, and the anatomy, of the animals moſt familiarly known, in vain do we ſtill flatter ourſelves with our having acquired a complete acquaintance. The principal requiſite, in my opinion, is yet wanting; I mean, the origin of their friendſhips and of their feuds. In this conſiſts, if I am not miſtaken, the eſſence of their Hiſtory, to which muſt be referred their inſtincts, their loves, their wars; the attire, the arms, and the very form which Nature gives them. A moral ſentiment ſeems to have determined their phyſical organization. I know not of any Naturaliſt who has engaged in a reſearch of this ſort. The Poets have endeavoured to explain theſe

wonderful and innate inſtincts, by their ingenious fictions. The ſwallow Progné flies the foreſt; her ſiſter Philomela delights to ſing in ſolitary places. Progné thus, one day, addreſſes her:

Le déſert eſt-il fait pour des talens ſi beaux?
Venez faire aux cités eclater leurs merveilles:
Auſſi bien, en voyant les bois,
Sans ceſſe il vous ſouvient que Térée autrefois,
Parmi ces demeures pareilles,
Exerça ſa fureur ſur vos divins appas,—
Et c'eſt le ſouvenir d'un ſi cruel outrage,
Qui fait, reprit ſa ſœur, que je ne vous ſuis pas;
En voyant les hommes, helas!
Il m'en ſouvient bien davantage. *

I never hear the enchantingly melancholy ſong of a nightingale, ſhrouded in ſhrubbery, and the lengthened piou-piou, which interrupt, like ſighs, the muſic of that ſolitary ſongſter, without believing, that Nature had revealed her adventure to

* Thus imitated:

Why waſte ſuch ſweetneſs on the deſert air!
Come, charm the city with thy tuneful note.
Think too, in ſolitude, that form ſo fair
Felt violation: flee the horrid thought.

Ah! ſiſter dear, ſad Philomel replies,
'Tis this that makes me ſhun the haunts of men:
Terëus and Courts the anguiſh'd heart allies,
And haſtes, for ſhelter, to the woods again.

the

the ſublime *La Fontaine*, at the time ſhe inſpired him to compoſe theſe verſes. If theſe fables were not the hiſtory of men, they would be, to me, at leaſt a ſupplement to that of animals. Philoſophers of name, unfaithful to the teſtimony of their reaſon and conſcience, have dared to repreſent them as mere machines. They aſcribe to them blind inſtincts, which regulate, in a manner perfectly uniform, all their actions, without paſſion, without will, without choice, and even without any degree of ſenſibility. I one day expreſſed my aſtoniſhment at this to *J. J. Rouſſeau*; and ſaid to him, it ſeemed exceedingly ſtrange, that men of genius ſhould maintain a poſition ſo extravagant. He very ſagely replied, *The ſolution is this, When Man begins to reaſon, he ceaſes to feel.*

In order to confute the opinions of ſuch Philoſophers, I ſhall have recourſe, not to thoſe animals whoſe ſagacity and induſtry excite our admiration, ſuch as the beaver, the bee, the ant, &c. I ſhall produce only one example, taken from the claſs of thoſe which are moſt indocile, ſuch as fiſhes, and ſhall ſelect it from among a ſpecies, governed by an inſtinct the moſt impetuous and the moſt ſtupid, which is gluttony.

The ſhark is a fiſh ſo voracious, that he will not only devour his own ſpecies, when preſſed by hunger,

ger, but he ſwallows, without diſtinction, every thing that drops from a ſhip into the ſea, cordage, cloth, pitch, wood, iron, nay, even knives. Nevertheleſs, I have been a frequent witneſs of his abſtinence, in two remarkable circumſtances; the one is, however urged by famine, he never touches a kind of ſmall fiſh, ſpeckled with yellow and black, called the pilot fiſh, who ſwim juſt before his ſnout, to guide him to his prey, which he cannot ſee till he is cloſe to it; for Nature, as a counterbalance to the ferocity of this fiſh, has rendered him almoſt blind. The other caſe is this, when you throw into the ſea a dead fowl, the noiſe brings him to the ſpot, but on diſcovering it to be a fowl, he immediately retires, without devouring it; this has furniſhed ſailors with a proverb: *The ſhark flees from the feather*. It is impoſſible, in the firſt caſe, not to aſcribe to him ſome portion of underſtanding, which repreſſes his voracity, in favour of his guides; and not to attribute, in the ſecond, his averſion to feathered fleſh, to that univerſal reaſon, which, deſtining him to live along the ſhallows, where cadaverous ſubſtances, of creatures periſhing in the ſea, fall and are depoſited, inſpires him with an averſion for feathered animals, that he may not deſtroy the ſea-fowls, which reſort thither in great numbers, employed, like himſelf, in looking out for a livelihood, and in cleanſing the ſhores from impurities.

Other

Other Philoſophers, on the contrary, have aſcribed the manners of animals, as thoſe of men, to education; and their natural affections, as well as their animoſities, to reſemblance or diſſimilitude of form. But if friendſhip is founded in ſimilitude of form, how comes it, that the hen, who walks in ſecurity, at the head of her brood, among the horſes and oxen of a farm-yard, though part of her family is ſometimes accidentally cruſhed by the feet of thoſe animals, collects her young with anxious inquietude at ſight of the hawk, a feathered animal like herſelf, who appears in the air but as a black point, and whom, perhaps, ſhe hardly, if ever, ſaw before? Why does the dog, in the yard, fall a barking, in the night time, at the ſmell only of the fox, an animal which has a ſtrong reſemblance to himſelf? If habits of long ſtanding could influence animals, as they do men, how has it been poſſible to render the oſtrich of the deſert familiar to ſuch a degree, that he has been made to carry children on his plumeleſs crupper; whereas no ſkill has, hitherto, been able to tame the ſwallow, a bird which has, from time immemorial, built his neſt in our houſes?

Where can we find, among the Hiſtorians of Nature, a *Tacitus*, who ſhall unveil to us theſe myſteries of the Cabinet of Heaven, without an explanation of which, it is impoſſible to write the Hiſtory

Hiſtory of a ſingle animal on the Earth? We find no one ſpecies deviating, like the human, from the laws impoſed on it by Nature. Bees, univerſally, live in republics, as they did in the time of *Eſop*. The common fly has always been a vagabond, a herd without any police or reſtraint. How comes it that, among theſe, no *Lycurgus* has ever yet ariſen, to reduce them into order, for the general good; and to preſcribe to them, as Philoſophers tell us the firſt Legiſlators among men did, laws dictated by their weakneſs, and by the neceſſity of uniting in ſociety?

On the other hand, Whence is it, as *Machiavel* affirms of Nations poſſeſſing too much happineſs, that among the canine ſpecies, exulting in the ſuperiority of their ſtrength, no *Catiline* ariſes, to impel his aſſociates to take advantage of the ſecurity of their maſters, and deſtroy them at once; no *Spartacus* to rouſe them to liberty by his howling, that they may live as ſovereigns of the foreſt, they to whom Nature has given arms, courage, and ſkill to ſubdue, in whole armies, animals the moſt formidable? When ſo many trivial laws of Nature are, under our very eyes, unknown, or miſunderſtood, how dare we to aſſign thoſe which regulate the courſe of the ſtars, and which embrace the immenſity of the Univerſe?

To

To the difficulties oppoſed to us by Nature, let us add thoſe which we ourſelves throw in the way. Firſt, methods and ſyſtems of all ſorts prepare, in every man, his manner of viewing objects. I do not ſpeak of Metaphyſicians, who explain all by means of abſtract ideas; nor of Algebraiſts, with their formules; nor of Geometricians, with their compaſſes; nor of Chymiſts with their ſalts; nor of the revolutions which their opinions, though intolerant in the extreme, undergo in every age. Let us confine ourſelves to notions the moſt univerſally admitted, and ſupported by the higheſt authority.

To begin with Geographers. They repreſent the Earth as divided into four principal parts, whereas, in reality, there are only two. Inſtead of the rivers which water it, the rocks which form it's barriers, the chains of mountains which divide it into climates, and other natural ſubdiviſions, they exhibit it ſpeckled all over with parti-coloured lines, which divide and ſubdivide it into empires, dioceſes, principalities, electorates, bailliwicks, ſalt-magazines. They have diſfigured the originals, or ſubſtituted names without a meaning, in place of thoſe which the native inhabitants of every country had given them, and which ſo well expreſſed their nature. They call, for example, a city, near to that of Mexico, where the Spaniards

ſhed

ſhed ſuch oceans of human blood, the *City of Angels*, but to which the Mexicans give the name of *Cuet-lax-conpan*, that is, *the ſnake in the water*, becauſe that of two fountains, which iſſue from thence, one is poiſonous; they call the *Miſſiſſipi*, that great river of North America, which the natives denominate *Méchaſſipi*, *the father of waters*; the *Cordelieres*, thoſe high mountains bordering on the South Sea, which are always covered with ſnow, and which are called by the Peruvians, in the royal language of the Incas, *Ritiſuyu*, *ſnow-ridge*; and ſo of an infinite number of other proper names. They have ſtripped the works of Nature of their diſtinctive characters, and Nations of their monuments.

On reading theſe ancient names, with their explanations, in *Garcillaſo de la Vega*, in *Thomas Gage*, and the earlieſt navigators, you have impreſſed on the mind, by means of a few ſimple words, the landſcape of every country, and ſomething of it's natural Hiſtory: without taking into the account, the reſpect attached to their antiquity, for this renders the places, which they deſcribe, ſtill more venerable. Thoſe only of the Chineſe, who traffic with the Europeans, know that their country is called China. The name given it by the inhabitants is *Chium-hoa*, *the middle-kingdom*. They change the name of it, when the families of their ſovereigns become

become extinct. A new dynasty gives it a new name; thus the law has determined, to instruct Kings, that the destiny of their people was attached to them, as that of their own family. Europeans have destroyed all these correspondencies. They shall for ever bear the punishment of this injustice, as well as that of so many other of their violations; for, obstinately persevering in giving what names they please to the countries which they seize, or in which they settle, it comes to pass that, when you see the same countries on maps, or in Dutch, English, Portugueze, Spanish, or French books of travels, you are utterly incapable of distinguishing any thing. Their very longitude is changed, for every Nation now makes its own capital the first meridian.

Botanists mislead us still more. I have spoken of the perpetual variations of their dictionaries; but their method is no less faulty. They have devised, in order to distinguish plants, characters the most complicated, which frequently deceive them, though derived from all the parts of the vegetable kingdom, while they have never been able to express, by a single descriptive term, their combination, from which the unlearned can distinguish them at first sight. They must have magnifying glasses and scales, in order to class the trees of a forest. It is not sufficient to see them standing and

and covered with leaves, the Botaniſt muſt examine the flower, and frequently the fruit too. The clown knows them all perfectly, in the boughs which compoſe his faggot.

In order to give me an idea of the varieties of germination, I am ſhewn, in bottles, a long ſeries of naked grains of all forms; but it is the capſule which preſerves them, the downy tuft which reſows them, the elaſtic branch which darts them to a diſtance, that it imports me to examine. To ſhew me the character of a flower, it is preſented to me dry, diſcoloured, and ſpread out on the leaf of a herbary. Is it in ſuch a ſtate that I can diſtinguiſh a lily? Is it not on the brink of a rivulet, raiſing it's ſtately ſtem over the verdant declivity, and reflecting, in the limpid ſtream, it's beautiful calix *, whiter than ivory, that I diſcern, and admire,

* According to Botaniſts, the lily has no *calix*, but only a *corolla*, conſiſting of many petals. They call the flower a corolla, and the caſe which contains the flowers a calix. This is, evidently, an abuſe of terms. *Calix*, in Greek, and in Latin, means a cup; and *corolla*, a little crown. Now, an infinite number of flowers, as the cruciform, the papilionaceous, thoſe with long throats, and a multitude of others, are not formed like a coronet, nor their caſes like cups. I dare venture to affirm, that if Botaniſts had given the ſimple name of caſe, or wrapper, to the parts of the plant which incloſe and protect the flower before it blows, they would have been on the road to more than one curious diſcovery.

mire, the king of the vallies? Is not it's incomparable whiteneſs rendered ſtill more dazzling, when ſpotted, as with drops of coral, by the little, ſcarlet, hemiſpherical lady-bird, garniſhed with black ſpecks, which conſtantly reſorts to it as an aſylum? Who can diſcover the queen of flowers in a dried roſe? In order to it's being an object, at once, of love and of philoſophy, it muſt be viewed when, iſſuing from the cleft of a humid rock, it ſhines on it's native verdure, when the zephyr balances it, on a ſtem armed with thorns; when Aurora has bedewed it with her tears; when, by it's luſtre and it's fragrance, it invites the hands of lovers. A cantharide, ſometimes, lurking in it's corolla, heightens the glowing carmine, by preſenting the contraſt of his emerald-coloured robe; it is then this flower ſeems to ſay, that, ſymbol of pleaſure, from her charms, and the rapidity of her decay, like pleaſure too, ſhe carries danger around her, and repentance in her boſom.

Naturaliſts betray us into ſtill wider deviations from Nature, in attempting to explain, by uniform

diſcovery. This impropriety of elementary terms in the Sciences, is the firſt twiſt given to human reaſon; it is thereby put, from the very firſt ſetting out, entirely aſide from the path of Nature. See *Vol.* II. *Study* XI.

laws, and by the mere action of air, water, and heat, the expanſion of ſo many plants, growing on the ſame dunghill, of colours, forms, ſavours, and perfumes ſo different. Do they try to decompound the principles of them? Poiſon and food preſent, in their ſtoves, the ſame reſults. Thus Nature ſports herſelf with their art, as with their theory. The corn plant alone, gathered in handfuls only by the vulgar, anſwers a thouſand valuable purpoſes, while a multitude of vegetables have remained entirely uſeleſs, in the laboratories of the learned.

I remember my having read, many years ago, ſeveral grave diſſertations on the manner of employing the horſe-cheſnut as food for cattle. Every Academy in Europe has, at leaſt, propoſed it's own; and the reſult of all their learned diſquiſitions was, that the horſe-cheſnut was uſeleſs, unleſs prepared by a very expenſive proceſs, and that, even then, it was good only in the manufacture of tapers and hair powder. I was aſtoniſhed at this, not that Naturaliſts ſhould be ignorant of it's uſe, and that they had ſtudied it merely as an article of luxury, but that Nature ſhould have produced a fruit of no uſe even to the brute creation. But I was, at laſt, cured of my ignorance, by the brutes themſelves. I happened to take my walk, one day,

to

to the *Bois de Boulogne* *, with a branch of the horſe-cheſnut in my hand, when I perceived a goat feeding. I went up, and amuſed myſelf with ſtroking her. As ſoon as ſhe perceived the horſe-cheſnut bough, ſhe ſeized, and ſnapped it up, inſtantly. The lad who tended her told me, that the goats were all very fond of this plant, and that it contributed greatly to the increaſe of their milk. I perceived, at ſome diſtance, in the cheſnut alley, which leads to the *Château de Madrid*, a herd of cows eagerly looking for horſe-cheſnuts, which they greedily devoured, without ſauce or pickle. Thus, our learned and ingenious ſyſtems conceal from us natural truths, with which every peaſant is acquainted.

What a ſpectacle do our cabinets of preſerved animals preſent? To no purpoſe has the art of a *Daubenton* endeavoured to keep up the appearance of life. Let induſtry do it's utmoſt to preſerve the form, their ſtiff and motionleſs attitude, their fixed and ſtaring eyes, their briſtly hair, all declare that they have been ſmitten with the ſtroke of death. In ſuch a ſtate, even beauty itſelf inſpires horror; whereas objects the moſt homely are agreeable, when placed in the ſituation which Na-

* The *Bois de Boulogne*, and *Château de Madrid*, are a wood, and caſtle, not many miles from Paris.

ture has assigned them. I have been often highly diverted, in the West-Indies, at the sight of a crab on the sand, straining, with his claws, to break into a huge cocoa-nut; or a shaggy ape balancing himself on the summit of a tree, at the extremity of a *liane*, loaded with pods and brilliant flowers.

Our books of Natural History are merely the romance of Nature, and our cabinets her tomb. To what a degree have our speculations and our prejudices degraded her? Our treatises on Agriculture shew us, on the plains of Ceres, nothing but bags of grain; in the meadows, the beloved haunt of the nymphs, only bundles of hay; and in the majestic forest, only cords of wood and faggots.

What shall we say of the violence done to her by Pride and Avarice? How many charming hills have been reduced to a state of villanage, by our laws! What majestic rivers degraded into servitude by imposts!

The History of Man has been disfigured in a very different manner. If we except the interest which religion, or humanity, has prompted some good men to take, in favour of their fellow-creatures, the rest of Historians have written under the impulse of a thousand different passions. The Politician represents Man, as divided into nobility and

and commonalty, into papiſts and huguenots, into ſoldiers and ſlaves; the Moraliſt, into the avaricious, the hypocritical, the debauched, the proud; the Tragic Poet, into tyrants and their victims; the Comic, into drolls and buffoons; the Phyſician, into the pituitous, the bilious, the phlegmatic. They are univerſally exhibited as ſubjects of averſion, of hatred, or of contempt: Man has been univerſally diſſected, and now nothing is ſhewn of him but the carcaſe. Thus the maſter-piece of Creation, like every thing elſe in Nature, has been degraded by our learning.

I do not mean to affirm, however, that from ſuch partial means, no uſeful diſcovery has proceeded: but all theſe circles, within which we circumſcribe the Supreme Power, far from determining it's bounds, only mark the limits of human genius. We accuſtom ourſelves to crowd all our own ideas into that narrow ſpace, and diſhoneſtly to reject all that does not accord with them. We act the part of the tyrant of Sicily, who fitted the unhappy traveller to his bed of iron: he violently ſtretched, to the length of the bed, the limbs of thoſe who were ſhorter, and cut ſhort the limbs of thoſe who were longer. It is thus we apply all the operations of Nature to our pitiful methods, in order to reduce the whole to one common ſtandard.

Hurried away myself, by the spirit of the age in which I live, I gave, at the end of the journal of my voyage to the Isle of France, a system of botany, in which I pretended to explain the expansion of plants, as our Naturalists explain that of madrépores, from the mechanism of the small animals which constitute them. I quote this Work, though I composed it merely as an amusement, to prove how easy it is to support a false principle by true observations; for having communicated it to *J. J. Rousseau*, who was, it is well known, a great proficient in Botany, he said to me; *I do not adopt your system; but it would cost me, at least, six months to refute it; and even then, I could not flatter myself with the certainty of having succeeded.* Had the decision of this candid gentleman been wholly unreserved, it could not have justified my libertinism.

Fiction embellishes the history of Man only, it degrades that of Nature. Nature is herself the source of all that is ingenious, amiable, and beautiful. By applying to her the violence of our imaginary laws, or by extending to all her operations, those with which we are acquainted, we conceal others, worthy of the highest admiration, with which we are totally unacquainted. We add, to the cloud with which she veils her divinity, that of our own errors. They get into credit by time, by professorships, by books, by protectors, by associations,

ciations, and especially by pensions; whereas no one is paid for searching after truths, which have the improvement of Mankind for their only object. We carry with us, into researches so independent and so sublime, the passions of the college and of the world, intolerance and envy.

Those who enter first on the career, oblige those who come after them to walk in their footsteps, or to give it up; as if Nature were their patrimony, or, as if the study of Nature were an exclusive trade, that did not admit of every one's participation. What trouble did it cost to eradicate in France, the metaphysics of *Aristotle*, which had become a species of religion? The philosophy of *Descartes*, which supplanted it, might have subsisted to this day, had it's revenues been as ample. That of *Newton*, with it's attractions, is not more solidly established. I have an unbounded respect for the memory of these great men, whose very deviations have assisted us, in opening great highways through the vast empire of Nature; but, on more occasions than one, I shall combat their principles, and, especially, the general applications which have been made of them, in the full persuasion, that, if I renounce their systems, I promote their intentions. It was the study of their whole life to raise men toward the DEITY, by their sublime discoveries, without suspecting, that the

laws which they were eſtabliſhing in Phyſics, might, one day, ſerve to ſubvert thoſe of Morality.

In order to form a right judgment of the magnificent ſpectacle of Nature, we muſt ſuffer every object to remain in it's place, and remain ourſelves in that which ſhe has aſſigned to us. It is from a regard to our happineſs, that ſhe has concealed from us the laws of her Omnipotence. How is it poſſible for a being ſo feeble as Man, to embrace infinite ſpace? But ſhe has brought within our graſp what it is at once uſeful and delightful to know: namely, the emanations from her beneficence. In the view of uniting Mankind, by a reciprocal communication of knowledge, ſhe has given to each of us, in particular, ignorance, treaſuring up Science in a common ſtock, to render us neceſſary and intereſting to each other.

The Earth is covered over with vegetables and animals, the ſimple vocabulary of which no Scholar, no Academy, no one Nation, will ever be able perfectly to acquire; but it is to be preſumed, that the human race is acquainted with all their properties. In vain do enlightened Nations boaſt, that they are the great repoſitories of all the Arts and Sciences. It is to Savages, to men utterly unknown, that we are indebted for the firſt obſervations, which are the ſource of all Science. It is

neither

neither to the polished Greeks nor Romans, but to Nations which we denominate barbarous, that we owe the use of simples, of bread, of wine, of domestic animals, of cloths, of dye-stuffs, of metals, and of every thing most useful, and most agreeable, for human life.

Modern Europe glories in her discoveries; but the invention of the art of Printing, one of the fairest titles to immortality, is to be ascribed to a person so obscure, that several cities of Holland, of Germany, nay, of China, have claimed the discovery as their own. *Galileo* would never have calculated the gravity of air, but for the observation of a fountain-player, who remarked that water could rise only up to thirty-two feet in the tubes of a forcing engine. *Newton* had never read the starry heavens, unless a spectacle-maker's children, in Zealand, had, at play, with the lenses in their father's shop, suggested the first idea of the telescopic cylinder. Our artillery would never have subjugated the New World, but for the accidental discovery of gun-powder by a lazy monk; and whatever glory Spain may pretend to derive from the discovery of that vast Continent, the Savages of Asia had planted Empires there, long before the arrival of *Christopher Columbus*. What must have become of that great man himself, if the good and simple inhabitants whom he found in the country

country had not ſupplied him with proviſions? Let Academies, then, accumulate machines, ſyſtems, books, elogiums: the chief praiſe of all is due to the ignorant, who furniſhed the firſt materials.

Advancing no higher claim, I preſume to contribute my humble offering. It is the fruit of many years of application, which, amidſt ſtorms long and ſevere, ſtole away in theſe calm reſearches, like a ſingle day of ſerenity. I earneſtly wiſhed, if it ſhould not be permitted me to reach a boundary, at which to ſtop, to communicate to others, at leaſt, the pleaſure which I had enjoyed on my way.

I have conveyed my obſervations in the beſt ſtyle of which I am capable; frequently ſtepping aſide to the right hand and to the left, as the ſubject carried me; ſometimes abandoning myſelf to a multitude of projects, which the infinite intelligence of Nature inſpires; ſometimes dwelling with complacency on happier ſeaſons and ſituations, which are never more to return; ſometimes plunging into futurity, panting after a more fortunate ſtate of being, of which the goodneſs of Heaven affords us now and then a glimpſe, through the dark clouds of this wretched life. Deſcriptions, conjectures, perceptions, views, objections, doubts, nay, my very ignorances, I have heaped all on one pile;

pile; and I have given to these ruins the name of *Studies*, as a Painter does to the studies of a great original, to which he was unable to give a finishing.

Amidst this disorder, it was necessary, however, to adopt something like method, without which, the confusion of the matter must have still more increased the insufficiency of the Author. I have followed the most simple. First, I endeavour to refute the objections raised against a Providence; I, then, proceed to examine into the existence of certain sentiments, which are common to all men, and which constrain us to acknowledge, in all the works of Nature, the laws of her wisdom and goodness; and, finally, I make application of these laws to the Globe, to Plants, to Animals, and to MAN.

Such, from the outset, is the manner in which I propose to direct my course. If, in the rapid sketch I am going to present of it, the Reader should be disgusted with its driness, I must intreat him to reflect, that the same complaint must lie against all abridgments; that, in return, I spare him the fatigue of a preface; and that *Pliny*, who had a much better head than mine, has not hesitated to make up the first book of his Natural History, of the bare titles of the Chapters which compose it.

I said,

I ſaid, then, to myſelf: In the FIRST PART of my Work, I will diſplay the bleſſings beſtowed by Nature, on the age in which we live; and the objections which have been ſtarted in it, againſt the Providence of it's AUTHOR. I will conceal no one of theſe that I know of; and in order to give them greater force, I will exhibit them in their combination. I will employ, in refuting them, not metaphyſical reaſonings, like thoſe of which the objections conſiſt, and which never brought any diſpute to a termination, but the facts themſelves of Nature, which admit of no reply. With theſe ſame facts, I will raiſe, in my turn, difficulties which militate againſt the principles of human Science, and which have been deemed infallible. I will from thence proceed to infer the feebleneſs of our reaſon; I will enquire whether there be univerſal truths, and what we are to underſtand by order, beauty, correſpondency, harmony, pleaſure, happineſs, and their contraries; and, finally, what an organized body is.

From this examination of our faculties, and of the effects of Nature, will reſult the evidence of many phyſical laws, conſtantly directed to one ſingle end, and that of a moral law, which affects Man alone, and the ſentiment of which has been univerſal, in all ages, and among all Nations. Theſe are neceſſary preliminaries. Before we attempt

tempt to rear the fabric, the ground muſt be cleared, and the foundation laid.

In the SECOND PART, I ſhall make application of theſe laws to the Globe; I ſhall examine it's form, it's extent, the diviſion of it's Hemiſpheres, and as it is compoſed, like every other organized work of Nature, of parts ſimilar, and of parts contrary. I ſhall conſider, ſucceſſively, it's different elements, and the manner of their adaptation to each other, the fire to air, the air to water, the water to the earth. This order eſtabliſhes among them a real ſubordination, of which the Sun is the principal agent. But he is not the only mover in Nature, and ſtill leſs the Sovereign Diſpoſer. His uniform action on the elements would, at laſt, ſeparate or confound them. Other laws counterbalance his, and maintain the general harmony.

I ſhall point out the admirable variety of his courſe, the effects of his heat and light, and the wonderful manner in which they are weakened or multiplied in the Heavens, in the inverſe ratio of latitudes and ſeaſons. I ſhall ſpeak of the great reverberations of Heaven, of the Moon, of the *Aurora Borealis*, of the Stars, and of the myſteries of Night, only ſo far as the human eye is permitted to perceive them, and the heart to feel their impreſſion.

I ſhall

I ſhall ſpeak, likewiſe, of the nature of *Fire*, not to explain it, but to evince our profound ignorance of the ſubject. This element, which renders all things elſe perceptible, itſelf eludes our moſt eager reſearches. We ſhall demonſtrate, that there is neither animal, nor plant, nor even foſſil, capable of ſubſiſting any length of time in it. It is the only being which increaſes it's bulk by communicating itſelf. It penetrates all bodies, without being penetrated by them. It is diviſible only in one dimenſion. It has no gravity. Though nothing attracts it to the centre of the Earth, it is diffuſed through all the parts of the Globe. It's nature differs from that of all other bodies. It's deſtructive and indefinable character ſeems to favour the opinion of *Newton*, who conſidered it only as a motion communicated to matter, and thereby reduced the number of Elements to three. However, as it is one of the four general principles of life, in every living creature; as we often diſcover it, in others, in a dormant ſtate, and as there is no one, as we ſhall ſee, but what has organs, or parts, diſpoſed to weaken, or to multiply theſe effects, we muſt acknowledge it not only to be an Element, but Nature's primary agent.

From the Fire I ſhall paſs to the *Air*. I ſhall examine the quality which it has of expanding and contracting, of heating and cooling; and the effects

fects of that vaſt ſtratum of frozen air which ſurrounds our Globe, about a league above the ſurface, and of which hardly any one of the phenomena has hitherto been explained.

I ſhall, next, conſider the effects of *Water:* in what manner heat evaporates, and cold fixes it; it's different exiſtences; of volatility in the air, in clouds, in dew, and in rain; of fluidity on the earth, in rivers, and in Seas; of ſolidity at the Poles, and on lofty mountains, in ſnow and ice. I ſhall enquire, how the Seas, which are the great reſervoirs of this element, are diſtributed, with relation to the Sun; how they receive from him, through the mediation of the air, a part of their movements; in what manner they continually renew their waters, by means of the ice accumulated at the Poles; the annual or periodical fuſion of which, maintains their flux and reflux as conſtantly, as the fuſion of the ices on the ſummit of high mountains renews and ſupplies the waters of great rivers. I ſhall hence deduce the phenomena of the Tides, of the Monſoons in the Indian Ocean, and of the principal Currents of the vaſt watery Element.

I ſhall, afterwards, hazard my conjectures reſpecting the quantity of water which ſurrounds the Earth, in the three ſtates of volatility, fluidity, and

and ſolidity; and ſhall examine whether it is poſſible, that, on being all reduced to a ſtate of fluidity, they ſhould entirely cover the Globe.

I ſhall conſider in what manner all the parts of the *Earth*, that is, the dry land, are diſtributed with relation to the Sun; ſo that there ſhould be no cavity of valley, nor elevation of rocky mountain, but what muſt be, at ſome ſeaſon of the year, expoſed to his rays, and diſpoſed, at the ſame time, in the moſt perfectly adapted order, to multiply, or to mitigate his heat, by it's form, or even by it's colour. I will demonſtrate that, notwithſtanding the apparent irregularity of the different parts of this Globe, they are oppoſed, with ſo much harmony, to the different currents of air, that there is no one but what is, by turns, ventilated by winds, hot, cold, dry, and humid; that the cold winds blow moſt conſtantly into warm countries, and warm winds into cold countries; that theſe countries, in their turn, re-act on the air; ſo that the cauſe of the winds is not to be ſought, according to the received opinion, in the places whence they proceed, but in thoſe which they viſit.

I ſhall, after that, ſpeak of the direction of mountains, of their declivities, and of their aſpects, with relation to the lakes and Seas, whoſe emanations their different ridges are all adapted to receive;

receive; of the matter which attracts them, and fixes round their peaks, rising like so many electric needles.

Finally, I shall examine, For what reason Nature has divided the Globe into two Hemispheres; what means she employs to accelerate, or retard, the course of rivers, and to protect their mouths against the movements and currents of the Ocean. I shall treat of banks, of shallows, of rocks, of isles, whether in seas or rivers; and I shall prove, I am confident to say, to a demonstration, that these parcels detached from the Continent, are no more ruinous fragments, violently separated from them, than bays, gulfs, and inland-seas, are violent irruptions of the Ocean.

I shall terminate this part, by indicating the principal agents, employed by Nature, in repairing her works: how she makes use of fire to purify, in the form of thunder, the air, so frequently loaded with mephitic vapours during the violent heats of Summer; and the waters of great lakes and Seas, by the volcanos which she has placed in their neighbourhood, at the extremity of their currents, and which she has multiplied in warm countries; how she cleanses the basons of these very waters, which, in the course of a few ages, would be choked up by the accumulated spoils of

the Earth, by means of tempeſts and hurricanes, which agitate them to the very foundation, and cover their banks with the wreck; and how, after having reſtored theſe wrecks to their firſt elements, by fires in the air, by volcanos, and the perpetual motion of the waves, which reduces them to ſand, and to an impalpable powder on the ſhore of the Sea, ſhe repairs, by means of winds and attractions, the inceſſant diminution of the mountains, occaſioned by the rains and torrents.

I ſhall demonſtrate, in a word, that, notwithſtanding the enormous maſſes of the mountains, the profundity of the vallies, the tempeſtuous Oceans, and temperatures the moſt oppoſite, which enter into the compoſition of this Globe, the communication of all it's parts has been rendered eaſy to a being ſo ſmall, and ſo feeble, as Man, and is poſſible only to him. This laſt view will furniſh me with ſome curious conjectures reſpecting the earlieſt voyages undertaken by Mankind.

I flatter myſelf, that I have ſaid enough to ſhew, in this ſimple proſpectus, that the ſame Intelligence, whoſe productions we ſo juſtly admire in plants and animals, preſides equally in the edifice which we inhabit. The Earth has, hitherto, been conſidered as only in a ſtate of ruin; and it

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is this prejudice which renders the ſtudy of Geography ſo inſipid; but I venture to affirm that, after peruſing my trivial obſervations, the courſe of a rivulet, on a map, will appear more agreeable than the port of a plant in a Botaniſt's herbal, and the topography of a place, as intereſting as it's landſcape.

In the THIRD PART of this Work, I will ſhew how the different parts of plants are diſpoſed in correſpondence with the Elements, in ſuch a manner that, far from being a neceſſary production of theirs, as ſome Philoſophers pretend, they are, on the contrary, almoſt always in oppoſition to their action. I ſhall refer, therefore, their flowers to the Sun; the thickneſs of their barks, the ſcurf which covers their buds, the hair, the down, the reſinous ſubſtances with which they are cloathed, to the abſence of ſolar heat; the pliancy, or ſtiffneſs, of their ſtems, to the different impulſions of the Air; their leaves, to the waters of Heaven; finally, their roots, to ſands, to mires, to rocks, by their fibres, their pivots, and their long cordage. This laſt relation of plants to the Earth is, if I may judge, the moſt important of all, though the leaſt obſerved, for there is not a ſingle one, but what is attached to it, whether it floats in water, or balances itſelf in the air; no one but derives part, at leaſt, of it's nutriment from thence, and,

in it's turn re-acts on the Earth, by the ſhade which contributes to it's freſhneſs, by the offal which fertilizes it, and by the roots which bind it's different *ſtrata*.

I ſhall adhere, however, to the exterior characters by which Nature ſeems to divide them into different genera. Their principal character, it is very difficult to determine, not only becauſe the ſimpleſt plant unites a very great variety of relations to all the Elements, but becauſe Nature does not place the character of her works, in any one of the parts, but in their combination. We ſhall ſeek that of each plant, therefore, in it's grain, which, as being the principle, muſt unite every thing proper for it's expanſion, and determine, at leaſt, the Element in which it muſt grow. Thoſe, accordingly, which have grains extremely volatile, or furniſhed with tufts of down, pinions, ſails, &c. ſhall be referred to the Air. They grow, in fact, in places expoſed to the wind, as moſt part of the gramineous, of the thiſtle tribe, &c. Thoſe which have fins, floaters, and other inſtruments of ſwimming, ſhall be aſſigned to the Water; not only ſuch as the fucus, the alga, and other ſea-plants, but the cocoa-tree, the walnut, the almond, and other vegetables which affect the Water's edge. Thoſe, finally, which, by their roundneſs, and other varieties of form, are adapted for rolling, ſpringing,

ſpringing, câtching, &c. and are ſuſceptible of various ôther movements, ſhall be allotted to the Earth, properly ſo called.

This reference of plants to Geography, preſents to us, at once, a great general order of eaſy comprehenſion, and a multitude of ſubdiviſions, which we may run over, very agreeably, in detail. Firſt, their genera divide themſelves, like thoſe of animals, into aërial, aquatic, and terreſtrial. Then, their claſſes are ſubdivided relatively to the Zones, and to the degrees of latitude of each Zone; ſuch are, to the South, the claſs of palms, and, to the North, that of firs; and their ſpecies to the territory of that Zone, according as it is champaign, mountainous, rocky, marſhy, &c. Accordingly, in the claſs of palms, the cocoa-tree of the ſea-ſhore, the latanier on the ſtrand, the date of the rocks, the palmiſt of the mountains, and ſo on, crown the various ſites of the torrid Zone; whereas in that of firs, the pine, the ſpruce, the larch, the cedar, &c. divide among themſelves the empire of the North. This order, by putting every vegetable in it's natural place, furniſhes us, beſides, with the means of tracing the uſe of all it's parts; and, I am bold enough to affirm, of tracing the reaſons which have determined Nature to vary their form, and to create ſo many ſpecies of the ſame genus, and ſo many varieties of the ſame ſpe-

cies, by diſcovering to us the admirable correſpondency which they have, in every latitude, with the Sun, the Winds, the Water, and the Earth.

On this plan, we have a glimpſe of the light which Geography may diffuſe over the ſtudy of Botany; and of the light with which Botany, in it's turn, may illuminate Geography; for, ſuppoſing we were enabled to form botanical charts, in which, by colours and ſigns, ſhould be repreſented, in each particular country, the reign of each vegetable there produced, by determining it's centre and limits, we might perceive, at once, the fecundity proper to each diſtrict. This knowledge would ſupply very ample means of rural economy, as we might ſubſtitute to the indigenous plants which were there in greateſt abundance, and moſt vigorous, ſuch of our domeſtic plants as are of the ſame ſpecies, and which would there infallibly ſucceed. Beſides, theſe different claſſes of vegetables would, in their various natural arrangement, indicate the degrees of the humidity, of the drineſs, of the cold, of the heat, and of the elevation of each diſtrict, with a preciſion which our barometers, thermometers, and other phyſical apparatus, can never attain. I omit a multitude of other relations, productive of pleaſure and of utility, which would reſult from ſuch claſſification, but which I ſhall endeavour to unfold in their place.

In

In the FOURTH PART, which treats of Animals, I ſhall purſue the ſame track. I ſhall preſent, firſt, their relations to the Elements. Beginning with that of Fire, I ſhall conſider the relation which they have to the Luminary which is the ſource of it, from their eyes furniſhed with lids and laſhes, to moderate the luſtre of his light; from that ſtate of torpitude, called ſleep, into which moſt of them fall, when he is no longer above the Horizon; and by the colour of their ſkin, and the thickneſs of their furs, correſponding to their diſtance from him.

We ſhall then trace the relations in which they ſtand to the Air, by their attitude, their weight, their lightneſs, and the organs of reſpiration; to the Water, by the various curves of their bodies, the unctuoſity of their hair and plumage, their ſcales and fins; and, finally, to the Earth, by the form of their feet, ſometimes forked, or armed with prongs and claws, adapted to a hard ſoil, ſometimes broad, or furniſhed with a hide, ſuited to a yielding ſoil, and by other means of progreſſion, which Nature has varied, in proportion to the obſtacles which are to be ſurmounted.

On the whole of this we ſhall obſerve, as in the caſe of Plants, that ſo many configurations, ſo different, far from being, in animals, mechanical ef-

fects of the action of the Elements in which they live, are, on the contrary, almoſt always, in the inverſe ratio of theſe very cauſes. Thus, for example, a great many fiſhes are caſed in rough and hard ſhells, in the boſom of the waters; and many animals, the inhabitants of the rocks, are clothed with ſoft furs. We ſhall divide animals, therefore, as we did vegetables, by referring their genus to the Elements, their claſſes to the Zones, and their ſpecies, to the different Diſtricts of each Zone. This arrangement, at once, puts every animal in it's natural place; but we ſhall reduce it to a fixedneſs of determination, ſtill more preciſe, and more intereſting, by referring the ſpecies of animal to that of the plant which a particular Diſtrict produces in greateſt abundance.

Nature herſelf indicates this order. She has adapted to plants, the ſmelling, the mouths, the lips, the tongues, the jaws, the teeth, the beaks, the ſtomach, the chylification, the ſecretions which enſue, in a word, the appetite and inſtinct of animals. It cannot, indeed, be affirmed with truth, that every ſpecies of animal lives on one ſingle ſpecies of plant; but any perſon may convince himſelf, by experiment, that each of them prefers ſome one to every other, when permitted to chooſe. This preference is particularly remarkable, at the ſeaſon when the production of their young engages attention.

attention. Then they are determined in favour of that which provides them, at once, with nutriment, litter, and ſhelter, in the moſt perfect ſuitableneſs to their ſituation. Thus the goldfinch affects the thiſtle, and hence, in the French language, derives his name from that of the plant *, becauſe he finds a rampart in it's prickly leaves, food in it's ſeeds, and materials for his neſt in it's down. The bird-fly of Florida, for ſimilar reaſons, prefers the bignonia: this is a creeping plant, which finds it's way to the tops of the higheſt trees, and frequently covers the whole trunk. He builds his neſt in one of it's leaves, which he rolls into the form of a cornet; he finds his food in it's red flowers, reſembling thoſe of the foxglove, the nectareous glands of which he licks; he plunges his little body into them, which appears in the heart of the flower, like an emerald ſet in coral; and he gets in, ſometimes, ſo far, that he ſuffers himſelf to be ſurprized there, and caught.

In the neſts of animals, then, we ſhall look for their character, as we ſought that of plants in their grains. It is from theſe we ſhall be enabled to determine the Element in which they muſt live, the proper ſite of their habitation, the aliment beſt adapted to their conſtitution, and the firſt leſſons

* In French, goldfinch is *chardonneret*, and thiſtle *chardon*.

of

of induſtry, of love, or of ferocity, which they receive from their parents. The plan of their life is contained in their cradles. However ſtrange theſe indications may appear, they are thoſe of Nature, who ſeems to tell us, that we may diſtinguiſh the character of her children, like her own, in the fruits of love, and in the care which they take of their poſterity.

She, frequently, lodges under the ſame roof, the vegetable and animal life, and unites the deſtiny of the one to that of the other. We ſee them burſting together from the ſame ſhell, blowing, expanding, propagating, dying, in a ſimilar progreſſion. At the ſame inſtant of time they preſent, if I may be allowed the expreſſion, the ſame metamorphoſes. While the plant is unfolding, in ſucceſſion, it's germs, it's buds, it's flowers, it's fruits, the inſect is diſplaying, ſucceſſively, on one of it's leaves, the egg, the worm, the nymph, the butterfly, which contains, like it's parents, the ſeeds of it's poſterity, with thoſe of the plant which nouriſhed it. It is thus that fable, far leſs marvellous than Nature, incloſed the life of the Dryad within the bark of the Oak.

Theſe relations are ſo ſtriking, in inſects, that Naturaliſts themſelves, notwithſtanding their prodigious number of iſolated, and indeterminable claſſes,

claſſes, have characterized ſome of them by the name of the plant on which they live; ſuch are the caterpillar of the tithymale, and the ſilk-worm of the mulberry. But I do not believe there is a ſingle animal which deviates from this plan, not even excepting the carnivorous. Though the life of theſe laſt appears to be, in ſome meaſure, ingrafted on that of the living ſpecies, there is not one among them, but what makes uſe of ſome ſpecies of vegetable. This is obſervable, not only in dogs, which feed on the graſs that bears their name, and in wolves, foxes, birds of prey, which eat the plants denominated from the names of the reſpective animals, but even in the fiſhes of the Sea, which are entire ſtrangers to our Element. They are attracted, at firſt, to the banks, by inſects, whoſe ſpoils they collect, which eſtabliſhes between them and vegetables, intermediate relations; afterwards by the plants themſelves, for moſt of them come to ſpawn on our coaſts, only when certain plants are in flower, or in fruit. If theſe happen to be deſtroyed, the fiſhes viſit us no longer.

Denis, Governor of Canada, relates, in his Natural Hiſtory of North America*, that the cod, which, in ſhoals, uſed to frequent the coaſts of the

* Vol. II. chap. 22. page 350.

Iſland

Iſland of Miſcou, diſappeared in 1669, becauſe in the year preceding, the forests had been devoured by a conflagration. He remarks, that the ſame cauſe had produced the ſame effect in different places. Though he aſcribes the diſappearance of theſe fiſhes to the particular effects of fire, and is, in other reſpects, a very intelligent Writer, we ſhall demonſtrate, by other curious obſervations, that it muſt have been occaſioned by the deſtruction of the vegetables which uſed to attract them to the ſhore. Thus, every thing in Nature is in ſtrict alliance. The Fauns, the Dryads, and the Nereids, walk every where hand in hand.

What a charming ſpectacle would a botanical Zoology preſent? What unknown harmonies would be reflected from a plant to an animal, and from an animal to a plant! What pictureſque beauties would appear! What relations of utility, of every ſpecies, contributing either to pleaſure or to profit, would reſult from it! The introduction of a new plant into our fields, would be ſufficient to allure a new ſet of ſongſters to our groves, and ſhoals of unknown fiſhes to the mouths of our rivers. Might it not be poſſible to increaſe even the family of our domeſtic animals, by peopling the glaciers of the lofty mountains of Dauphiné, and of Auvergne, with herds of rein-deer, an animal ſo valuable in the northern parts of Europe; or with the

the lama of Peru, who delights in the ſnows at the foot of the Andes, and whom Nature has clothed in the fineſt of wool? A little moſs, a few ruſhes of their own country, would be enough to fix them in ours.

Attempts have frequently been made, I admit, to propagate the breed of foreign animals in our parks, by obſerving even the choice of thoſe ſpecies whoſe native climate came neareſt to ours; but they all languiſh and die, becauſe no care was taken to tranſplant with them their proper vegetable. You ſee them always reſtleſs, with the head hanging down, ſcratching up the ground, as if demanding from it the nouriſhment which they had loſt. A ſingle herb would have been ſufficient to quiet them, by recalling the taſtes of their early life, the breezes which uſed to fan them, the cool fountains and refreſhing ſhades of their native country: leſs unhappy, however, than Man, who can be cured of regret only by the total loſs of memory.

In the FIFTH PART, we ſhall ſpeak of MAN. Every Work of Nature has preſented to us, hitherto, only partial relations; Man will furniſh ſuch as are univerſal. We ſhall examine, firſt, thoſe which he ſtands in to the Elements. Beginning with that of Light and Fire; we ſhall obſerve, that his eyes are turned, not towards Heaven,

Heaven, as the Poets, and even ſome Philoſophers, allege, but to the Horizon; ſo that he may view, at once, the Heaven which illuminates, and the Earth which ſupports him. His viſual rays take in near half of the celeſtial Hemiſphere, and of the plane on which he treads, and their reach extends from the grain of ſand, which he tramples under foot, to the ſtar which ſhines over his head, at an immeaſurable diſtance.

He alone, of animals, can enjoy equally the day and the night; he alone can bear to live within the torrid Zone, and upon the ice of the frigid. If certain animals are partakers with him in theſe advantages, it is only by means of his inſtructions, and under his protection. For all this he is indebted to the Element of Fire, of which he alone is the Sovereign Lord. Some Authors pretend, that certain of the brute creation underſtand the management of it, and that the monkeys in America keep up the fires kindled by travellers in the foreſts. No one denies that they love it's heat, and reſort to it for warmth, when Man retires. But as they have perceived it's utility, Why have they not preſerved the uſe of it? However ſimple the manner of keeping up fire may be, by ſupplying it with fuel, not one of them will ever attain to that degree of ſagacity.

The

The dog, much more intelligent than the monkey, a witneſs every hour of the effects of fire; accuſtomed, in our kitchens, to live only on meat that is dreſſed, if you give him raw fleſh, will never dream of going to roaſt it on the coals. This barrier, which ſeparates Man from the brute, weak as it may appear, is inſurmountable to animals. And this is one of the great bleſſings of Providence; beſtowed for the general ſecurity; for how many unforeſeen, and irreparable conflagrations would take place, were Fire at their diſpoſal? God has intruſted the firſt agent in Nature, to that being alone who, by his reaſon, is qualified to make a right uſe of it.

While ſome Hiſtorians beſtow this faculty on the brutes, others deny it to Man. They allege, that many Nations were entirely deſtitute of it, till the arrival of the Europeans among them. To prove this, they quote the inhabitants of the Marianne Iſlands, otherwiſe called the Iſle of Thieves, by a calumnious imputation ſo common among ſailors; but this aſſertion is grounded on bare ſuppoſition; namely, on the very natural aſtoniſhment expreſſed by theſe Iſlanders, on ſeeing their villages ſet on fire by the Spaniards *,

* See the Hiſtory of their Diſcoveries, by Magellan; the Hiſtory of the Marianne Iſles, by Father Gobien, vol. ii. page 44; and that of the Weſt-Indies, by Herrera, vol. iii. page 10 and 712.

whom

whom they had recived with kindneſs. They contradict themſelves, at the ſame time, by relating, that theſe very people uſed canoes, daubed over with bitumen, which neceſſarily ſuppoſes, in the caſe of ſavages unacquainted with iron, that fire had been employed in the hollowing of their canoes, or, at leaſt, in careening them. Finally, we are told, that they fed on rice, the preparation of which, however ſimple, requires, of neceſſity, the application of fire.

This Element is univerſally neceſſary to human exiſtence, even in the hotteſt climates. By means of fire alone, Man guards his habitation, by night, from the ravenous beaſts of prey; drives away the inſects which thirſt for his blood; clears the ground of the trees and plants which cover it, and whoſe ſtems and trunks would reſiſt every ſpecies of cultivation, ſhould he find means, any other way, to bring them down. In a word, in every country, with Fire he prepares his food, diſſolves metals, vitrifies rocks, hardens clay, ſoftens iron, and gives, to all the productions of the Earth, the forms, and the combinations, which his neceſſities require.

The benefits which he derives from the Air are no leſs extenſive. Few animals are, like him, capable of reſpiring, with equal eaſe, at the level of the

the Sea, and on the ſummit of the loftieſt mountains. Man is the only being who gives it all the modulations of which it is ſuſceptible. With his voice alone, he imitates the hiſſing, the cries, the ſinging of all animals; while he enjoys the gift of ſpeech, denied to every other. Sometimes he communicates ſenſibility to the Air; he makes it ſigh in the pipe, to complain in the flute, to threaten in the trumpet, and to animate to the tone of his paſſions the braſs, the box-tree, and the reed. Sometimes he makes it his ſlave; he forces it to grind, to bruiſe, and to move, to his advantage, an endleſs variety of machinery. In a word, he yokes it to his car, and conſtrains it to waft him even over the billows of the Ocean.

That Element, in which few of the inhabitants of Earth are able to live, and which ſeparates their different claſſes, by a boundary more inſurmountable than that of Climate, preſents to Man alone the eaſieſt of communications. He ſwims in it, he dives, he purſues the ſea-monſter to the abyſſes of the deep; he hunts and ſtabs the whale even under mountains of ice; and alights on every iſland in the boſom of the Sea, and aſſerts his empire over it.

But he had no need of that which he exerciſes over Air and Water, to render his ſovereignty

univerſal. He has only to remain on the Earth where he was born. Nature has planted his throne on his cradle. Every thing that lives comes thither to pay him homage. There is not a vegetable but what fixes it's roots under his feet, not a bird but there builds his neſt, not a fiſh but there depoſits her ſpawn.

Whatever irregularity may appear on the ſurface of his domain, he is the only being formed with the capacity of pervading all it's parts. And what, in this reſpect, excites the higheſt admiration, there is eſtabliſhed, among all his limbs, an equilibrium ſo perfect, ſo difficult to be preſerved, ſo contrary to the laws of our mechaniſm, that there is no Sculptor capable of forming a ſtatue reſembling Man, broader and heavier above than below, which ſhall be able to maintain an erect poſition, and remain immoveable, on a baſis ſo ſmall as his feet. It would be quickly overſet by the ſlighteſt breath of wind. How much more, then, would be requiſite to make it walk like Man? There is no animal whoſe body is ſuſceptible of ſo many different movements; and I am tempted to believe, that he unites in himſelf all the poſſible varieties of animal motion, on ſeeing how he bends, kneels, creeps, ſlides, ſwims, tumbles himſelf into the form of an arch, rounds himſelf like a wheel, like a bowl, walks, runs, leaps, ſprings, mounts, deſcends,

deſcends, climbs; in a word, how his frame is equally adapted to clamber to the ſummit of the rock, and to walk on the ſurface of the ſnow; to traverſe the river and the foreſt, to pick the moſs of the fountain, and the fruit of the palm-tree; to feed the bee, and to tame the elephant.

With all theſe advantages, Nature has collected in the human figure every thing that is lovely in colour and form, whether from harmony or from contraſt. To theſe ſhe has added movements the moſt majeſtic and the moſt graceful. From an accurate obſervation of this, Virgil has been enabled to finiſh, by a maſter-ſtroke, the portrait of Venus diſguiſed, talking with Eneas, who remained ignorant who ſhe was, while beauty only was diſplayed, but diſtinguiſhed her the inſtant ſhe began to move: *Vera inceſſu patuit Dea*; "Her gait declared the Goddeſs." *

The AUTHOR of Nature has united in Man every ſpecies of beauty, and has formed of theſe a combination ſo wonderful, that all animals, in

* Milton's deſcription of Eve is ſtill more characteriſtic of female majeſty:

Grace was in all her ſteps, Heaven in her eye;
In every geſture, dignity and love.

PAR. LOST, BOOK IV.

their natural ſtate, are ſtruck, at ſight of him, with love, or terror; this we ſhall demonſtrate by more than one curious remark. Thus, too, is fulfilled the Word which conferred on him the original ſovereignty of the World: * "And the fear of "you, and the dread of you ſhall be upon every "beaſt of the Earth, and upon every fowl of the "Air, upon all that moveth upon the Earth, and "upon all the fiſhes of the Sea: into your hand "are they delivered."

As he is the only being who has the diſpoſal of Fire, which is the principle of life, ſo he alone practiſes Agriculture, which is it's ſupport. All frugiverous animals have, like him, occaſion for it, moſt of them the experience, but no one the practice. The ox never thinks of reſowing the grain which he treads out in the barn floor, nor the monkey, the maize of the field which he plunders. We are preſented with far-fetched theories of the relations which may ſubſiſt between brutes and Man, in the view of reducing them to a level, while the trivial differences are overlooked, which are continually before our eyes, and interpoſe between us and them an immeaſurable interval, and which are the more wonderful, the more eaſy it appears to ſurmount the difficulty.

* Geneſis ix. 2.

Every

Every one of the brute creation is circumſcribed within a narrow ſphere of vegetables, and of means neceſſary to gather them. No one extends it's induſtry beyond it's inſtinct, be it's wants what they may. Man alone raiſes his intelligence up to that of Nature. He not only purſues her plans, but recedes from them. He ſubſtitutes others in their place. He covers regions deſtined for forests with corn and wine. He ſays to the pine of Virginia, and to the cheſnut of India, "You ſhall grow in "Europe." Nature ſeconds his efforts, and ſeems, by her complaiſance, to invite him to preſcribe laws to her.

For him ſhe has covered the Earth with plants, and though their ſpecies be infinite, there is not a ſingle one but may be converted to his uſe. She has, firſt, ſelected ſome out of every claſs, to miniſter to his pleaſure, or ſupport, wherever he pleaſes to fix his habitation: from among the palm-groves of Arabia, the date; among the ferns of the Moluccas, the ſago; among the reeds of Aſia, the ſugar-cane; among the ſolanums of America, the yam; among the lianne tribe, the vine; among the papilionaceous, the French-bean and the pea; finally, the potatoe, the manioc, the maize, and an innumerable multitude of fruits, grains, and roots, proper for food, are diſtributed

for him, in every family of vegetables, and over every latitude of the Globe. She permits the plants which are moſt uſeful to him to grow in all climates; the domeſtic plants, from the cabbage up to the corn, alone, like Man himſelf, are citizens of the World. The others ſerve for his bed, for his roof, for his clothing, for medicine, at leaſt for fuel. And, in order that there might be no one but what ſhould contribute to the ſupport of his life, and that the diſtance, or ruggedneſs of the ſoil in which they grow might interpoſe no obobſtacle to his enjoyment of them, Nature has formed certain animals to ſeek them out for him, and to convert them to his uſe.

Theſe animals are formed, in the moſt wonderful manner, at once to live in ſituations the moſt rugged, and, animated by an inſtinct the moſt tractable, to aſſociate with Man. The lama of Peru, with his forked feet, armed with two ſpurs, ſcrambles over the precipices of the Andes, and brings back to him his roſe-coloured fleece. The rein-deer, with her broad and cloven hoof, traverſes the ſnows of the North, and fills for him her dugs diſtended with cream, in the moſſy paſtures. The aſs, the camel, the elephant, the rhinoceros, are detached, on his ſervice, to the rocks, to the ſands, to the mountains, and to the moraſſes of the torrid

torrid Zone. Every region is ſupporting a race of ſervants for him; the roughest, the moſt robuſt; the moſt patient, the moſt ungrateful.

But animals alone, in which are united the greateſt number of utilities, live with him over the whole face of the earth. The ſluggiſh cow paſtures in the cavity of the valley, the bounding ſheep on the declivity of the hill. The ſcrambling goat browzes among the ſhrubs of the rock; the hog, armed with a ſnout, turns up the foundation of the marſhy ground, with the help of an appendage of ſpurs, which Nature has planted above his heels, to prevent his ſinking in it; the ſwimming duck feeds on the fluviatic plants; the hen, with attentive eye, picks up every grain ſcattered about, and loſt in the field; the pigeon, on rapid wing, collects a ſimilar tribute from the refuſe of the grove, and the frugal bee turns to account, for Man, even the ſmall duſt on the flower.

There is no corner of the Earth where the whole vegetable crop may not be reaped. Thoſe plants which are rejected by one, are a delicacy to another; and even to the finny tribes, contribute to their fatneſs. The hog devours the horſe-tail and hen-bane; the goat, the thiſtle and hemlock. All return, in the evening, to the habitation of

Man, with murmurs, with bleatings, with cries of joy, bringing back to him the delicious tribute of innumerable plants, transformed, by a proceſs the moſt inconceivable, into honey, milk, butter, eggs, and cream.

Man ſubjects, to his dominion, not only the whole vegetable, but the whole animal creation, though their ſmallneſs, their ſwiftneſs, their ſtrength, their cunning, nay, the very Elements, may ſeem to exempt them from his juriſdiction.

To begin with the infinite legions of inſects, his duck and his hen feed upon them. Theſe fowls ſwallow even various ſorts of venemous reptiles, without ſuſtaining the ſlighteſt injury. His dog ſubdues for him every other ſpecies of brute. The numerous varieties of that animal are evidently adapted to their ſeveral uſes and ends; the ſhepherd's dog, for the wolf; the terrier, for the fox; the grey-hound, for animals of the plain; the maſtiff, for thoſe of the mountain; the pointer, for birds; the water-ſpaniel, for the amphibious race; in a word, from the little lap-dog of Malta, formed only for amuſement, up to the huge hunter of the Indies, who, according to Pliny and Plutarch, ſcorns to attack any thing inferior to the lion or the elephant, and whoſe breed ſtill ſubſiſts among the Tartars, their ſpecies are ſo varied, in form, in

ſize,

ſize, in reſpect of inſtinct, that I am conſtrained to believe, Nature has produced as many ſorts of them, as ſhe has produced animal ſpecies to be ſubjugated. We croſs the breed of cats, of goats, of ſheep, of horſes, a thouſand different ways; and after all our efforts and combinations, we can produce only a few trivial varieties, which deſerve, in no reſpect, to be compared with the natural varieties of the canine ſpecies.

While ſome Philoſophers aſſign to every ſpecies of dog a common origin, others aſcribe a difference of origin to Man. Their ſyſtem is founded on the variety of ſize and colour in the human ſpecies; but neither colour, nor ſtature, are diſtinctive characters, in the judgment of all Naturaliſts. According to them, colour is merely accidental; ſuperior ſtature only a greater expanſion of forms. Difference of ſpecies ariſes from the difference of proportions: now this characterizes that of dogs. The proportions of the human body no where vary; the black colour, within the Tropics, is ſimply the effect of the heat of the Sun, which tinges him in proportion as he approaches the line. And it is, as we ſhall ſee, one of the bleſſings of Nature. His ſize is invariably the ſame in every age, and in all places, notwithſtanding the influence of food and climate, by which other animals are ſo powerfully affected. There are breeds of horſes

horſes and of black cattle, double the ſize the one of the other, as any one may be convinced, by comparing the large artillery horſes of Holſtein, with the ſmall poneys of Sardinia, no taller than ſheep; and the huge Flanders ox with the diminutive one of Bengal; but from the talleſt to the ſhorteſt of the human race, there is not, at moſt, the difference of a foot. Their ſtature is the ſame, at this day, as it was in the time of the Egyptians; and the ſame at Archangel as in Africa, as is evident from the length of mummies, and that of the tombs of the ancient Indians, found in Siberia, along the banks of the river Petzora.

The ſomewhat contracted ſtature of the Laplanders is to be imputed, I preſume, to their ſedentary mode of living; for I have obſerved, among ourſelves, a ſimilar contraction of ſize in perſons of certain occupations, which require little exerciſe. That of the Patagonians, on the contrary, is more expanded than that of the Laplanders, though they inhabit a latitude as cold, from their greater diſpoſition to be moving about. The Laplander paſſes the greater part of the year ſhut up amidſt his herds of rein-deer; whereas the Patagonian is perpetually a ſtroller, for he lives entirely by hunting and fiſhing. Beſides, the firſt travellers to whom we are indebted for our knowledge of theſe two nations, have greatly exaggerated the

ſmallneſs

ſmallneſs of the one, and the magnitude of the other, becauſe they ſaw the Laplanders ſquatted on the floor of their ſmoky huts; and the Patagonians in a poſition which magnifies every object, namely, at a diſtance, on the ſummit of their rocky ſhores, whither they flock as ſoon as a veſſel appears, and through the fogs which are ſo frequent in their climates, and which, it is well known, greatly increaſe the apparent ſize of all bodies, eſpecially when in the Horizon, by refracting the light wherewith they are ſurrounded.

The Swedes and Norwegians, who inhabit ſimilar latitudes, in which the cold prevents, as it is alleged, the expanſion of the human body, are of the ſame ſtature with the natives of Senegal, where the heat, for the oppoſite reaſon, ought to favour growth; and neither the one nor the other is taller than we are. Man, over the whole Globe, is at the centre of all magnitudes, of all movements, and of all harmonies. His ſtature, his limbs, his organs, have proportions ſo adjuſted to all the works of Nature, that ſhe has rendered them invariable as their combination. He conſtitutes himſelf alone, a genus which has neither claſs nor ſpecies, dignified, by way of excellence, with the title of MANKIND.

He

He forms a real family, all the members of which are ſcattered over the face of the Earth, to collect her productions, and are capable of maintaining a moſt wonderful correſpondence, adapted to their mutual neceſſities. Man has been, in every age, the friend of Man, not merely from the intereſts of commerce, but by the more ſacred, the more indiſſoluble, bands of Humanity. Sages appeared, two or three thouſand years ago, in the Eaſt, and their wiſdom is now illuminating us at the remoteſt verge of the Weſt. To-day, a ſavage is oppreſſed in the wilds of America; he ſends his arrow round from family to family, from nation to nation, and the flame of war is kindled in the four quarters of the Globe. We are all bondſmen for each other.

We ſhall frequently recur to this great truth, which is the baſis of the morality of Subjects as well as of Sovereigns. The happineſs of every individual is attached to the happineſs of Mankind. He is under obligation to exert himſelf for the general good, becauſe his own depends on it. But intereſt is not the only motive which renders virtue a duty to him; to Nature he is indebted for it's ſublimeſt leſſons. Being born deſtitute of inſtinct, he was laid under the neceſſity of forming his intellect on her productions. He could imagine nothing but after the models of every kind with

with which ſhe had preſented him. He was inſtructed in deviſing and perfecting the mechanic Arts, from plans ſuggeſted by the induſtry of animals; and in the liberal Arts and Sciences, after the model of Nature's own immediate harmonies and plans. To her ſublime ſtudies he is indebted for a light which illuminates no other animal. Inſtinct diſcovers to the animal it's neceſſities only; but Man alone, has raiſed himſelf from the dark womb of profound ignorance, to the knowledge and belief of a GOD.

This knowledge has not been confined to a Socrates, or a Plato: No, they have it in common with Tartars, Indians, Savages, Negros, Laplanders; with men of every deſcription. It is the reſult of every contemplation, whatever be the object, a grain of moſs, or the Sun. On it are founded all the aſſociations of the human race, without a ſingle exception.

As Man has formed his intellect on that of Nature, he has been obliged to regulate his moral ſenſe by that of her AUTHOR. He felt, that, in order to pleaſe Him who is the principle of all good, it was neceſſary to contribute to the general good; hence the efforts made by Man, in every age, to raiſe himſelf to GOD, by the practice of virtue. This religious character, which diſtinguiſhes

guiſhes him from every other ſenſible being, belongs more properly to his heart than to his underſtanding. It is, in him, not ſo much an illumination as a feeling, for it appears independent even of the ſpectacle of Nature, and manifeſts itſelf with equal energy in thoſe who live moſt remote from it, as in theſe who are continually enjoying it. The ſenſations of the infinity, of the univerſality, of the glory, and of the immortality with which it is connected, are inceſſantly agitating the inhabitants of the city, as well as thoſe of the country. Man, feeble, miſerable, mortal, indulges himſelf, every where, in theſe celeſtial paſſions. Thither he directs, without perceiving it, his hopes, his fears, his pleaſures, his pains, his loves; and paſſes his life in purſuing, or combatting, theſe fugitive impreſſions of DEITY.

Such is the career which I have preſcribed to myſelf. But as, in a long voyage, we ſometimes perceive, on our way, flowery iſles, in the boſom of a great river, and enchanting groves on the ſummit of inacceſſible precipices: in like manner, the progreſs we ſhall make in the ſtudy of Nature, will gradually diſcloſe to us ſome delightful proſpects. With theſe we ſhall, at leaſt, feaſt the eye as we paſs along, if we are not permitted to ſtop, and ſurvey them at leiſure. We ſhall have frequent occaſion to remark, that the works of Nature

ture exhibit contrasts, harmonies, and transitions, which wonderfully unite their different empires to each other.

We shall examine by what magic it is, that the contrasts are productive, at once, of pleasure and pain, of friendship and hatred, of existence and destruction. From them proceeds that great principle of Love, which divides all the individuals into two great classes, objects loving, and objects beloved. This principle extends from animals and plants, which are distinguished by sex, down to insensible fossils; as metals, which have magnetic powers, most of which are still unknown to us; and from salts which strive to unite in the fluids where they swim, up to the Globes, which have a mutual attraction in the Heavens. It opposes individual to individual by difference of sex, and genus to genus by difference of forms, in order to extract from them harmonies innumerable.

In the Elements, Light is opposed to Darkness, Heat to Cold, Earth to Water, and their accords produce days, temperatures, views, the most agreeable. In vegetables, we shall see, in the forests of the North, the thick and gloomy foliage, the tranquil attitude and the pyramidical form of the fir, contrast with the tender verdure, and moveable foliage, of the birch, which, from it's spreading

ſpreading top and ſlender baſe, preſents the appearance of a pyramid inverted. The foreſts of the South will exhibit ſimilar harmonies, and we ſhall find them even in the herbage of our meadows.

The ſame oppoſitions reign in the animal kingdom; and, to inſtance only in ſuch as are moſt familiar to us, the bee and the butterfly, the hen and the duck, the indigenous ſparrow and rambling ſwallow, the nimble courſer and ſluggiſh ox, the patient aſs and capricious goat; in a word, the cat and dog, diſplay an endleſs contraſt, on our flower-beds, in the meadow, in our houſes, of forms, of movements, of inſtincts.

I do not comprehend, in theſe harmonical oppoſitions, the carnivorous animals, which make war on the others, and whoſe correſponding intercourſe regards them not as living, but as dead. I underſtand by contraſt, that which Nature has eſtabliſhed between two claſſes, different in manners, in inclinations, and in figures, and to which, nevertheleſs, ſhe has given certain ſecret ſympathetic ſenſibilities, which engage them, in their natural ſtate, to inhabit the ſame places, to aſſociate together, and to live in peace. Such is the contraſt of the horſe, who delights to gallop about in the ſame field where the ox walks gravely on, ruminating

minating as he goes. Such, again, is that of the aſs, who, well-pleaſed, follows, with a ſlow and meaſured pace, the nimble-footed goat, up to the very precipices over which ſhe ſcrambles. From the bee and the butterfly, up to the elephant and the camelopard, there is not a ſingle animal on the Earth but what has its contraſt, Man only excepted.

The contraſts of Man are all within himſelf. Two oppoſite paſſions, Love and Ambition, balance all his actions. To Love, are referable all the pleaſures of the ſenſes; to Ambition, all thoſe of the ſoul. Theſe two paſſions are in perpetual counterpoiſe in the ſame ſubject; and while the firſt is accumulating on Man every kind of corporeal enjoyment, and inſenſibly ſinking him below the level of the beaſts; the ſecond prompts him to aim at univerſal dominion, and to exalt himſelf, at length, up to the DEITY. Theſe two contradictory effects are obſervable in all men, who have it in their power, without obſtruction, to follow theſe oppoſite impulſes, whether in the claſs of Kings, or that of ſlaves. The *Neros*, the *Caligulas*, the *Domitians*, lived like brutes, and exacted the adoration due to Gods. We find in Negros the ſame incontinence, the ſame pride, and the ſame ſtupidity.

Nature, however, has beſtowed theſe two paſſions on Man, as a ſource of happineſs. She produces an equal number of each ſex, in order to direct the love of every man to a ſingle object, and in that object ſhe has united all the harmonies which are ſcattered over her moſt beautiful productions. There is between Man and Woman a wonderful analogy of forms, of inclinations, and of taſtes; but there is a difference ſtill greater, of theſe very qualities. Love, as we ſhall have occaſion to obſerve, reſults only from contraſts, and the greater they are, the more powerful is it's energy. I could eaſily demonſtrate this, by the evidence of a thouſand hiſtorical facts. It is well known, for example, with what a mad exceſs of paſſion that tall and clumſy ſoldier *Mark Anthony* loved, and was beloved by, *Cleopatra*; not the perſon whom our Sculptors repreſent, of a tall, portly, ſabine figure, but the *Cleopatra* whom Hiſtorians paint, as little, lively, ſprightly, carried, in diſguiſe, about the ſtreets of Alexandria, in the night-time, packed up in a parcel of goods, on the ſhoulders of *Appollodorus*, to keep an aſſignation with *Julius Cæſar*.

The influence of contraſts, in Love, is ſo certain, that, on ſeeing the lover, it would be eaſily poſſible to draw the portrait of the beloved object, without having ſeen it, provided only it were known

known that the paſſion was extremely violent. Of this I myſelf have made proof, on various occaſions; among others, in a city where I was entirely a ſtranger. A gentleman of the place, one of my friends, carried me to viſit his ſiſter, a very virtuous young lady, and he informed me, as we were going, that ſhe was violently in love. Being arrived at her apartments, and Love happening to become the ſubject of converſation, it came into my head to ſay to her, that I knew the laws which determined our choice in love, and that, if ſhe would permit me, I could draw her lover's picture, though he was utterly unknown to me. She bid me defiance: upon this, taking the oppoſite to her tall and buxom figure, to her temperament and character, which her brother had been deſcribing to me, I painted her favourite as a little man, not overloaded with fleſh, with blue eyes, and fair hair, ſomewhat fickle, eager after information. Every word I uttered made her bluſh up to the eyes, and ſhe became ſeriouſly angry with her brother, accuſing him of having betrayed her ſecret. This, however, was not the caſe, and he was fully as much aſtoniſhed as herſelf.

Theſe obſervations are of more importance than we, generally, imagine. They will enable us to demonſtrate, to what a degree our Inſtitutions deviate from the Laws of Nature, and weaken the

power of Love, when they assign to Woman the studies and the employments of Man. Virtue alone knows how to turn these contrasts to good account, in the married state, in which the duties of the two sexes are so very different. There, too, she presents to their natural ambition, a career the most sublime, in the education of their children, whose reason it is their duty to form; and their sweetest recompense to receive, in exchange, the first sentiments of filial affection. In the hearts of their children their memory is to be perpetuated on the earth, in a manner more affecting, and infinitely more indelible, than the memory of Kings on public monuments. What power can equal that which confers existence, and the power of thought; and what recollection can last so long as that of filial gratitude?

The government of a good King has been compared to that of a Father; but the empire of a virtuous Father can be compared only to that of God himself. Virtue is, to Man, the true law of Nature. It is the harmony of all harmonies. Virtue alone can render Love sublime, and Ambition beneficent. It can derive the purest gratification even from privations the most severe. Rob it of Love, Friendship, Honour, the Sun, the Elements, it feels that, under the administration of a Being just and good, abundant compensation is reserved

reserved for it, and it acquires an increase of confidence in GOD, even from the cruelty and injustice of Man. It was virtue that supported, in every situation of life, an *Antoninus*, a *Socrates*, an *Epictetus*, a *Fenelon*; that rendered them, at once, the happiest, and the most respectable of Mankind.

If, on the one hand, Nature has established contrasts, in all works, on the other, she has deduced from them harmonies which re-unite them all again. It would appear that, having fixed upon a model, it was her intention to communicate to all places a participation in it's beauty. The light and disk of the Sun are, accordingly, reflected a thousand different ways, by the planets in the heavens, by the parhelions and rainbow in the clouds, by the *Aurora-borealis* in the ices of the North; in a word, by the refractions of the Atmosphere, the reflexes of the waters, and the specular reflexions of most bodies on the Earth. The islands, in the midst of the Ocean, represent the mountainous forms of the Continent; and the mediterranean Seas and Lakes in the bosom of mountains, represent the vast plains of the mighty Deep.

Trees, in the climate of India, affect the port of herbs; and the herbs in our gardens that of trees. A multitude of flowers seem modelled after the rose

and the lily. Among our domeſtic animals, the cat appears to be formed on the model of the tyger, the dog on that of the wolf, the ſheep on that of the camel. Every ſpecies has its correſpondent, Mankind only excepted. That of the monkey, which ſome would make a variety of the human ſpecies, has relations, much more direct, to other animals. The man of the woods, with his long arms, his meagre feet, his fleſhleſs paws, his flattened noſe, his lipleſs mouth, his round eyes, his abominable hairy coat, has, certainly, a very imperfect reſemblance to the Apollo of the Vatican; and whatever inclination one might have to reduce Man to the beaſt, it would be difficult to find, in the female of that animal, a ſecond model of the human figure, which ſhould come near the Venus de Medicis, or the Diana of Allegrain, which is ſhewn at Lucienne. But I have ſeen monkeys which had a ſtrong reſemblance to the bear, as the bavian of the Cape of Good-Hope; or to the greyhound, as the maki of Madagaſcar. Some are formed like little lions; ſuch is a very handſome white ſpecies, with a mane, found in Braſil. I preſume that moſt ſpecies of quadrupeds, eſpecially among the ferocious kinds, have their counterparts in thoſe of the monkey tribe.

Theſe ſame correſpondencies are likewiſe diſcernible in the numerous varieties of parrots, which,

which, in their forms, their bills, their claws, their ſcream, and their ſports, imitate, for the moſt part, birds of prey. Finally, they extend even to the plants, denominated, for this very reaſon, *mimoſas*, which repreſent, in their flowers, or in the aggregation of their grains, inſects and reptiles, ſuch as ſnails, flies, caterpillars, lizards, ſcorpions, &c.

Nature, in forming and preſenting theſe correſpondencies, muſt have ſome intention, which I do not comprehend. What is very remarkable, they are common only between the Tropics, where the foreſts ſwarm with every ſpecies of the monkey and parrot race. Perhaps ſhe meant to exhibit, under harmleſs forms, thoſe of the noxious animals, which are there found in great numbers, in order to expoſe to the light of day the terrible figure of thoſe ſons of darkneſs and carnage, and that none of her productions ſhould remain concealed, in the womb of Night, from the eyes of Man.

Whatever may be in this, no one animal, on the face of the Earth, is formed on the noble proportions of the human figure; and if Man, under the impulſe of paſſion, frequently degrades himſelf to the level of the beaſts, his reſtleſsneſs, his intelligence, and his ſublime affections, ſufficiently de-

monſtrate, that he himſelf is the counterpart of the DEITY.

Finally, the ſpheres of all beings have a communication, by means of rays, which ſeem to unite their extremities. We ſhall remark on the ſtalactities and chryſtallizations of foſſils, the proceſſes of vegetation; and I think we may perceive even the movement of animals in that of their magnetic influence. On the other hand, we ſhall ſee plants forming themſelves, after the manner of foſſils, without any apparent organization; ſuch is, among others, the truffle, which has neither leaves, nor flowers, nor roots. Others repreſent, in their flowers, the figure of animals, as the orchites; or their ſenſibility, as the ſenſitive plant, which lets fall, and ſhuts it's leaves at the ſlighteſt touch; or their inſtinct, as the *dionæa muſcipula*, which catches flies. The petals of this plant are formed of oppoſite little leaves, impregnated with a ſugary ſubſtance, which attracts the flies; but the inſtant they alight, theſe little leaves ſuddenly cloſe together with a ſpring, like the jaws of a fox-trap, and pierce the fly with their prickly edges.

There are others ſtill more aſtoniſhing, as having within themſelves the principle of motion; ſuch is the *hedyſarum movens*, or *burum chandali*, imported

imported, some years ago, from Bengal into England. This plant moves, alternately, the two pendent lobes which are attached to it's leaves, though no exterior or apparent cause contributes to this species of oscillation.

But, without going so far in quest of wonders, we shall find, perhaps, in our common gardens, appearances of Nature still more surprizing. We shall see the pea, for example, pushing out it's tendrils, precisely at the height where they begin to stand in need of support, and curling them round the boughs, with an address which can hardly be ascribed to chance. These relations seem to suppose intelligence; but we shall find others still more amiable, which are a demonstration of goodness, not in the vegetable, but in the hand which formed it. The *sylphium*, of our gardens, is a great ferulaceous plant, which resembles, on the first glance, what is known by the name of the sun-flower. It's capacious leaves are opposed at the base, and their cavities uniting, form an oval cup, in which the rain water collects, to the quantity of a pretty large glass-full. They are placed in stories, not in the same direction, but at right angles, in order to receive the rain water that falls in the whole extent of their circumference. It's square stem is very commodious for being firmly caught by the claws of birds; and it's flowers

flowers produce ſeeds of which many of them are exceſſively fond, particularly the thruſh. So that this whole plant, like the perch of a parrot-cage, preſents, at once, to the birds, a reſting place, and meat, and drink.

We ſhall, likewiſe, ſpeak of the ſmell and taſte of plants. We ſhall remark, under theſe relations, a great number of botanical characters, which are not the leaſt certain. It was from the ſmell and taſte that Man acquired the firſt knowledge of their poiſonous, medicinal, or nutritive qualities. Nay, the very ſounds of plants are not to be overlooked; for, when agitated by the winds, moſt of them emit ſounds peculiar to themſelves, and which produce harmonies, or contraſts, the moſt agreeable, with the ſites of the places where they uſually grow. In India, the hollow canes of the bamboo, which ſhade the banks of rivers, imitate, as they ruſtle againſt each other, the guſhing noiſe excited by the motion of a ſhip through the water; and the pods of the cinnamon, agitated by the winds on the mountain's top, the tic-tac of a mill. The moveable leaves of the poplar convey to our ears, in the wood, the bubbling of a brook. The green meadows, and the calm foreſts, fanned by the zephyrs, repreſent, in the hollow of the valley, and on the declivity of the rock, the undulations and murmurs of the waves

waves of the ſea breaking on the ſhore. The early inhabitants of the Globe, ſtruck with theſe myſterious ſounds, imagined that they heard oracles pronounced from the trunk of the oak, and that Nymphs and Dryads, incloſed in the rugged bark, inhabited the mountains of Dodona.

The ſphere of animals extends ſtill farther theſe wonderful harmonies. From the motionleſs ſhelly race, which pave and ſtrengthen the capacious bed of the Sea, to the fly who wings his way by night, over the plains of the torrid Zone, glittering with rays of light like a ſtar, you will find in them the configurations of rocks, of vegetables, of ſtars. A thouſand ineffable paſſions, a thouſand inſtincts animate them, which they expreſs in ſongs, in cries, in hummings, nay, even in the articulate ſounds of the human voice.

Some of them compoſe noiſy republics, others live in a profound ſolitude. The whole life of ſome is employed in waging war, that of others in making love. In their combats they uſe every imaginable ſpecies of armour, and every poſſible method of availing themſelves of the weapons with which Nature has furniſhed them, from the porcupine, who darts his pointed arrows at the foe, to the torpedo, who invſibly ſmites his aſſailant, as with a ſtroke of electricity.

Their

Their loves are not leſs varied than their animoſities. One muſt have his ſeraglio; another is ſatisfied with a tranſient miſtreſs; a third unites himſelf to a faithful companion, whom he never abandons till death makes the ſeparation. Man unites, in his enjoyments, their pleaſures and their tranſports; and, ſatiated, ſighs, and demands of Heaven felicity of a different kind.

We ſhall examine, ſimply by the light which reaſon ſupplies, whether Man, ſubjected, by his body, to the condition of the animal creation, all whoſe neceſſities he unites in himſelf, is not, by his ſoul, allied to creatures of a ſuperior order: whether Nature, who has aſſigned the juriſdiction of the immenſity of her productions on the Earth, to a being naked, deſtitute of inſtinct, and who muſt undergo an apprenticeſhip of ſeveral years in learning to walk only, has reduced him, from his birth, to the alternative of ſtudying their qualities, or of periſhing; and whether ſhe has not reſerved to herſelf ſome extraordinary means of interpoſing for his relief, amidſt the evils of every kind which checker his exiſtence, even among beings of the ſame ſpecies with himſelf.

On reviewing the tranſitions which unite the different kingdoms, and which extend their limits to regions hitherto unknown, we ſhall not adopt the

the opinion of thoſe who believe, that the works of Nature, being the reſults of all poſſible combinations, muſt preſent every poſſible mode of exiſtence. "You will find in them," ſay they, "order, and, at the ſame time, diſorder. Throw "about the characters of the alphabet, in an in- "finite variety of manners, and you ſhall form of "them the Iliad, and poems ſuperior even to the "Iliad; but you will have, at the ſame time, an "infinity of formleſs aſſemblages." We adopt this compariſon, obſerving, however, that the ſuppoſition of the twenty-four letters of the alphabet ſuggeſts a previous idea of order, which it was neceſſary to admit as a foundation even to the hypotheſis of chance. If, then, the multiplied throws of theſe twenty-four letters gave, in fact, an infinite number of poems, good and bad, how many muſt principles, much more numerous, of exiſtence in itſelf, ſuch as the elements, colours, ſurfaces, forms, depths, movements, produce of different modes of exiſting, were we to take but a ſingle hundred of the modifications of each primordial combination of matter!

We ſhould have, at leaſt, the general tranſitions of the different kingdoms. We ſhould ſee plants walking on feet like animals; animals fixed in the earth by roots like plants; rocks with eyes; herbs which

which vegetated only in air. The chief intervals of the ſpheres of exiſtence would be filled up. But every thing poſſible does not exiſt. There exiſts nothing but what is uſeful relatively to Man. The ſame order which pervades the general combination of the ſpheres, ſubſiſts in the parts of each of the individuals which compoſe them. There is not a ſingle one which has, in its organs, either deficiency or redundancy.

Their mutual adaptation is ſo perceptible, and they poſſeſs characters ſo very ſtriking, that if you were to ſhew to a Naturaliſt of ability any repreſentation of a plant, or animal, which he had never ſeen, he could tell, from the harmony of it's parts, whether it were a creature of the imagination, or a copy after Nature. One day, the ſtudents in Botany, wiſhing to put to trial the knowledge of the celebrated *Bernard de Juſſieu*, preſented to him a plant which was not in the collection of the Royal Garden, requeſting him to indicate it's genus and ſpecies. The moment he caſt his eyes on it, he replied, "This plant is artificially compoſed; "you have taken the leaves of one, the ſtalk of "another, and the flower of a third." This was the fact. They had, however, ſelected, with the greateſt art, the parts of ſuch as had the moſt ſtriking analogy.

I am

I am confident to affirm, that, by the method which I ſhall propoſe, the Science may be carried ſtill much farther, and that we ſhall be enabled, by it, to determine, at ſight of an unknown plant, the nature of the ſoil in which it grew; whether it is a native of a hot or a cold country; whether it is an inhabitant of the mountain, or of the ſtream; and, perhaps, even the animal ſpecies to which it is particularly allied.

In ſtudying theſe laws, moſt of which are unknown, or neglected, we ſhall reject others, which are founded only on particular obſervations, and which have been too much generalized. Such are, for example, the following; that the number and fecundity of created beings are in the inverſe ratio of their magnitude; and that the time of their decay is in proportion to that of their increaſe. We ſhall ſhew, that there are moſſes leſs prolific than the fir, and ſhell fiſh leſs numerous than whales: ſuch is, to name only one, the hammer-fiſh. There are animals which grow very faſt, and decay very ſlowly: this is the caſe of moſt fiſhes. I ſhould never have done, if I went about to prove, that the longevity, the ſtrength, the ſize, the fecundity, the form, of every being, is adapted, in a moſt wonderful manner, not only to it's individual happineſs, but to the general happineſs of all, from which reſults that of Mankind.

We

We ſhall, likewiſe, reject thoſe analogies, ſo commonly admitted, which are drawn from climate and ſoil, in order to explain all the operations of Nature by mechanical cauſes; for I ſhall demonſtrate, that ſhe frequently produces in theſe, both vegetables and animals, whoſe qualities are diametrically oppoſite to thoſe of their climate and ſoil.

The tubulous and drieſt plants, ſuch as reeds, ruſhes, as well as the birch, whoſe bark, ſimilar to leather overlaid with oil, is incorruptible by humidity, grow by the water ſides, like boats provided for croſſing over. On the contrary, plants with the richeſt juices, and the moſt humid, grow in the drieſt ſituations, ſuch as the aloe, the taper of Peru, and the lianne impregnated with water; which are to be found only on the parched rocks of the torrid Zone, where Nature has placed them like ſo many vegetable fountains.

Even the inſtincts of animals appear to be leſs adapted to their own perſonal utility, than to that of Man; and are ſometimes in harmony with the nature of the ſoil which they inhabit, and ſometimes in oppoſition to it. The gluttonous hog delights to live in the mire, from which he is intended to purify the habitation of Man; and the ſober

ſober camel, to force his way through the burning ſands of Africa, impervious, but for him, to every effort of the traveller. The appetites of theſe animals do not grow out of the places which they inhabit; for the oſtrich, who is a fellow-tenant of the ſame deſerts with the camel, is ſtill more voracious than the hog.

No one law of magnetiſm, of gravity, of attraction, of electricity, of heat, or of cold, governs the World. Theſe pretended general laws, are nothing more than particular means. Our Sciences miſlead us, by aſcribing to Nature a falſe providence. They put the balance into her hand, it is true, but not of juſtice; no, it is only the balance of commerce. They weigh only the ſalts and the maſſes, but put aſide the wiſdom, the intelligence, and the goodneſs. They are not afraid of excluding from the heart of Man that ſentiment of the divine qualities, which communicates to him ſo much force; and of accumulating on his mind, the weights and movements which oppreſs him. They put in oppoſition the ſquares of times and velocities, but they neglect thoſe wonderful compenſations with which Nature interpoſes for the relief of all beings, having beſtowed the moſt ingenious on the moſt feeble, the moſt abundant on the pooreſt, and having united all for the relief of

the Human Race, undoubtedly, as being the moſt wretched ſpecies of all.

We can know that only which Nature makes us feel; and we can form no judgment of her Works but in the place, and at the time, ſhe is pleaſed to diſplay them. All that we imagine, beyond this, preſents only contradiction, doubt, error, or abſurdity. I do not except, from this deſcription, even our imaginary plans of perfection. For example, it is a tradition common to all Nations, ſupported by the teſtimony of the Holy Scriptures, and founded on a natural feeling, that Man has lived in a better order of things, and that we are deſtined to another, which is ſtill to ſurpaſs it. We are incapable, however, of ſaying any thing of either the one or the other. It is impoſſible for us to retrench any thing from that in which we live, or to add any thing to it, without rendering our condition worſe. Whatever Nature has introduced into it, is neceſſary. Pain and death are among the proofs of her goodneſs. But for pain, we ſhould be bruiſing ourſelves, every ſtep we took, without perceiving it. But for death, new beings could not be raiſed into exiſtence; and ſuppoſing thoſe which already are in the world could be rendered eternal, that eternity would involve in it the ruin of generations, of the configuration

ration of the two ſexes, and of all the relations of conjugal, filial, and parental affection; that is to ſay, of the whole ſyſtem of actual happineſs.

In vain do we ſearch, in our cradles, for the archives which our tombs deny us: the paſt, like the future, covers our myſterious deſtiny with an impenetrable veil. In vain do we apply to it the light which illumines us, and ſeek, in the origin of things, the weights, the times, and the meaſures, which we find in their enjoyment; but the order which produced them has, with relation to GOD, neither time, nor weight, nor meaſure. The diviſions of matter and time were made only for circumſcribed, feeble, tranſient Man. The Univerſe, ſaid *Newton*, was produced at a ſingle caſt. We are ſeeking for youth in what was always old, for old age in what is always young, for germs in ſpecies, births in generations, epochs in nature; but when the ſphere, in which we live, iſſued from the hand of it's divine AUTHOR, all times, all ages, all proportions, manifeſted themſelves in it at once.

In order that Etna might vomit out it's fires, from the very firſt conſtruction of theſe tremendous furnaces, lavas muſt have been provided which had not yet begun to flow. In order that

the Amazonian river might roll it's ſtream acroſs America, the Andes of Peru muſt have been, from the beginning, covered with the ſnows, which the winds of the Eaſt had not yet accumulated upon them. In the boſom of new-created foreſts, ancient trees muſt have ſprung up, that inſects and birds might find their proper aliment on the antique rind: Carrion muſt have been created for the ſupport of carnivorous animals. There muſt have been produced, in all the kingdoms of Nature, beings young, old, living, dying, and dead. All the parts of this immenſe fabric muſt have appeared at the ſame inſtant; and if there was a ſcaffolding, to us it has diſappeared.

Let others extend the boundaries of our Sciences, I ſhall conſider myſelf as having rendered a more uſeful ſervice to my fellow-creatures, if I am enabled to fix thoſe of our ignorance. Our illumination, like our virtue, conſiſts in deſcending: and our force in becoming ſenſible of our feebleneſs. If I do not purſue the road which Nature has reſerved for herſelf, I ſhall, at leaſt, walk in that which Man ought to take. It is the only one which preſents him eaſy obſervations, uſeful diſcoveries, enjoyments of every deſcription, without inſtruments, without a cabinet, without metaphyſics, and without ſyſtem.

In

In order to be convinced how agreeable it is, let us conſtruct, in conformity to our method, any group, with the ſites, the vegetables, and the animals, moſt commonly to be found in our Climates. Let us ſuppoſe a ſoil the moſt obdurate, a craggy protuberance on the coaſt, where a river diſgorges itſelf into the Ocean, preſenting a ſteep toward the ſea, and a gentle declivity toward the land: that, on the ſide turned toward the ſea, the billows cover with foam rocks clothed with ſea-weed, fucuſes, alga-marinas, of all colours, and of all forms, green, brown, purple, in tufts, and garlands, as I have ſeen them on the coaſts of Normandy, affixed to the rocks of white marl, which the ſea detaches from the main ſhore. Let us farther ſuppoſe, that, on the ſide of the river, we ſee on the yellow ſand, a ſcanty verdure, mixed with a little trefoil, and here and there a ſprig of marine wormwood. Let us introduce ſome willows, not like thoſe which grow in our meadows, but the native crop of the ſoil, and ſimilar to thoſe which are to be ſeen on the banks of the Sprée, in the vicinity of Berlin, with broad buſhy tops, and riſing to the height of more than fifty feet. Let us not forget, in this arrangement, the harmony of different ages, which it is ſo agreeable to meet, in every ſpecies of aggregation, but eſpecially in that of vegetables. Let us obſerve, of theſe willows ſo ſmooth and full of moiſture, ſome puſhing

their young branches into the air, and others of an aged form, with pendent top and hollow trunk.

Let us add to theſe their auxiliary plants, ſuch as the green moſſes and gilded *lichen*, which marble their gray rind, and ſome of the convolvuluſes, vulgarly called lady's-ſmock, which delight to ſcramble along their trunk, and to embelliſh the branches, which have no flowers of their own, with leaves in form of a heart, and flowers white as ſnow, hollowed into the ſhape of a ſpire. Let us, finally, introduce the inhabitants natural to the willow, and it's acceſſory plants, their butterflies, their flies, their beetles, and other inſects, togegether with the feathered animals which make war on them, ſuch as the water-hen, poliſhed like the burniſhed ſteel, which catches them in the air; the wag-tail, which purſues them on the land, making the movement from which he derives his name; and the king's-fiſher, who hunts for them along the ſurface of the water; and you will ſee a multitude of agreeable harmonies ariſing out of one ſingle ſpecies of tree.

They are, however, ſtill imperfect. To the willow let us oppoſe the alder, which likewiſe affects the bank of the river, and which, by it's form reſembling that of a long tower, it's broad foliage, it's duſky verdure, it's fleſhy roots, formed like

like cords running along the banks, and binding together the ſoil, forms a complete contraſt with the extended maſs, the light foliage, the white-ſtreaked verdure, and the trundling roots of the willow. Add to this the individuals of the alder, of different ages, riſing like ſo many verdant obeliſks, with their paraſite plants, ſuch as the maiden-hair ſpreading into ſtars of verdure over the humid trunk, the long hart's-tongue hanging from the boughs down to the ground, and the other acceſſories of inſects and fowls, and even of quadrupeds, which, probably, contraſt as to form, colour, gait and inſtinct, with thoſe of the willow; and we ſhall have a delicious concert of vegetables and animals, compoſed of two trees only, together with their accompaniments.

If we illuminate our little plantation with the firſt rays of Aurora, we ſhall behold, at once, ſhades deep and ſhades tranſparent, diffuſed over the verdure; a duſky and a ſilvered verdure interſect each other, on the azure of the Heavens, and their ſoft reflexes, blended together, moving along the boſom of the waters. Let us, farther, ſuppoſe, what neither poetry nor painting can pretend to imitate, the odour of the plants, and even the ſmell of the ſea, the ruſtling of leaves, the humming of inſects, the matin-ſong of the birds, the hollow murmuring noiſe, intermixed with ſilence,

of the billows breaking on the ſhore, and the repetitions of all theſe ſounds, repercuſſed by the diſtant echos, which, loſing themſelves in the ſea, reſemble the voice of the Nereïds: Ah! if Love, or Philoſophy, ſhould ever tempt you to ſuch a ſolitude, you will find in it an aſylum more delicious than the palaces of Kings can beſtow.

Would you wiſh that ſenſations of a different order ſhould be excited? Would you wiſh to hear the voice of paſſion and ſentiment burſt from the boſom of the rock? Let the tomb of a virtuous and unfortunate man ſtart up amidſt the weeping willows, preſenting this inſcription to the eye:—*Here reſts* J. J. ROUSSEAU.

Would you wiſh to ſtrengthen the impreſſion of this picture, without, however, doing violence to Nature, as to the ſubject? Change the time, the place, the monument; let this iſle be Samos; the trees of theſe groves, laurels and wild olives, and this tomb the tomb of *Philoctetes*. Look at the grotto, which ſerved as a habitation to that great man, when abandoned by the Greeks, whoſe battles he had fought; his wooden pot, the tatters in which he was clothed, the bow and arrows of Hercules, which, in his hands, had ſubdued ſo many monſters, and with which he, at laſt, wounded himſelf: and you will be impreſſed with

two

two powerful ſenſations at once, the one phyſical, which increaſes in proportion as you approach the works of Nature; becauſe their beauty diſcloſes itſelf only to the eye which examines it; the other moral, which grows upon you, in proportion as you retire from the monuments of Virtue, becauſe to do good to men, and to be no longer within their reach, is a reſemblance to the DEITY.

What would it be then, were we to take a glance of the general harmonies of this Globe? To dwell only on thoſe which are beſt known to us, behold how the Sun conſtantly encircles with his rays one half of the Earth, while Night covers the other with her ſhade. How many contraſts and concords reſult from their ever changing oppoſitions? There is not a ſingle point in the two Hemiſpheres, in which there does not appear, by turns, a dawn, a twilight, an aurora, a noon, a ſetting of burniſhed gold, and a night ſometimes ſtudded with ſtars, ſometimes clothed in a ſable mantle.

The Seaſons walk hand in hand under his eye, like the hours of the day. Spring, crowned with flowers, precedes his flaming car; Summer ſurrounds it with her golden ſheaves; and Autumn follows it, bearing her cornucopia running over with gloſſy fruit. In vain would Winter and Night,

Night, retiring to the Poles of the World, attempt to ſet bounds to his majeſtic career: In vain do they raiſe out of the boſom of the polar Seas of the North and of the South, new Continents with their vallies, their mountains, and their icy coruſcations: the Father of Day, with his fiery ſhafts, overturns the fantaſtic fabric; and without deſcending from his throne, reſumes the empire of the Univerſe. Nothing can ſcreen itſelf from his prolific heat.

From the boſom of the Ocean, he raiſes into the Air, the rivers which are afterwards to flow through the Old and New Worlds. He gives commandment to the Winds to diſtribute them over iſlands and continents. Theſe inviſible children of the Air tranſport them, from place to place, under a thouſand capricious forms. Sometimes they are ſpread over the face of Heaven like veils of gold and ſtreamers of ſilk; ſometimes they are rolled up in the form of frightful dragons, and roaring lions, vomiting out torrents of fire and thunder. They pour them out on the mountains in as many different ways, in dews, in rains, in hail, in ſnow, in impetuous torrents.

However extravagant the mode of performing their ſervices may appear, every part of the Earth annually receives from them neither more nor leſs, than

than it's accuſtomed portion of water. Every River fills his urn, and every Naïad her ſhell. In their progreſs, they impreſs on the liquid plains of the Sea, the variety of their characters. Some hardly ruffle the ſmooth expanſe; others ſwell it into billows of azure; and others turn it up from the bottom with a dreadful noiſe, and daſh it foaming over the rocky promontory.

Every place poſſeſſes harmonies peculiar to itſelf, and every place preſents them in rotation. Run over, at pleaſure, a Meridian, or a Parallel, you will find on it mountains of ice, and mountains of fire; plains of every kind of level, and hills of every curve; iſlands of all forms, and rivers of all currents; ſome ſpouting up, as if they iſſued from the centre of the Earth, others precipitating themſelves down in cataracts, as if they were deſcending from the clouds. Nevertheleſs, this Globe, agitated with ſuch a variety of convulſive movements, and loaded with ſuch a variety of burdens, apparently ſo irregular, advances in a ſteady and unalterable courſe through the immenſity of the Heavens.

Beauties of a different order decorate it's Architecture, and render it habitable to ſenſible beings. A girdle of palm-trees, to which are ſuſpended the date and the cocoa, ſurrounds it between the burning

burning Tropics; and foreſts of moſſy firs begird it under the Polar Circles. Other vegetables extend, like rays, from South to North, and, having reached a certain latitude, expire. The banana advances from the Line to the ſouthern ſhore of the Mediterranean. The orange croſſes that Sea, and embelliſhes, with it's golden fruit, the ſouthern extremities of Europe. The moſt neceſſary plants, ſuch as corn and the gramineous tribes, penetrate the fartheſt, and, ſtrong from their weakneſs, ſtretch, in the ſhelter of the vallies, from the banks of the Ganges to the ſhores of the Frozen Ocean.

Others, more hardy, take their departure from the rude climates of the North, advance over the ſummit of Mount Taurus, and make their way, under favour of the ſnows, into the very boſom of the Torrid Zone. The fir and the cedar clothe the mountains of Arabia, and of the kingdom of Cachemire, and view at their feet the ſcorched plains of Aden and Lahor, where the date and the ſugar-cane are reaped. Other trees, equally averſe to heat and cold, have their centre in the Temperate Zones. The vine languiſhes in Germany and Senegal. The apple, the tree of my own country, never ſaw the Sun perpendicularly over it's head; or deſcribing round it the complete circle of the Horizon, to ripen it's beautiful fruit.

But

But every ſoil has it's Flora, and it's Pomona. The rocks, the moraſſes, the mire, the ſand, have each vegetables peculiar to itſelf. The very ſhallows of the ſea are fertile. The cocoa-tree thrives only on the ſtrand, and ſuſpends it's milky fruit over the billows of the briny Deep. Other plants are adapted to the winds, to the ſeaſons, to the hours of the day, with ſuch exact preciſion, that, by means of them, *Linnæus* conſtructed botanical almanacks and time-pieces.

Who is capable of deſcribing the infinite variety of their figure? What cradles, arches, avenues, pyramids of verdure, loaded with fruits, preſent the moſt enchanting habitations! What happy republics lodge under their tranquil ſhade! What delicious banquets are there prepared! Nothing of them is loſt. The quadrupeds eat the tender foliage, the feathered race the ſeeds, and other animals the roots and the rind. The inſects feed on the offal. Their infinite legions are armed with every kind of inſtruments for collecting it. The bees have their thighs furniſhed with ſpoons, lined with hair, for picking up the fine powder of their flowers: the fly is provided with a pump for ſucking out the ſap: the worm has an augre, a wimble, a file, to ſeparate the ſolid parts; and the ant has pincers for carrying off the crumbs. On conſidering the diverſity of form, of manners, of governments,

governments, of all these animals, and the continual wars which they wage, you would suppose them a multitude of foreign and hostile nations, who are on the point of destroying each other. From their constancy in love, the perpetuity of their species, their wonderful harmony with all the parts of the vegetable kingdom, you would receive the idea of a single people, which had it's hereditary nobility, it's carpenters, it's pump-makers, and other artisans.

Other tribes hold vegetables in contempt, and are adapted to the Elements, to Day, to Night, to Tempests, and to different parts of the Globe. The eagle trusts her nest to the rock which loses itself in the clouds; the ostrich, to the parched sands of the desert; the rose-coloured flamingo, to the mires of the Southern Ocean. The white bird of the Tropic, and the black frigat, take pleasure to sweep along, in company, over the vast extent of the Seas, to view, from the highest regions of the Atmosphere, the fleets of India toiling after them in vain; and to circumscribe the Globe from East to West, disputing rapidity of flight with the Sun himself.

In the same latitudes, the turtle dove and the perroquet, less daring, travel only from isle to isle, having their young ones in their train, and picking up,

up, in the forefts, the grains of fpicery which they brufh off as they hop from branch to branch. While fowls of this defcription preferve an equal temperature, under the fame Parallels, others find it in the track of the fame Meridian. Long triangles of wild-geefe and of fwans go and come every year from South to North, ftop only at the hoary limits of Winter, hurry, without defire, or aftonifhment, over the populous cities of Europe, and look down with difdain on their fertile plains, preferting the furrows of green corn in the midft of fnow: to fuch a degree does liberty appear preferable to abundance, even in the eyes of the animal creation!

On the other hand, legions of heavy quails crofs the Sea, and go to the South, in queft of the Summer's heat. Toward the end of September, they avail themfelves of a northerly wind to take their departure from Europe, and flapping one wing, while they prefent the other to the gale, half fail, half oar, they graze the billows of the Mediterranean, with their fattened rump, and bury themfelves in the fands of Africa, to ferve as food to the famifhed inhabitants of Zara.

There are animals which travel only by night. Millions of crabs, in the Antilles, defcend from the mountains by the light of the Moon, clafhing their

their claws; and present to the Caraïbs, on the sterile strand of their isles, innumerable shells replenished with exquisite marrow. At other seasons, on the contrary, the tortoise quits the Sea, and lands on the same shores, to accumulate layers of eggs in their barren sands.

The very ices of the Pole are inhabited. We find in their Seas, and under their floating promontories of crystal, the black enormous whale, with more oil on his back than a whole plantation of olives could produce. Foxes clothed in precious furs, find the means of living on shores abandoned by the Sun; herds of rein-deer there scratch up the snow in search of moss, and advance, braying, into those desolate regions of night, by the glimmering light of the *Aurora Borealis*. Through a Providence, worthy of the highest admiration, places the most unprolific, present to Man, in the greatest abundance, provisions, clothing, lamps, and firing, not of his own production.

How delightful would it be to behold the Human Race collecting all these various blessings, and communicating them to each other, in peace, from Climate to Climate! We look with expectation, every Winter, to the period when the swallow and the nightingale shall announce to us the return of serenity.

ſerenity. How much more affecting would it be, to behold the People of diſtant Lands arrive, with the Spring, on our ſhores, not with the dreadful noiſe of artillery, like modern Europeans, but with the ſound of the flute and the hautboy, as the ancient Navigators, in the earlier ages of the World! We ſhould behold the tawny Indian of Southern Aſia, forcing his way, as formerly, up it's mighty rivers, in his leathern canoe; penetrating, through the current of the Petzora, to the extremities of the North, and diſplaying, on the frozen ſhores of the Icy Sea, the riches of the Ganges. We ſhould ſee the copper-coloured Indian of America, in his hollowed log, traverſing the extended chain of the Antilles, conveying from iſle to iſle, from ſhore to ſhore, perhaps to our very Continent, his gold and emeralds. Numerous caravans of Arabs, mounted on camels and oxen, would arrive, following the courſe of the Sun, from paſture to paſture, recalling the memory of the innocent and happy life of the ancient Patriarchs.

Winter itſelf would be no interruption to the communication of mankind. The Laplander, covered with warm fur, would arrive, under favour of the ſnow, in his ſledge drawn by the rein-deer, and expoſe for ſale, in our markets, the ſable ſkins

of Siberia. Did men live in peace, every Sea would be navigated, every region would be explored, all their productions would be collected. What a gratification of curiosity would it be to listen to the adventures of these foreign travellers, attracted to us by the gentleness of our manners! They would not be slow in communicating, to our hospitality, the secrets of their plants, of their industry, and of their traditions, which they will for ever conceal from our ambitious commerce.

It is among the members of the vast family of Mankind that the fragments of their History are scattered. How interesting would it be to learn that of our ancient separation, the motives which determined each tribe to choose a separate habitation, on an unknown Globe; and to traverse, as Chance directed, mountains which presented no path; and rivers which had not yet received a name?

What pictures would be presented to us in the descriptions of those countries, decorated with a pompous magnificence, as they proceeded from the hands of Nature, but wild, and unadapted to the necessities of Man destitute of experience! They would paint to us the astonishment of their forefathers, at sight of the new plants which every new

new Climate exhibited to their view, and the trials which they made of them, as the means of ſubſiſtence; how they were aided, no doubt, in their neceſſitous circumſtances, and in their induſtry, by ſome celeſtial Intelligence, who commiſerated their diſtreſs; how they gradually formed an eſtabliſhment; what was the origin of their laws, of their cuſtoms, and of their religions.

What acts of virtue, what inſtances of generous love have ennobled the deſerts, and are unknown to our pride! We flatter ourſelves, that we have got a clear inſight into the Hiſtory of foreign Nations, becauſe we have collected a few anecdotes, picked up at random by travellers. But this is much the ſame, as if they were to compoſe ours from the tales of a mariner, or the artificial repreſentations of a courtier, amidſt the jealouſies of war, or the corruptions of commerce. The knowledge and the ſentiments of a Nation, are not depoſited in books. They repoſe in the heads, and in the hearts, of it's ſages; if there be on Earth ſuch a thing as a ſecure aſylum for Truth. We have already employed ourſelves ſufficiently in paſſing judgment on them; it would be of more importance for us, to ſubmit to be judged by them, in our turn, and to profit by their expreſſions of aſtoniſhment, at ſight of our Cuſtoms, of our Sciences, and of our Arts.

If it be delightful to acquire knowledge, it is much more delightful ſtill to diffuſe it. The nobleſt reward of Science is the pleaſure of the ignorant man inſtructed. What a ſublime ſatisfaction ſhould it be to us, to enjoy their joy, to behold their dances in our public ſquares, and to hear the drums of the Tartar, and the ivory cornet of the Negro re-echo round the ſtatues of our Kings! Alſ, if we were good, I figure them, to myſelf, ſtruck with aſtoniſhment and ſorrow, at the exceſſive and unhappy populouſneſs of our cities, inviting us to ſpread ourſelves over their ſolitudes, to contract marriages with them, and by new alliances to re-unite the branches of the Human Race, which are unhappily ſeparating farther and farther, and which national prejudices diſunite ſtill more than Ages and Climates!

Alas! bleſſings have been given us in common, and we communicate to each other only the ills of life. Man is every where complaining of the want of land, and the Globe is covered with deſerts. Man alone is expoſed to famine, while the animal creation, down to inſects, are wallowing in plenty. Almoſt every where he is the ſlave of his equal, while the feebleſt of animals maintain their liberty againſt the ſtrongeſt. Nature, who deſigned him for love, denied him arms, and he has forged them for himſelf, to combat his fellow. She

preſents

preſents to all her children aſylums and feſtivals; and the avenues of our cities announce our approach to them only by the ſad ſpectacle of wheels and gibbets. The Hiſtory of Nature exhibits bleſſings only, that of Man, nothing but robbery and madneſs. His heroes are the perſons who have rendered themſelves the moſt tremendous. Every where he deſpiſes the hand which ſpins the garment that clothes him, and which cultivates for him the fertile boſom of the Earth. Every where he eſteems his deceiver, and reveres his oppreſſor. Always diſſatisfied with the preſent, he alone of beings regrets the paſt, and trembles at the thought of futurity. Nature has granted to him alone, the knowledge of a DEITY, and ſwarms of inhuman religions have ſprung up out of a ſentiment ſo ſimple and ſo conſolatory. What, then, is the power which has oppoſed barriers to that of Nature? What illuſion has miſled that marvellous reaſon, which has invented ſo many arts, except the art of being happy? O ye Legiſlators! boaſt no longer of your laws. Either Man is born to be miſerable; or the Earth every where watered with his blood, and with his tears, accuſes you all of having miſunderſtood thoſe of Nature.

He who adapts not himſelf to his Country, his Country to Mankind, and Mankind to GOD, is no more acquainted with the laws of Politics, than

he who, forming a ſyſtem of Phyſics for himſelf alone, and ſeparating his perſonal relations from all connection with the Elements, the Earth, and the Sun, is acquainted with the Laws of Nature. To the inveſtigation of theſe divine harmonies, I have devoted my life, and this Work. If, like ſo many others, I have gone aſtray, at leaſt my errors ſhall not be fatal to my religion. It alone appears to me the natural bond of Mankind, the hope of our ſublime paſſions, and the complement of our miſerable deſtiny. Happy, if I have been able ſometimes to prop, with my feeble ſupport, that ſacred edifice, aſſailed as it is, in theſe times, on every ſide! But it's foundations reſt not on the Earth, and to Heaven it's ſtately columns rear their heads. However bold ſome of my ſpeculations may be, they have nothing to do with bad people. But, perhaps, more than one Epicurean may diſcern in them, that Man's ſupreme pleaſure is in Virtue. Good citizens will, perhaps, find in them new means of being uſeful. At leaſt, I ſhall have the full recompenſe of my labour, if ſo much as one unfortunate wretch, ready to ſink at the melancholy ſpectacle which the World preſents, ſhall revive, on beholding, in Nature, a Father, a Friend, a Rewarder.

Such was the vaſt plan I propoſed to execute. I had collected, in this view, more materials than I had

had occaſion for. But a variety of obſtacles has prevented my making a complete arrangement of them. I ſhall, perhaps, reſume this employment in happier times. I have, meanwhile, ſelected as much as was ſufficient to convey an idea of the harmonies of Nature. Though my labours are here reduced to ſimple *Studies* merely, I have, however, been careful to preſerve ſo much order, as was neceſſary to unveil my original deſign. Thus, a periſtyle, an arcade half in ruins, avenues of columns, ſimple fragments of walls, preſent ſtill to travellers, in an iſle of Greece, the image of an ancient temple, notwithſtanding the ravages of time, and of the barbarians who demoliſhed it.

In ſetting out, I change ſcarcely any thing of the *Firſt Part* of my Work, the arrangement excepted. I there diſplay, in the firſt place, the benefits conferred by Nature on our World, and on the Age we live in; and the objections which have been raiſed to the Providence of their Author. I, next, reply ſucceſſively to thoſe which are ſtarted from the diſorder of the Elements, of Vegetables, of Animals, of Man; and to thoſe which are levelled againſt the nature of GOD himſelf. I am bold to affirm, that I have treated theſe ſubjects, without any perſonal, or extraneous, conſideration whatever. Having replied to theſe objections, I propoſe ſome, in my turn, to the

elements of human Science, which we deem infallible; and I combat that pretended principle of our knowledge, which we call *Reaſon*.

After having cleared the ground of our opinions, in my firſt Studies, I proceed, in thoſe that follow, to rear the fabric of human Knowledge. I examine what may be the portion of our intelligence, at which the light of Nature fixes it's boundary; and what we underſtand by the terms Beauty, Order, Virtue, and their contraries. I deduce the evidence of it, from ſeveral laws, phyſical and moral, the ſentiment of which is univerſal among all Nations of the Globe. I afterwards make application of the phyſical laws, not to the order of the Earth, but to that of Plants.

I balanced long, I acknowledge, between theſe two orders. The firſt would have exhibited, I confidently affirm, relations entirely new, uſeful to Navigation, to Commerce, and to Geography. But the ſecond has preſented me with relations equally new, equally agreeable, more eaſily demonſtrable to the generality of Readers, of high importance to Agriculture, and, conſequently, to the moſt numerous deſcription of Mankind. Beſides, ſome of the harmonic relations of this Globe are to be found diſplayed in my replies to the objections againſt Providence, and in the elementary relations

relations of Plants, in a manner ſufficiently luminous to demonſtrate the exiſtence of this new order. The vegetable order has, moreover, furniſhed me with occaſion to ſpeak of the relations of the Globe, which extend directly to animals and to men; and, likewiſe, to ſuggeſt ſome hints reſpecting the earlieſt voyages of the Human Race, to the principal Quarters of the World.

I apply, in the following *Study*, the laws of Nature to Man. I eſtabliſh the proofs of the immortality of the ſoul, and of the exiſtence of the DEITY, not on the principles of our reaſon, which ſo frequently miſleads us, but on an intimate feeling, which never deceives nor betrays. I refer to thoſe phyſical and moral laws, the origin of our predominant paſſions, Love and Ambition, and even the cauſes which interrupt the enjoyment of them, and which render our joys ſo tranſient, and our melancholy ſo profound. I flatter myſelf with the belief, that theſe proofs will intereſt the Reader, both by their novelty, and by their ſimplicity.

I proceed, afterwards, from theſe notions, to propoſe the palliatives, and the remedies, adapted to the ills of Civil Society, the repreſentation of which is delineated in the firſt Volume. It was not my wiſh to imitate the example of moſt Moraliſts, who ſatisfy themſelves with laſhing vice,

or

or with turning it into ridicule, without either assigning the principal causes, or indicating the remedies: much less shall I act the part of our modern Politicians, who foment vice, in order to make a gain of it. I am vain enough to hope, that this last *Study*, which has been a most agreeable one to myself, will exhibit some views, which may be rendered highly beneficial to my Country.

The rich and the great imagine, that every one is miserable, and out of the World, who does not live as they do; but they are the persons who, living far from Nature, live out of the World. They would find thee, O eternal Beauty! always ancient, and always new *; O life, pure and blissful, of all those who truly live, if they sought thee only within themselves! Wert thou a steril mass of gold, or a victorious Prince, who shall not be alive to-morrow, or some attractive and deceitful female, they would perceive thee, and ascribe to thee the power of conferring some pleasure upon them. Thy vain nature would employ their vanity. Thou wouldst be an object proportioned to their timid and grovelling thoughts. But, because thou art too much within themselves, where they never choose to look, and too magnificent externally, diffusing thyself through infinite space,

* St. Augustin's *City of God*.

thou

thou remainest to them an unknown GOD *. In losing themselves, they have lost thee.

The order, nay, the beauty, with which thou hast invested all thy creatures, to serve as so many steps by which Man may raise himself to thee, are transformed into a veil, which conceals thee from his sickly eyes. Men have no sight but for vain shadows. The light dazzles them. Mere nothings are to them every thing; and all-perfection passes with them for nothing. Nevertheless, he who never saw thee, has never seen any thing; he who has no relish for thee is an utter stranger to true pleasure; he is as if he were not, and his whole life is only a miserable dream.

I myself, O my God, misled by the prejudices of a faulty education, pursued a vain felicity, in systems of Science, in arms, in the favour of the Great, sometimes in frivolous and dangerous pleasures. In all these agitations, I was hunting after calamity, while happiness was within my reach. At a distance from my native Land, I sighed for joys which it contained not for me; and, nevertheless, thou wert bestowing on me blessings innumerable, scattered by thy bountiful hand over the whole Earth, which is the Country of Mankind. I disquieted myself to think that I had no power-

* Fenelon, on *the Existence of* GOD.

ful

ful protector, that I belonged to no corps; and by Thee I have been protected amidst a thousand dangers, in which they could have afforded me no assistance. It grieved me to think of living solitary, unnoticed, unregarded; and Thou hast vouchsafed to teach me, that Solitude is far preferable to the bustle of a Court, and Liberty to Grandeur. It filled me with many a painful reflection, that I had not the felicity of being directed to some fair spouse, to be the companion of my life, and the object of my affection; and thy wisdom invited me to walk to her habitation, and discovered to me, in each of her productions, an immortal Venus.

I never ceased to be happy, but when I ceased to trust in Thee. O my God! give to these labours of a man, I do not say the duration, or the spirit of life, but the freshness of the least of thy Works! Let their divine graces be transfused into my writings, and bring back a corrupted Age to Thee, as by them I myself have been brought back! Opposed to Thee, all power is weakness; supported by Thee, weakness becomes irresistible strength. When the rude northern blasts have ravaged the Earth, thou calleſt for the feebleſt of winds; at the sound of thy voice, the zephyr breathes, the verdure revives, the gentle primrose, and the humble violet cover the bosom of the bleak rock with a mantle of gold and purple.

STUDY

STUDY SECOND.

BENEFICENCE OF NATURE.

MOST men, in policed Nations, look on Nature with indifference. They are in the midſt of her Works, and they admire only human grandeur. What charm, after all, can render the Hiſtory of Men ſo intereſting? It has to boaſt of vain objects of glory alone, of uncertain opinions, of bloody victories, or, at moſt, of uſeleſs labours. If Nature, ſometimes, finds a place in it, we are called upon to obſerve only the ravages which ſhe has committed, and to hear her charged with a thouſand calamities, which may be all traced up to our own imprudence.

With what unremitting attention, on the contrary, is this common Mother providing for us the means of happineſs! She has diffuſed her benefits over the Globe, from Pole to Pole, entirely in the view of engaging us to unite in a mutual communication of them. She is inceſſantly recalling us,

us, from the prejudices, which unhappily ſeparate Mankind, to the univerſal laws of Juſtice and Humanity, by frequently putting our ills in the hands of the ſo highly vaunted conquerors, and our pleaſures in thoſe of the oppreſſed, whom we hardly deign to favour with ſo much as our pity.

When the Princes of Europe iſſued forth, with the Goſpels in their hand, to ravage Aſia, they brought back with them the peſtilence, the leproſy, and the ſmall-pox; but Nature pointed out to a Derviſe the coffee plant, in the mountains of Yemen, and produced, at one and the ſame time, our plagues from our Croiſades, and our delicious beverage from the cup of a Mahometan monk. The ſucceſſors of theſe Princes ſubjugated the American Continent, and have tranſmitted to us, by means of this diſcovery and conqueſt, an inexhauſtible ſucceſſion of wars and venereal diſeaſes. While they were exterminating the inoffenſive inhabitants of it by their murderous artillery, a Caraïb, in token of peace, ſet the ſailors a ſmoking his calumet; the perfume of tobacco diſſipated their chagrin, and the uſe of it is diſſeminated over the whole Earth; and while the miſeries of two Worlds are iſſuing from the cannon's mouth, which Kings call their ULTIMA RATIO, the conſolations of the civilized States of Europe, ſtream from the pipe of a Savage.

To

To whom are we indebted for the uſe of ſugar, of chocolate, of ſo many agreeable means of ſubſiſtence, and ſo many ſalutary medicines? To naked Indians, to poor Peaſants, to wretched Negros. The ſpade of ſlaves has done more good, than the ſword of conquerors has done miſchief. But in which of our great ſquares are we to look for the ſtatues of our obſcure benefactors? Our Hiſtories have not vouchſafed ſo much as to preſerve their names. We need not, however, to go ſo far, in queſt of proofs of the obligations under which we lie to Nature; Is it not to the ſtudy of her laws, that Paris is indebted for ſuch multiplied illumination, collected from every quarter of the Globe, combined a thouſand different ways, and reflected over Europe in Sciences the moſt ingenious, and enjoyments the moſt refined, of every ſpecies?

Where is now the time, when our forefathers leaped for joy at finding a wild plumb-tree, on the banks of the Loire; or at catching a poor roe in the chace in the vaſt plains of Normandy? Our fields, now ſo richly clothed with harveſts, and orchards, and flocks, did not then produce the common neceſſaries of life. They wandered up and down, living on the precarious ſupplies of hunting, and not daring to truſt to Nature. Her ſimpleſt phenomena filled them with terror. They trembled at the ſight of an eclipſe, of an *ignis-fatuus*,

fatuus, of a branch of miſletoe on the oak. Not that they believed the affairs of the World to be ſurrendered to Chance. They recognized every where Gods poſſeſſed of intelligence; but not daring to believe them good, while cruel prieſts were their only inſtructors in religion, theſe unfortunate people imagined, that the Gods took pleaſure only in tears, and immolated to them human victims, on the very ſpot, perhaps, on which now ſtands a receptacle for the wretched *.

Let

* Some Writers, of our own, have compoſed the elogium of the Druids. I ſhall oppoſe to them, among other authorities, that of the Romans, who, it is well known, were abundantly tolerant in matters of religion. Ceſar, in his Commentaries, informs us, that the Druids, in honour of their Gods, burnt men in baſkets of oſier; and that when criminals were wanting for this horrible purpoſe, they ſacrificed even the innocent. Suetonius, in his life of Claudius, gives this account of the matter: "The religion of the Druids, too cruel, it muſt be confeſſed, "and which, from the time of Auguſtus had been ſimply for-"bidden, was by him entirely aboliſhed." Herodotus had, long before, loaded them with the ſame reproach.

All that can be oppoſed to the teſtimony of three Roman Emperors, and to that of the Father of Hiſtory, is the ſilly evidence of the romance of Aſtræa. Have we not faults enough juſtly chargeable on ourſelves, without undertaking the difficult taſk of juſtifying thoſe of our anceſtors? They were not, indeed, it muſt be allowed, more culpable than other Nations, who all preſented human ſacrifices to the DIVINITY. Plutarch reproaches the Romans themſelves, with having immolated, in the earlier times of the Republic, two Gauls and two Greeks, whom they buried alive.

Is

Let me ſuppoſe, that a Philoſopher, ſuch as *Newton*, were, then, to have treated them with the ſpectacle of ſome of our natural Sciences, and to have ſhewn them, with the microſcope, foreſts in moſs, mountains in grains of ſand, thouſands of animals in drops of water, and all the wonders of Nature, which, in a downward progreſs to nothing, multiplies the reſources of her intelligence, while the human eye becomes incapable of perceiving the boundary: Let me go on to ſuppoſe, that afterwards, diſcovering to them, in the Heavens, a progreſſion of greatneſs equally infinite, he had ſhewn them, in the planets, hardly perceptible to the naked eye, Worlds much greater than ours, Saturn, three hundred millions of leagues diſtant; in the fixed ſtars, infinitely more remote, Suns which, probably, illuminate other Worlds; in the whiteneſs of the Milky Way, ſtars, that is Suns, innumerable, ſcattered about in the Heavens, as grains of duſt on the Earth, without Man's knowing whether all this may not

Is it poſſible, then, that the firſt ſentiment of Man, in a ſtate of nature, could have been that of terror; and that he muſt have believed in the Devil before he believed in God? O! no. It is Man who, univerſally, has miſled Man. One of the great benefits for which we are indebted to the Chriſtian Religion, has been the deſtruction, in a conſiderable part of the World, of theſe inhuman doctrines and ſacrifices.

be more than the threſhold of Creation merely; with what tranſports would they have viewed a ſpectacle which we, at this day, behold without emotion?

But I would rather ſuppoſe, that, unprovided with the magic of Science, a man like *Fenelon* had preſented himſelf to them, in all the majeſty of Virtue, and thus addreſſed the Druids: "You "frighten yourſelves, my friends, with the ground- "leſs terrors which you inſtil into the people. "God is righteous. He conveys to the wicked "terrible apprehenſions, which recoil on thoſe "who communicate them. But He ſpeaks to all "men in the bleſſings which He beſtows. Your "religion would govern men by fear; mine draws "them with cords of love, and imitates his Sun "in the firmament, whom He cauſes to ſhine on "the evil and on the good." Let me, finally, ſuppoſe, that, after this, he had diſtributed among them the ſimple preſents of Nature, till then unknown, ſheaves of corn, ſlips of the vine, ſheep clothed with the woolly fleece: Oh! what would have been the gratitude of our grandfathers! They would, perhaps, have fled with terror from the Inventor of the teleſcope, miſtaking him for a Spirit; but, undoubtedly, they would have fallen down, and worſhipped the Author of Telemachus.

Theſe

These, after all, are only the smallest part of the blessings for which their rich descendants stand indebted to Nature. I say nothing of that infinite number of arts, which are employed at home, to diffuse knowledge and delight; nor of that terrible invention of artillery, which secures to them the enjoyment of these, while the noise of it disturbs their repose at Paris, only to announce victories; nor of that new, and still more wonderful, art of electricity, which screens * their hotels from the

* On the subject of the effects of Electricity, a thought abundantly impious has been expressed, in a Latin verse, the import of which is, that Man has *disarmed the* DEITY. Thunder is by no means a particular instrument of divine Justice. It is necessary to the purification of the air, in the heats of Summer. God has permitted to Man the occasional disposal of it, as He has given him the power of using Fire, of crossing the Ocean, and of converting every thing in Nature to his advantage. It is the ancient Mythology, which, representing Jupiter always wielding the thunder, has inspired us with so much terror. We find, in the Holy Scriptures, ideas of the DIVINITY much more consolatory, and a much sounder Philosophy. I may, perhaps, be mistaken, but I do not believe there is a single passage in the Bible, in which thunder is mentioned as an instrument of divine Justice. Sodom was destroyed by showers of fire and brimstone. The ten plagues, with which Egypt was smitten, were the corruption of the waters, swarms of reptiles, lice, flies, the pestilence, ulcers, hail, caterpillars, thick darkness, and the death of the first-born. Corah, Dathan, and Abiram, were consumed by fire issuing out of the Earth. When the Israelites murmured in the wilderness of Paran; *the fire of the* LORD *burnt among them, and*

the thunder; nor of the privilege which they have, in this venal age, of preſiding, in all States, over the happineſs of men, when they believe they have nothing more to fear from the powers of Earth and Heaven.

But the whole world is engaged only in the purſuit of pleaſure. England, Spain, Italy, the Archipelago, Hungary, all Southern Europe, is adding, every year, wools to their wools, wines to their wines, ſilks to their ſilks. Aſia ſends them diamonds, ſpices, muſlins, chintzes, and porcelain; America, the gold and ſilver of her mountains, the emeralds of her rivers, the die-ſtuffs of her foreſts, the cochineal, the ſugar-cane, and the cocoa-nut of her fervid plains, which their hands did not cultivate; Africa, her ivory, her gold, her

and conſumed them that were in the uttermoſt parts of the camp, Numb. xi. 1. In the threatenings denounced againſt the people in Leviticus, no mention is made of thunder. On the contrary, it was amidſt the noiſe of thunder that GOD promulgated his law to his choſen people, from Mount Sinai. Finally, in that ſublime piece of poetry, wherein David ſummons all the works of JEHOVAH, to praiſe him, he calls, among the reſt, upon the thunder; and it is not foreign to our purpoſe to remark, that he includes, in his ſummons, all the meteors which enter into the neceſſary harmony of the Univerſe. He qualifies them with the majeſtic title of the *Angels*, and *Hoſts* of the MOST HIGH. *See Pſalm* cxlviii.

very

very children, which ſerve them as beaſts of burden all over the Globe.

There is not a ſpot of the Earth, or of the Sea, but what furniſhes them with ſome article of enjoyment. The gulfs of the Ocean provide them pearls, it's ſhallows, ambergris, and it's icy promontories, furs. At home, they have reduced the rivers and mountains to a ſtate of vaſſalage, in order to reſerve to themſelves feudal rights to fiſheries and chaſes. But there was no occaſion to put themſelves to ſo much expenſe. The ſands of Africa, where they have no game-keeper, ſend them, in clouds, quails, and other birds of paſſage, which croſs the Sea in Spring, to load their table in Autumn. The Northern Pole, where they have no cruiſer, pours on their ſhores, every Summer, legions of mackerel, of freſh cod, and of turbots, fattened in the long nights of Winter.

Not only the fowls and the fiſhes change, for them, their climate, but the very trees themſelves. Their orchards, formerly, were tranſplanted from Aſia, and, now, their parks from America. Inſtead of the cheſnut and walnut, which ſurrounded the farms of their vaſſals, in the ruſtic domains of their anceſtors, the ebony, the ſorb-apple of Canada, the great cheſnut of India, the magnolium,

the tulip-bearing laurel, encircle their country palaces with the umbrage of the New World, and, ere long, of its ſolitudes. They have ſummoned the jaſmin from Arabia, the orange from China, the pine-apple from Braſil, and a multitude of ſweet-ſcented plants, from every region of the torrid Zone. They have no longer occaſion for ſuns; they can diſpoſe of latitudes. They can convey, in their hot-houſes, the heats of Syria to exotic plants, at the very ſeaſon when their hinds are periſhing with the cold of the Alps, in their hovels.

No one of the productions of Nature can eſcape their avidity. What they cannot have living, they contrive to have dead. The inſects, birds, ſhell-fiſh, minerals, nay, the very ſoil, of the moſt diſtant lands, enrich their cabinets. Painting and engraving preſent them with the proſpect, and procure them the enjoyment, of the Glaciers of Switzerland, during the burning heat of the Dog-days; and of the Spring of the Canaries, in the midſt of Winter. The intrepid Navigator brings them, from regions into which the Arts dare not to penetrate, journals of voyages, ſtill more intereſting than the productions of the pencil; and redouble the ſilence, the tranquillity, the ſecurity of their nights, ſometimes by a recital of the horrible

horrible tempeſts of Cape-Horn, ſometimes by that of the dances of the happy Iſlanders of the South-Seas.

Not only every thing that actually exiſts, but Ages paſt, all contribute to their felicity. Not for the Temple of Venus only did Corinth invent thoſe beautiful columns, riſing like palm-trees; no, but to ſupport the alcoves of their beds. There voluptuous Art veils the light of the day through taffetas of every colour; and imitating, by ſoftened reflexes, either of moon-light, or of ſun-riſing, repreſents the objects of their loves like ſo many Dianas or Auroras. The art of Phidias has for them produced a contraſt to female beauty, in the venerable buſts of a Socrates and a Plato.

Obſcure ſcholars, by efforts of labour, which nothing can remunerate, have, for them procured the knowledge of the ſublime geniuſes, who were ornaments of the World, in times nearer to the Creation; Orpheus, Zoroaſter, Eſop, Lokman, David, Solomon, Confucius, and a multitude of others, unknown even to Antiquity. It was not for the Greeks, it is for them, that Homer ſtill ſings of Heroes and of Gods, and that Virgil warbles the notes of the Latin flute, which raviſhed the ears of the Court of Auguſtus, and there rekindled the love of Country and of Nature. For them it

is that Horace, Pope, Addiſon, La Fontaine, Geſner, have ſmoothed the rough paths of Wiſdom, and have rendered them more acceſſible, and more lovely, than the treacherous ſteeps of Folly.

A multitude of Poets and Hiſtorians of all Nations, a Sophocles, an Euripides, a Corneille, a Racine, a Shakeſpear, a Taſſo, a Xenophon, a Tacitus, a Plutarch, a Suetonius, introduce them into the very cloſets of thoſe terrible Potentates, who bruiſed, with a rod of iron, the head of the Nations, whoſe happineſs was intruſted to their care, and call them to rejoice in their happy deſtiny, and to hope for a better ſtill, under the reign of another Antoninus. Thoſe vaſt geniuſes, of all Ages, and of all Countries, celebrating, without concert, the undecaying luſtre of Virtue, and the Providence of Heaven, in the puniſhment of Vice, add the authority of their ſublime reaſon to the univerſal inſtinct of Mankind, and multiply a thouſand and a thouſand times, in their favour, the hopes of another life, of much longer duration, and of more exalted felicity.

Does it not ſeem reaſonable, that a chorus of praiſe ſhould aſcend, day and night, from the dome of every hotel, to the AUTHOR of Nature? Never did ancient King of Aſia accumulate ſo many means of enjoyment, in Suza, or Ecbatana,

as

as our common tradeſmen do in Paris. Theſe Monarchs, nevertheleſs, every day paid adoration to the Gods; they would engage in no enterprize till the Gods were conſulted; they would not ſo much as ſit down to table, until the libation of religious acknowledgment was poured out. Would to GOD that our Epicureans were chargeable with indifference only to the hand which is continually loading them with benefits! But it is from the very lap of plenteouſneſs and pleaſure, that the voice of murmuring againſt Providence now ariſes. From their Libraries, ſtored with ſo many ſources of knowledge, iſſue forth the black clouds which have obſcured the hopes and the virtues of Europe.

STUDY THIRD.

OBJECTIONS AGAINST PROVIDENCE.

"THERE is no God," ſay theſe ſelf-conſtituted ſages. "From the work form "your judgment of the workman*. Obſerve, "firſt of all, this Globe of ours, ſo deſtitute "of proportion and ſymmetry. Here it is de-"luged by vaſt ſeas; there it is parched with "thirſt, and preſents only wilderneſſes of barren "ſand. A centrifugal force, occaſioned by it's "diurnal rotation, has heaved out it's Equator "into enormous mountains, while it flattened "the Poles: for the Globe was originally in "a ſtate of ſoftneſs; whether it was a mud re-"covered from the empire of the Waters, or, "what is more probable, a ſcum detached from "the Sun. The volcanos, which are ſcattered "over the whole Earth, demonſtrate, that the "fire which formed it is ſtill under our feet. Over

* See replies to this objection in Study IV.

this

" this ſcoria, ſo wretchedly levelled, the rivers run
" as chance directs. Some of them inundate the
" plains; others are ſwallowed up, or precipi-
" pitate themſelves in cataracts, and no one of
" them preſents any thing like a regular current.
" The Iſlands, are merely fragments of the Conti-
" nent, violently ſeparated from it by the Ocean;
" and what is the Continent itſelf, but a maſs of
" hardened clay? Here the unbridled Deep de-
" vours it's ſhores; there, it deſerts them, and
" exhibits new mountains, which had been formed
" in it's womb. Amidſt this conflict of contend-
" ing elements, this baked lump grows harder and
" harder, colder and colder, every day. The ices
" of the Poles, and of the lofty mountains, ad-
" vance into the plains, and inſenſibly extend the
" uniformity of an eternal Winter over this maſs
" of confuſion, ravaged by the Winds, the Fire,
" and the Water.

" In the vegetable World, the diſorder increaſes
" upon us *. Plants are a fortuitous production,
" of humid and dry, of hot and cold, the mould
" of the Earth merely. The heat of the Sun makes
" them ſpring up, the cold of the Poles kills
" them. Their ſap obeys the ſame mechanical
" laws with the liquid in the thermometer, and in

* The reply is in Study V.

" capillary

" capillary tubes. Dilated by heat, it aſcends " through the wood, and re-deſcends through the " rind, following in it's direction the vertical co- " lumn of the air which impreſſes that direction. " Hence it is that all vegetables riſe perpendicu- " cularly, and that the inclined plane of a moun- " tain can contain no more than the horizontal " plane of it's baſe, as may be demonſtrated by " Geometry. Beſides, the Earth is an ill-aſſorted " garden, which preſents, almoſt every where, " uſeleſs weeds, or mortal poiſons.

" As to the animals, which we know better, " becauſe they are brought nearer to us, by ſimilar " affections, and ſimilar wants, they preſent ſtill " greater abſurdities *. They proceeded, at firſt, " from the expanſive force of the Earth, in the " firſt Ages of the World, and were formed out of " the fermented mire of the Ocean and of the " Nile, as certain Hiſtorians aſſure us; among " others Herodotus, who had his information " from the Prieſts of Egypt. Moſt of them are " out of all proportion. Some have enormous " heads and bills, ſuch as the toucan; others long " necks and long legs, like the crane: theſe have " no feet at all, thoſe have them by hundreds;

* The reply to this is in Study VI.

" others

" others have theirs disfigured by ſuperfluous ex-
" creſcences, ſuch as the meaningleſs ſpurs of the
" hog, which, appended at the diſtance of ſome
" inches from his feet, can be of no ſervice to him
" in walking.

" There are animals ſcarcely capable of motion,
" and which come into the World in a paralytic
" ſtate, ſuch as the ſloth or ſluggard, who cannot
" make out fifty paces a day, and ſcreams out la-
" mentably as he goes.

" Our cabinets of Natural Hiſtory are filled
" with monſters; bodies with two heads; heads
" with three eyes, ſheep with ſix feet, &c. which
" demonſtrate that Nature acts at random, and
" propoſes to herſelf no determinate end, unleſs it
" be that of combining all poſſible forms: and,
" after all, this plan would denote an intention
" which it's monotony diſavows. Our Painters
" will always imagine many more beings than can
" poſſibly be created. Add to all this, the rage and
" fury which deſolate every thing that breathes:
" the hawk devours the harmleſs dove in the face
" of Heaven.

" But the diſcord which rages among animals
" is nothing, compared to that which conſumes

" the

" the human race *. First, ſeveral different ſpecies
" of men, ſcattered over the earth, demonſtrate
" that they do not all proceed from the ſame ori-
" ginal. There are ſome black, others white, red,
" copper-coloured, lead-coloured. There are ſome
" who have wool inſtead of hair; others who have
" no beard. There are dwarfs and giants. Such
" are, in part, the varieties of the human ſpecies,
" every where equally odious to Nature. No
" where does ſhe nouriſh him with perfect good-
" will. He is the only ſenſible being laid under
" the neceſſity of cultivating the earth, in order to
" ſubſiſt: and, as if this unnatural mother were
" determined to perſecute, with unrelenting ſeve-
" rity, the child whom ſhe has brought forth, in-
" ſects devour the ſeed as he ſows it, hurricanes
" ſweep away his harveſts, ferocious animals prey
" on his cattle, volcanos and earthquakes deſtroy
" his cities; and the peſtilence which, from time
" to time, makes the circuit of the Globe, threat-
" ens, at length, his utter extermination.

" He is indebted to his own hands for his intel-
" ligence, his morality is the creature of climate,
" his governments are founded in force, and his
" religion in fear. Cold gives him energy; heat
" relaxes him. Warlike and free in the North,

* The reply is in Study VII.

he

" he is a coward and a ſlave between the Tropics. " His only natural laws are his paſſions. And, " what other laws ſhould he look for? If they " ſometimes lead him aſtray, is not Nature, who " beſtowed them upon him, an accomplice, at " leaſt, in his criminality? But he is made ſenſible " of their impulſe only as a warning never to gra- " tify them.

" The difficulty of finding ſubſiſtence, wars, " impoſts, prejudices, calumnies, implacable ene- " mies, perfidious friends, treacherous females, " four hundred ſorts of bodily diſtemper, thoſe of " the mind, both more cruel and more numerous, " render him the moſt wretched of creatures that " ever ſaw the light. It were much better that he " had never been born. He is every where the " victim of ſome tyrant. Other animals are fur- " niſhed with the means of fighting, or, at leaſt, " of flying; but Man has been toſſed on the Earth " by chance, without an aſylum, without claws, " without fangs, without velocity, without inſtinct, " and almoſt without a ſkin; and as if it were not " enough for him to be perſecuted by all nature, " he is in a ſtate of perpetual war with his own " ſpecies. In vain would he try to defend himſelf " from it. Virtue ſteps in, and bind his hands, " that vice, in ſafety, may cut his throat. He " has no choice but to ſuffer, and to be ſilent.

" What

" What, after all, is this virtue, about which " ſuch parade is made? A combination of his im- " becility; a reſult of his temperament. With " what illuſions is ſhe fed? Abſurd opinions, " founded merely on the ſophiſms of deſigning " men, who have acquired a ſupreme power by " recommending humility, and immenſe riches " by preaching up poverty. Every thing expires " with us. From experience of the paſt, let us " form a judgment of the future; we were no- " thing before our birth; we ſhall be nothing after " death. The hope of our virtues is a mere hu- " man invention, and the inſtinct of our paſſions " is of divine inſtitution.

" But there is no GOD *. If there were, He " would be unjuſt. What being, of unlimited " power and goodneſs, would have expoſed, to ſo " many ills, the exiſtence of his creatures; and " laid it down as a law, that the life of ſome could " be ſupported only by the death of others? So " much diſorder is a proof that there is no GOD. " It is fear that formed him. How muſt the " World have been aſtoniſhed at ſuch a metaphy- " ſical idea, when Man firſt, under the influence " of terror, thought proper to cry out, that there

* The reply is in Study VIII.

" was a GOD! What could have made him " GOD? Why ſhould he be GOD? What plea- " ſure could he take in that perpetual circle of " woes, of regenerations, and deaths *."

* The refutation of theſe objections will be found by the numeral characters, which correſpond to each particular Study. All of them are there reſolved directly, or indirectly: for it was not poſſible to follow, in a Work of this kind, the ſcholaſtic order of a ſyſtem of philoſophy.

STUDY

STUDY FOURTH.

REPLIES TO THE OBJECTIONS AGAINST PROVIDENCE.

SUCH are the principal objections which have been raiſed, in almoſt every Age, againſt a Providence, and which no one will accuſe me of having ſtated too feebly. Before I attempt a refutation of them, I muſt be permitted to make a few reflections on the perſons who maintain them.

Did theſe murmurings proceed from ſome wretched mariners, expoſed at ſea to all the revolutions of the Atmoſphere, or from ſome oppreſſed peaſant, labouring under the contempt of that ſociety whom his labour is feeding, my aſtoniſhment would be leſs. But our Atheiſts are, for the moſt part, well ſheltered from the injuries of the Elements, and eſpecially from thoſe of Fortune. The greateſt part of them have never ſo much as travelled. As to the ills of Civil Society, they moſt unreaſonably complain; for they enjoy it's ſweeteſt and moſt reſpectful homage, after having

having burſt aſunder all it's bands, by the propagation of their opinions. What have they not written on Friendſhip, on Love, on Patriotiſm, and on all the Human Affections, which they have reduced to the level of thoſe of the beaſts, while ſome of them could render human affection almoſt divine by the ſublimity of their talents!

Are not they, in part, the very perſons to whom many of our calamities may be juſtly imputed, for their flattering, in a thouſand different ways, the paſſions of our modern tyrants, whilſt a croſs, riſing in the midſt of a deſert, comforts the miſerable? It is a matter of no ſmall difficulty to retain theſe laſt in a rational devotion; and it is a moral phenomenon which appeared to me, for a long time, inexplicable, to behold, in every Age, atheiſm ſpringing up among men who had moſt reaſon to cry up the goodneſs of Nature, and ſuperſtition among thoſe who have the juſteſt ground of complaint againſt her. It is amidſt the luxury of Greece and Rome, in the boſom of the wealth of Indoſtan, of the pomp of Perſia, of the voluptuouſneſs of China, of the overflowing abundance of European Capitals, that men firſt ſtarted up, who dared to deny the exiſtence of a DEITY. On the contrary, the houſeleſs Tartars; the Savages of America, continually preſſed with famine; the Negros, without foreſight, and without a police;

a police; the inhabitants of the rude climates of the North, ſuch as the Laplanders, the Greenlanders, the Eſquimaux, ſee Gods every where, even in a flint.

I long thought that atheiſm, in the rich and luxurious, was a dictate of conſcience. "I am "rich, and I am a knave," muſt be their reaſoning, "therefore there is no GOD." "Beſides, "if there is a GOD, I have an account to ren-"der." But theſe reaſonings, though natural, are not general. There are atheiſts, who poſſeſs legitimate fortunes, and uſe them morally well, at leaſt externally. Beſides, for the contrary reaſon, the poor man ought to argue thus; "I am induſ-"trious, honeſt, and miſerable; therefore there "muſt be no Providence." But in Nature herſelf we muſt look for the ſource of this unnatural ratiocination.

In all countries, the poor riſe early, labour the ground, live in the open air, and in the fields. They are penetrated with that active power of Nature which fills the Univerſe. But their reaſon, ſinking under the preſſure of calamity, and diſtracted by their daily occaſions, is unable to ſupport it's luſtre. It ſtops ſhort, without generalizing, at the ſenſible effects of this inviſible cauſe. They believe, from a ſentiment natural to weak

minds, that the objects of their religious worſhip will be at their diſpoſal, in proportion as they are within their reach. Hence it is that the devotions of the common people, in every country, are preſented in the fields, and have natural objects for their centre. It always attracts the religion of the peaſantry. A hermitage on the ſide of a mountain, a chapel at the ſource of a ſtream, a good image of the Virgin, in wood, niched in the trunk of an oak, or under the foliage of a hawthorn, have, to them, a much more powerful attraction than the gilded altars of our Cathedrals. I except thoſe, however, whom the love of money has completely debauched, for ſuch perſons muſt have ſaints of ſilver, even in the country.

The principal religious acts of the people in Turkey, in Perſia, in the Indies, and in China, are pilgrimages in the fields. The rich, on the contrary, prevented in all their wants and wiſhes by men, no longer look up to GOD for any thing. Their whole life is paſſed within doors, where they ſee only the productions of human induſtry, luſtres, wax-candles, mirrors, ſecretaries, paraſites, books, wits. They come inſenſibly to loſe ſight of Nature; whoſe productions are, beſides, almoſt always exhibited to them diſfigured, or out of ſeaſon, and always as an effect of the art of their gardeners, or artiſans.

They

They fail not, likewiſe, to interpret her ſublime operations, by the mechaniſm of the arts moſt familiar to them. Hence ſo many ſyſtems, which eaſily enable you to gueſs at the occupation of their authors. Epicurus, exhauſted by voluptuouſneſs, framed his world and his atoms, with which Providence has nothing to do, out of his own apathy; the Geometrician forms it with his compaſſes; the Chymiſt compounds it of ſalts; the Mineralogiſt extracts it from the fire; and they who apply themſelves to nothing, and theſe are not few in number, ſuppoſe it, like themſelves, in a ſtate of chaos, and moving at random.

Thus, the corruption of the heart is the original ſource of our errors. Afterwards, the Sciences employing, in the inveſtigation of natural things, definitions, principles, methods, inveſted with a great geometrical apparatus, ſeem, by this pretended order, to reduce to order what widely deviates from it. But ſuppoſing this order to exiſt, ſuch as they preſent it to us, of what uſe could it be to Man? Would it be ſufficient to reſtrain, and to conſole, the miſerable; and what intereſt will they take in that of a ſociety which tramples them under foot, when they have nothing to hope from that of Nature, who abandons them to the laws of motion?

I now proceed to anſwer, one after another, the objections, formerly ſtated, againſt Providence, founded on the diſorders of the Globe; of vegetables, of animals, of Man, and on the nature of GOD himſelf.

Replies to the Objections againſt Providence, founded on the Diſorders of the Globe.

Though my ignorance of the means employed by Nature, in the government of the World, is greater than I am able to expreſs; it is ſufficient, however, to throw one's eyes on a geographical chart, and to have read a little, to be enabled to demonſtrate that thoſe, by which her operations are pretendedly explained to us, have no foundation in truth. From human inſufficiency ſpring the objections levelled at the divine Providence.

Firſt, it appears, to me, no more natural to compoſe the uniform motion of the Earth through the Heavens, of the two motions of projection and attraction, than to attribute to ſimilar cauſes, that of a man walking on the Earth. The centrifugal and centripetal forces ſeem, to me, no more to exiſt in the Heavens, than the two circles denominated the Equator and the Zodiac. However ingenious

genious, theſe hypotheſes may be, they are only ſcaffoldings imagined by men of genius, for rearing the fabric of Science, but which no more aſſiſt us in penetrating into the ſanctuary of Nature, than thoſe employed in the conſtruction of our churches, can introduce us into the ſanctuary of Religion. Theſe combined forces are no more the moving principle of the courſe of the ſtars, than the circles of the ſphere are their barriers. They are ſigns merely, which have, at laſt, uſurped the place of the objects which they were intended only to repreſent, like every thing elſe of human eſtabliſhment.

If a centrifugal force had ſwelled the mountains of the Globe, when it was in a ſtate of fuſion, there muſt have been mountains much more elevated than the Andes of Peru and Chili. That of Chimboraco, which is the higheſt of them, is only 3220, or 3350 fathoms in height, for the Sciences are not perfectly agreed, even in matters of obſervation. This elevation, which is nearly the greateſt known on Earth, is leſs perceptible on it than the third part of a line would be on a globe of ſix feet diameter. Now, a maſs of melted metal preſents, in proportion to it's ſize, ſcorias much more conſiderable. Look at the anfractuoſities of a ſimple morſel of iron-droſs. What frightful ſwellings, then, muſt have been formed on a globe, of hete-

rogeneous

rogeneous and fermenting materials, more than three thouſand leagues thick? The Moon, whoſe diameter is much leſs conſiderable, contains, according to *Caſſini*, mountains three leagues high. But what would be the caſe if, with the action of the heterogeneouſneſs of our terreſtrial materials, all in fuſion, we ſhould beſides ſuppoſe that of a centrifugal force, produced by the Earth's rotatory motion round it's axis? I imagine that this force muſt have been neceſſarily exerted in the direction of its Equator, and inſtead of forming it into a globe, muſt have flattened it out in the Heavens, like thoſe large plates of glaſs which glaſs-blowers expand with their breath.

Not only the diameter of the Earth, at the Equator, is no greater than under it's Meridians, but the mountains there are not more elevated than elſewhere. The noted Andes of Peru have not their commencement at the Equator, but ſeveral degrees beyond it, toward the South; and coaſting along Peru, Chili, and Magellan's land, ſtop at the fifty-fifth degree of Southern Latitude, in the Terra del Fuego, where they preſent to the Ocean a promontory of eternal ice, of a prodigious height. Through the whole extent of this immenſe track, they never open but at the Straits of Magellan, forming throughout, according to the teſtimony

teſtimony of *Garcillaſo de la Véga* *, a rampart fortified with pyramids of ice, inacceſſible to men, to quadrupeds, and even to birds.*

The mountains of the iſthmus of Panama, on the contrary, which are nearly under the Line, have an elevation ſo ſmall, in compariſon with the Andes, that Admiral *Anſon*, who had coaſted along the whole, relates, that on his arriving at theſe heights, he experienced ſtifling heats, becauſe the air, ſays he, was not refreſhed by the Atmoſphere of the lofty mountains of Chili and Peru.

The higheſt mountains of Aſia are entirely out of the Tropics. The chain, known by the names of Taurus and Imäus, commences, in Africa, at Mount Atlas, toward the thirtieth degree of northern latitude. It runs acroſs all Africa and all Aſia, between the thirty-eighth and fortieth degree of north latitude, having it's ſummit covered, for the moſt part, through that immenſe extent, with ſnows that never melt; a proof, as ſhall afterwards be demonſtrated, of a very conſiderable elevation.

Mount Ararat, which makes part of this chain, is, perhaps, more elevated than any mountain of

* Hiſtory of the Incas. Book I. chap. 8.

the

the New World, if we form a judgment from the time which *Tournefort*, and other travellers, took to perform the diſtance from the baſis of that mountain, up to the commencement of the ſnow which covers it's ſummit, and, which is leſs arbitrary, from the diſtance at which it may be ſeen, and that is, at leaſt, ſix days journey of a caravan.

The Peak of Teneriff is viſible forty leagues off. The mountains of Norway called Felices, and, by ſome, the Alps of the North, are viſible at ſea fifty leagues diſtant; and, if we may believe an ingenious Swediſh Geographer, are three thouſand fathoms high.

The peaks of Spitzberghen, of New-Zealand, of the Alps, of the Pyrennées, of Switzerland, and thoſe on which ice is found, all the year round, are exceedingly elevated; though moſt of them very remote from the Equator. They do not even run in directions parallel to that circle, as muſt have been the caſe, on the ſuppoſition of the effect produced by the rotation of the Globe; for if the chain of Taurus, in the ancient Continent, runs from Weſt to Eaſt, that of the Andes, in the new, runs from North to South. Other chains proceed in other directions.

But

But if the pretended centrifugal force had, once, the power of heaving up mountains, why does it not poſſeſs, at this day, the power of toſſing up a ſtraw into the air? It ought not to leave a ſingle detached body on the ſurface of the Earth. They are affixed to it, I ſhall be told, by the centripetal force, or gravity. But if this laſt power, in fact, forces every body toward it, why have not the mountains too ſubmitted to this univerſal law, when they were in a ſtate of fuſion? I cannot conceive what reply can be made to this twofold objection.

The Sea appears, to me, not more adapted to the formation of mountains, than the centrifugal force is. How is it poſſible to imagine the poſſibility of it's having thrown them out of it's womb? It is incontrovertible, however, that marbles, and calcareous ſtones, which are only paſtes of madrépores and of ſhells amalgamated; that flints, which are concretions of theſe; that marles, which are a diſſolution of them; and that all marine bodies, which are found in every part of both Continents, have iſſued out of the Sea. Theſe matters ſerve as a baſis to great part of Europe; hills of a very conſiderable height are compoſed of them, and they are found in many parts of both the Old and New Worlds, at an equal degree of elevation. But their ſtrata cannot be explained by any of the

actual

actual movements of the Ocean. In vain would we aſcribe to it revolutions from Weſt to Eaſt; never will it have the power of raiſing any thing above it's level. If certain ports of the Mediterranean are produced as inſtances, which the Sea has actually left dry, it is no leſs certain, that there is a much greater number, on the ſame coaſts, which the water has not deſerted. Hear what is ſaid on the ſubject by that judicious Obſerver *Maundrel*, in his journey from Aleppo to Jeruſalem, in 1669: "In the Adriatic Gulf, the light-"houſe of Arminium, or Rimini, is a league from "the ſea; but Ancona, built by the Syracuſans, "is ſtill cloſe to the ſhore. The arch of Trajan, "which rendered it's port more commodious for "merchants, is ſituated immediately upon it. Be-"ritta, the favourite ſpot of Auguſtus, who gave "it the name of *Julia Felix*, preſerves no remains "of it's ancient beauty, except it's ſituation on "the brink of the Sea, above which it is elevated "no higher than is neceſſary to ſecure it againſt "the inundations of that element."

The teſtimony of travellers the moſt accurate, is conformable to that of this ingenious Engliſh gentleman. His compatriot, *Richard Pocock*, who travelled into Egypt in 1737, with leſs taſte, but with ſtill greater accuracy, atteſts, that the Mediterranean has gained fully as much ground as it has

has loſt *. "Nothing more is neceſſary," ſays "he, "to produce a conviction of this, than to "examine the coaſt; for you will ſee, under wa- "ter, not only a variety of artificial productions, "manufactured in the rock, but, likewiſe, the "ruins of many edifices. About two miles from "Alexandria are to be ſeen, under water, the ruins "of an ancient temple."

An anonymous Engliſh traveller, in the journal of a voyage ſtored with excellent obſervations, deſcribes ſeveral very ancient cities of the Archipelago, ſuch as Samos, the ruins of which are cloſe to the Sea. Hear what he ſays of Delos, which is, as every one knows, in the centre of the Cyclades †. "We found nothing elſe, all along the coaſt, but "the remains of ſuperb edifices, which had never "been completed, and the ruins of others which "have been deſtroyed. The Sea appears to have "gained on the Iſle of Delos; and the water be- "ing clear, and the weather calm, we had an op- "portunity of obſerving the remains of beautiful "buildings, in places where now the fiſhes ſwim "at their eaſe, and on which the ſmall boats of "theſe cantons row, to get at the coaſt."

* Travels into Egypt. Vol. I. page 4 and 30.

† Voyage into France, Italy, and the Iſlands of the Archipelago, in 1763. Vol. iv. Letter cxxvii. page 256.

The

The ports of Marſeilles, Carthage, Malta, Rhodes, Cadiz, &c. are ſtill frequented by Navigators, as they were in the remoteſt Antiquity. The Mediterranean could not have ſunk at any one point of its ſhores, without ſinking at every other, for water in the baſon always comes to it's level. This reaſoning may be extended to all the coaſts of the Ocean. If there are found any where tracks of land abandoned, it is not becauſe the Sea retires, but becauſe the Earth is gaining ground. This is the effect of alluſions, occaſioned frequently by the overflowing of rivers, and ſometimes by the ill-adviſed labours of Man. The encroachments of the Sea on the Land are equally local; and are the effect of earthquakes, which can be extended to no great diſtance. As theſe reciprocal invaſions of the two Elements are particular, and frequently in oppoſition on the ſame coaſts, which have, in other reſpects, conſtantly preſerved their ancient level, it is impoſſible to deduce from them any general law for the movements of the Ocean.

We ſhall preſently examine, how ſo many marine foſſils could have been extracted from it's bed; and I confidently believe that, conformably to reſpectable traditions, we ſhall be able to advance ſomething on this ſubject, not unworthy of the Reader's attention. To return, then, to other mountains, ſuch as thoſe of granite, which are the higheſt

higheſt on the Globe, and the formation of which has not been imputed to the Sea, becauſe they contain no depoſit to atteſt ſuch tranſition, the ſame Naturaliſts employ another ſyſtem to account for their origin. They ſuppoſe a primitive Earth, whoſe height equalled that of the preſent elevation of the higheſt peaks of the Andes, of Mount Taurus, of the Alps, &c. which remains ſo many evidences of the exiſtence of that primeval ſoil: after this, they employ ſnows, rains, winds, and I know not what beſides, to lower this original Continent down to the brink of the Sea; ſo that we inhabit only the bottom of this enormous quagmire. This idea has an impoſing air; firſt, becauſe it terrifies; and then, becauſe it is conformable to that picture of apparent ruin which the Globe preſents: but it vaniſhes away before this ſimple queſtion, What has become of the earth and the rocks of this tremendous ridance?

If it is ſaid, they have been thrown into the Sea. We muſt ſuppoſe, prior to all degradation, the exiſtence of the bed of the Sea, and it's excavation would then preſent a great many other difficulties. But let us admit it. How comes it that theſe ruins have not, in part, accumulated? Why has not the Sea overflowed? How can it have happened, on the contrary, that it ſhould have deſerted ſuch immenſe tracks of land, as are ſufficient to form the

greateſt part of two vaſt Continents? Our ſyſtems, therefore, cannot account for the ſteepy elevation of mountains of granite, by any kind of degradation, becauſe they know not how to diſpoſe of the fragments; nor for the formation of calcareous mountains, by the movements of the Ocean, becauſe, in it's actual ſtate, it is incapable of covering them.

Beſides, it is not an opinion of yeſterday, that Philoſophers have conſidered the Earth as a decaying edifice. Hear what Baron *Buſbequius* ſays of the opinion of *Polybius*, in his curious and entertaining letters: "*Polybius* pretends to have "proved, that the entrance of the Black Sea "would, in proceſs of time, be choked by the "banks of ſand, and by the mud, which the Da-"nube and the Boriſthenes were conſtantly forcing "into it: and that, conſequently, the Black Sea "would be rendered inacceſſible, and it's com-"merce entirely deſtroyed. The ſea of Pontus, "nevertheleſs, is juſt as navigable at this hour as "in the days of *Polybius* *."

Bays, gulfs, and mediterranean ſeas, are no more the effects of irruptions of the Ocean into the Land, than mountains are productions of the cen-

* Letter I. page 131.

trifugal

trifugal motion. These pretended disorders are necessary to the harmony of all the parts of the Earth. Let us suppose, for example, that the Straits of Gibraltar were closed, as it has been said was formerly the case, and that the Mediterranean existed no longer. What would become of so many rivers of Europe, Asia, and Africa, which are kept flowing by the vapours which ascend out of that Sea, and bring back their waters to it, in a wonderful exactness of proportion, as the calculations of many ingenious men have demonstrated? The North winds, which constantly refresh Egypt in Summer, and which convey the emanations of the Mediterranean as far as the mountains of Ethiopia, to supply the sources of the Nile, blowing, in this case, over a space destitute of water, would carry drought and barrenness over all the northern regions of Africa, and even into the interior of that Continent.

The southern parts of Europe would fare still worse; for the hot and parching winds of Africa, which load themselves with so many rainy clouds, as they cross the Mediterranean, now blowing over the dry bed of that Sea, without tempering the heat by humidity of any kind, would blast, with scorching sterility, all that vast region of Europe, which extends from the Straits of Gibraltar to the Euxine Sea, and utterly dry up all the countries

through which, at preſent, flow a multitude of rivers, ſuch as the Rhone, the Po, the Danube, &c.

Beſides, it is not ſufficient to ſuppoſe, that the Ocean forced a paſſage into the bed of the Mediterranean, as a river ſpreads over a champaign country, after having overflowed it's banks; it muſt farther be ſuppoſed, that the track of land innundated was lower than the Ocean, a phenomenon not to be met with in any other part of the *terra-firma*, all of which is above the level of the Sea, thoſe parts excepted which have been wreſted from the Deep by means of human induſtry, as is the caſe in Holland.

It muſt ſtill farther be ſuppoſed, that a lateral ſinking of the Earth muſt have taken place all round the baſon of the Mediterranean, to regulate the circuits, declivities, canals, and windings of ſo many rivers, which come from ſuch a diſtance to empty themſelves into it, and that this ſinking muſt have been effected with admirable proportions: for theſe rivers, iſſuing, in many caſes, from one and the ſame mountain, arrive, by the ſame declivities, to diſtances widely different, without their channel's ceaſing to be full, or their water's flowing too faſt or too ſlow, notwithſtanding the difference of their courſes and levels.

It

It is not, then, to an irruption of the Ocean that we are to aſcribe the Mediterranean, but to an excavation of the Globe, more than twelve hundred leagues long, and above eight hundred broad, which has been executed with diſpoſitions ſo happy, and ſo favourable to the circulation of ſo many lateral rivers, that if time permitted me to trace the courſe of any ſingle one, it would be evident how deſtitute of all foundation the ſuppoſition is which I am combating. Earthquakes, indeed, produce excavations, but of ſmall extent; and which, far from forming channels for rivers, ſometimes abſorb the courſe of rivulets, and change them into pools, or marſhes. Theſe hypotheſes may be applied to all gulfs, bays, great lakes, and mediterranean ſeas; and we ſhall be convinced, that if theſe interior waters did not exiſt, not a fountain would remain in the greateſt part of the habitable Globe.

If we would form a juſt idea of the order of Nature, we muſt give up our circumſcribed ideas of human order. We muſt renounce the plans of our Architecture, which frequently employs ſtraight lines, that the weakneſs of our ſight may be enabled to take in the whole extent of our domain at a ſingle glance; which ſymmetrizes all our diſtributions, and which, in conſtructing our houſes, places wings to the right, and wings to the left,

that all the parts of our habitation may be comprehended in a ſingle view, while we occupy the centre; and which levels, fits to the plummet, ſmooths, and poliſhes the ſtones employed in building, that the monuments we raiſe may be ſoft to the eye and to the touch. The harmonies of Nature are not thoſe of a Sybarite; but they are thoſe of Mankind, and of all beings. When Nature raiſes a rock, ſhe introduces clefts, inequalities, points, perforations. She hollows and roughens it with the chiſel of Time, and of the Elements; ſhe plants herbs and trees upon it; ſhe ſtores it with animals, and places it in the boſom of the Sea, in the very focus of ſtorms and tempeſts, that it may there afford an aſylum to the inhabitants of the Air and of the Waters.

When Nature, in like manner intended to ſcoop out baſons to receive the Seas, ſhe neither rounded the borders, nor applied the line to them; but contrived and produced deep bays, ſheltered from the general currents of the Ocean, that, during ſtormy weather, the rivers might diſcharge themſelves into it in ſecurity; that the finny legions might reſort thither, for refuge, at all ſeaſons, there lick up the alluvion of the earth, carried down by the freſh water; come thither to ſpawn, mounting upward and upward, many of them, toward the very ſource, where they can find both food

food and ſhelter for their young. And for the preſervation of theſe adaptations it is, that Nature has fortified every ſhore with long banks of ſand, ſhelves, enormous rocks, and iſlands, which are arranged round them, at proper diſtances, to protect them from the fury of the Ocean.

She has employed ſimilar diſpoſitions in forming the beds of rivers, as we ſhall ſhew in the ſequel of this Study, though we have room only to glance at a ſubject ſo new, and ſo fertile in obſervation. Accordingly, ſhe has made the current of rivers to flow, not in a ſtraight line, as they muſt have run, had the laws of Hydraulics been obſerved, becauſe of the tendency of their motions toward a ſingle point; but ſhe makes them wind about for a long time through the boſom of the Land, before they pour themſelves into the Sea.

In order to regulate the courſe of theſe rivers, and to accelerate or retard it, conformably to the level of the countries through which they flow, ſhe pours into them lateral rivers, which accelerate it in a flat country, when they form an acute angle with the ſource of the main river; or which retard it in a mountainous country, by forming a right, and ſometimes an obtuſe, angle, with the ſource of the principal ſtream. Theſe laws are ſo infallible, that a judgment may be formed, ſimply from

the map, whether the rivers which water any country are ſlow or rapid, and whether that country is flat or elevated, by the angle which the confluent rivers form with their courſes.

Thus, moſt of thoſe which throw themſelves into the Rhone, form right angles with that rapid river, to check its impetuoſity. Some of theſe confluent rivers are real dikes, which croſs the main river from ſide to ſide, in ſuch a manner, that the river croſſed, which was running very rapidly above the confluence, flows very gently below it. This obſervation applies to many of the rivers of America, and remarkably to the Méchaſſipi. From theſe ſimple perceptions, which I have, at preſent, only time to indicate, it may be concluded, that it is eaſy to retard, or accelerate the courſe of a river, by ſimply changing the angle of incidence of it's confluent rivers. I produce this not as a matter of advice, but as a very curious ſpeculation; for it is always dangerous for Man to derange the plans of Nature.

The rivers, on throwing themſelves into the Sea, produce, in their turn, by the direction of their mouths, acceleration, or retardation, in the courſe of the tides. But I muſt not launch farther out into the ſtudy of theſe grand and ſublime harmonies, I ſatisfy myſelf with having ſaid enough

to

to convince the candid Reader, that the bed of the Seas was ſcooped out, expreſsly for receiving them.

Nevertheleſs, I muſt produce one argument more, calculated to remove every poſſibility of doubt on the ſubject. Had the bed of the Seas been formed, as is ſuppoſed, by a ſinking down of the ſolid parts of the Globe, the ſhores of the Sea, under water, would have the ſame declivities with the adjoining Continent. Now, this is not found to be the caſe on any coaſt whatever. The declivity of the baſon of the Sea is much ſteeper than that of the bounding lands, and by no means a prolongation of it. Paris, for example, is raiſed above the level of the Sea, about 26 fathoms, reckoning from the baſe of the bridge of *Notre-Dame*. The Seine, accordingly, from this point, to where it empties itſelf into the Sea, has a declivity of little more than 130 feet, in a diſtance of forty leagues; whereas, meaſuring from the mouth of the river, out into the ſea, only a league and a half, you find, at once, an inclination of from 60 to 80 fathom, for this is the depth at which veſſels anchor, in the road of Havre-de-Grace.

Theſe differences of level at Land, from the level of the bed of the Sea, in the ſame line of direction, are to be met with on all coaſts, more or leſs.

leſs. Dampier, an Engliſh Navigator, has, indeed, obſerved, that Seas which waſh ſteep coaſts are much deeper; and that along flat ſhores their depth is ſmall; but this ſtriking difference is univerſally obſervable, that along flat coaſts, the bed of the Sea is much more inclined than the ſoil of the adjoining Continent, and that along high lands, ſometimes, no bottom is to be found.

This clearly demonſtrates, therefore, that the beds of the Seas were hollowed out expreſsly to contain them. The declivity of their excavations has been regulated by laws infinitely wiſe; for if it were the ſame with that of the adjacent Lands, the billows of the Sea, whenever the wind blew toward the ſhore, however lightly, would conſiderably encroach on the Land. This actually happens in the caſe of ſtorms and extraordinary tides, the waves overflow their uſual bounds; for then, meeting a declivity flat and gentle, compared to that of their bed, they ſometimes inundate the Land to the diſtance of ſeveral leagues. This happens, from time to time, in the iſland of Formoſa, the natural ramparts of which, ſuch as the manglier, the inhabitants, it is probable, formerly deſtroyed. Holland, for nearly a ſimilar reaſon, is expoſed to inundations, becauſe it has encroached on the very bed of the Sea.

It

It is principally on the ſhores of the Ocean that the inviſible boundary is fixed, which the AUTHOR of Nature has preſcribed to its waves. It is there you perceive, that you are at the interſection of two different planes, the one of which terminates the declivity of the Land, and the other commences that of the Sea.

It cannot be alleged, that it was by currents of the Sea the bed was hollowed out; for where could the earth that filled it before be depoſited? They could raiſe nothing above their own level. It cannot even be alleged, that the channels of rivers have been excavated by the current of their own ſtreams, for there are ſeveral which have found a ſubterraneous paſſage through maſſes of ſolid rock, ſo hard and ſo thick, as to bid defiance to the pick-axes and the mattocks of our labourers. Beſides, on the ſuppoſition which we are examining, theſe rivers muſt have formed, at the place of their falling into the Ocean, banks of ſand, and accumulations of earthy ſubſtances, of a magnitude proportional to the quantity of ground which they muſt have cleared away, in forming their channels. Moſt of them, on the contrary, as has been already obſerved, empty themſelves at the bottom of bays, hollowed for the expreſs purpoſe of receiving them.

How

How is it that they have not completely filled up these bays, as they are incessantly hurling down into them substances separated from the land? Why is not the very bed of the Ocean choked up, from the constant accumulation of the spoils of vegetables, sands, rocks, and the wreck of earth, which, on every shower that falls, tinge with yellow the rivers which fall into it? The waters of the Ocean have not risen a single inch since Man began to make observations, as might easily be demonstrated from the state of the most ancient sea-ports of the Globe, which are still, for the most part, at the same level.

Time permits me not to speak of the means employed by Nature for the construction, the support, and the purification, of this immense bason: they would suggest fresh subject of admiration. Enough has been said to prove, that what in Nature may appear to us the effect of ruin, or chance, is, in many cases, the result of intelligence the most profound. Not only, no hair falls from our head, and no sparrow from Heaven to the ground, but not a pebble rolls on the shore of the Ocean, without the permission of GOD: according to that sublime expression of Job: *Tempus posuit tenebris, & universorum finem Ipse considerat, lapidem quoque caliginis, & umbram mortis* *. "He setteth an end

* Job xxviii. 3.

to

" to darkneſs, and ſearcheth out all perfection;
" the ſtones of darkneſs, and the ſhadow of death:"
He likewiſe knows the moment when that ſtone, buried in darkneſs, muſt ſpring into light, to ſerve as a monument to the Nations.

Independent of geographical proofs, without number, which demonſtrate, that the Ocean, by it's irruptions, has not hollowed out one ſingle bay on the face of the Globe, nor detached any one part of the Continent from the reſt, there are ſtill many more which may be deduced from the vegetable and animal kingdoms, and from Man.

This is not the proper place for dwelling on the ſubject: but I ſhall quote, on my way, an obſervation from the vegetable World, which proves, for example, that Britain never was united to the European Continent, as has been ſuppoſed, but muſt have been, from the beginning, ſeparated by the Channel. It is a remark of Ceſar's, in his Commentaries, that during his ſtay in that Iſland, he had never ſeen either the beech tree or the fir; though theſe trees were very common in Gaul, along the banks of the Seine, and of the Rhine. If, therefore, theſe rivers had ever flowed through any part of Britain, they muſt have carried with them, the ſeeds of the vegetables, which grew at their ſources, or upon their banks. The beech and the fir, which, at this day, thrive exceedingly

ceedingly well in Britain, muſt, of neceſſity, have been found growing there in the time of Julius Ceſar, eſpecially as they would not have changed their Latitude, and being, as we ſhall ſee, in the proper place, of the genus of fluviatic trees, the ſeeds of which reſow themſelves, through the aſſiſtance of the waters. Beſides, from whence could the Seine, the Rhine, the Thames, and ſo many other rivers, whoſe currents are ſupplied from the emanations of the Channel, from whence, I ſay, could they have been fed with water? The Thames, then, muſt have flowed through France, or the Seine through England; or, to ſpeak more conformably to truth and nature, the countries now watered by theſe rivers, would have been completely dry.

By our geographical charts, as by moſt other inſtruments of Science, we are miſled. Obſerving in theſe ſo many retreatings and projections along the coaſts of the Continent, we have been induced to imagine, that theſe irregularities muſt have been occaſioned by violent Currents of the Sea. It has juſt been demonſtrated, that this effect *was* not thus produced; I now proceed to ſhew, that it *could not poſſibly* have been the caſe.

The Engliſh *Dampier*, who is not the firſt Navigator that ſailed round the Globe, but who is, in

in my opinion, the beſt of the travellers who have made obſervations on it, ſays, in his excellen treatiſe on winds, and tides: * "Bays ſcarcely have "any currents, or if there be ſuch a thing, they "are only counter-currents running from one "point to another." He quotes many obſervations, in proof of this, and many others, of a ſimilar nature, are found ſcattered over the journals of other Navigators. Though he has treated only of the Currents between the Tropics, and even that with ſome degree of obſcurity, we ſhall proceed to generalize this principle, and to apply it to the principal bays of Continents.

I reduce to two general Currents, thoſe of the Ocean. Both of theſe proceed from the Poles, and are produced, in my opinion, by the alternate fuſion of their ices. Though this be not the place to examine the cauſe of it, to me it appears ſo natural, ſo new, and of ſuch curious inveſtigation, that the Reader, I flatter myſelf, will not be angry with me, if I give him an idea of it, on my way.

The Poles appear to me the ſources of the Sea, as the icy mountains are the ſources of the principal rivers. It is, if I am not miſtaken, the ſnow and the ice which cover our Pole, that annually

* Vol. ii. page 385.

renovate

renovate the waters of the Sea, comprehended between our Continent and that of America, the projecting and retreating parts of which have, besides, a mutual correspondence, like the banks of a river.

It may be remarked, at first sight, on a map of the World, that the bed of the Atlantic Ocean, becomes narrower and narrower toward the North, and widens toward the South; and that the prominent part of Africa corresponds to that great retreating part of America, at the bottom of which is situated the Gulf of Mexico; as the prominent part of South America corresponds to the vast Gulf of Guinea; so that this bason has, in it's configuration, the proportions, the sinuosities, the source, and the mouth, of a vast fluviatic channel.

Let us now observe, that the ices and snows form, in the month of January, on our Hemisphere, a cupola, the arch of which extends more than two thousand leagues over the two Continents, with a thickness of some lines in Spain, of some inches in France, of several feet in Germany, of several fathoms in Russia, and of some hundreds of feet beyond the sixtieth degree of Latitude, such as the ices which *Henry Ellis* *, and other Naviga-

* Ellis's Voyage to Hudson's-Bay.

tors

tors of the North encountered there at Sea, even in the midſt of Summer, and of which ſome, if *Ellis* is to be believed, were from fifteen to eighteen hundred feet above it's level; for their elevation muſt probably go on increaſing, up to the very Pole, in conformity to the proportions obſervable in thoſe which cover the ſummits of our icy mountains; which muſt give them, under the very Pole, a height which there is no poſſibility of determining.

From this ſimple outline, it is clearly perceptible what an enormous aggregation of water is fixed, by the cold of Winter, in our Hemiſphere, above the level of the Ocean. It is ſo very conſiderable, that I think myſelf warranted to aſcribe to the periodical fuſion of this ice, the general movement of our Ocean, and that of the tides. We may apply, in like manner, the effects of the fuſion of the ices of the South Pole, which are there ſtill more enormous, to the movements of it's Ocean.

No concluſion has, hitherto, been drawn, relatively to the movements of the Sea, from the two maſſes of ice ſo conſiderable, alternately accumulated and diſſolved at the two Poles of the World. They neceſſarily muſt, however, occaſion a very perceptible augmentation of it's waters, on their

return to it, by the action of the Sun, which partly melts them once every year; and a great diminution, on being withdrawn, by the effect of the evaporations, which reduce them to ice at the Poles, when the Sun retires.

I proceed to lay before the Reader, ſome obſervations and reflections on this ſubject, which I have the confidence to call highly intereſting; and ſhall ſubmit the deciſion to thoſe who have not got into the trammels of ſyſtem and party. I ſhall endeavour to abridge them to the utmoſt of my power, and flatter myſelf with the hope of forgiveneſs, at leaſt, in conſideration of their novelty. I am going to deduce, merely from the alternate diſſolution of the polar ices, the general movements of the Seas, which have hitherto been aſcribed to gravitation, or to the attraction of the Sun, and of the Moon, on the Equator.

It is impoſſible to deny, in the firſt place, that the Currents and the Tides do not come from the Pole, in the vicinity of the polar Circle.

Frederic Martens, who, in his voyage to Spitzbergen, in 1671, advanced as far as to the eighty-firſt degree of northern Latitude, poſitively aſſerts, that the Currents, amidſt the ices, ſet in toward the South. He adds, farther, that he can affirm nothing

nothing with certainty respecting the flux and reflux of the Tides. Let this be carefully remarked.

Henry Ellis observed with astonishment, in his voyage to Hudson's-Bay, in 1746, and 1747, that the Tides there came from the North, and that they were accelerated, instead of being retarded, in proportion as the Latitude increased. He assures us that these effects, so contrary to their effects on our coasts, where they come from the South, demonstrate that the Tides, in those high Latitudes, do not come from the Line, nor from the Atlantic Ocean. He ascribes them to a pretended communication between Hudson's-Bay and the South-Sea: a communication which, with much ardor, he sought for, and which was, indeed, the object of his voyage; but now we have complete assurance that it does not exist, from the fruitless attempts lately made by *Captain Cook* to find it by the South-Sea, to the north of California, in conformity to the advice, long before given respecting it, by the illustrious Navigator *Dampier*, whose sagacity and observations have, by the by, greatly assisted *Captain Cook* in all his discoveries.

Ellis farther observed, that the course of these northern Tides of America, was so violent, at *Wager's* Strait, which is about 65° 37′ North Latitude, that it run at the rate of from eight to ten

leagues an hour. He compares it to the ſluice of a mill. He remarked that the ſurface of the water was there very ſmooth, which puzzled him exceedingly, by damping his hope of a communication between this Bay and the South-Sea. He remained, nevertheleſs, convinced of the exiſtence of ſuch a paſſage; ſuch is the pertinacity of Man in favour of pre-conceived opinions, in the very face of evidence.

John Huguez de Linſchotten, a Dutchman, had made nearly the ſame remarks on the currents of the northern Tides of Europe *, when he was at Waigats Strait, at 70° 20′ North Latitude. In the two voyages which that exact Obſerver made to this Strait, in 1594 and 1595, undertaken in the view of diſcovering a paſſage to China by the North of Europe, he repeated the ſame obſervations: "We obſerved," ſays he, "once more, "from the courſe of the tide, what we had al- "ready remarked with much exactneſs, that it "comes from the Eaſt." He likewiſe obſerved, that there the water was brackiſh, or half ſalt; this he aſcribes to the fuſion of a prodigious quantity of floating ice, which ſtopped his paſſage at Waigats Strait; for the ice formed even of ſea-

* See the firſt and ſecond Voyages to *Waigats*, by *H. J. Linſchotten*. Voyages to the North, vol. iv. page 204.

water

water is freſh. But *Linſchotten* draws no concluſion, any more than *Ellis*, from theſe tides of water half freſh, which deſcend from the North; and full of his object, like the Engliſh Navigator, he aſcribes them to a Sea, which he ſuppoſes open to the Eaſt, beyond Waigats Strait, through which he propoſed to find his way to China.

His compatriot, the unfortunate *William Barents* *, who made the ſame voyages in the ſame fleet, but in another veſſel, and who ended his days on the northern coaſts of Nova Zembla, where he had wintered, found, to the North and to the South of that iſland, a perpetual current of ice, ſetting in from the Eaſt, with a rapidity, which he compares, as *Ellis* does, to a ſluice. Some of theſe ices were to 36 fathoms of depth under water, and 16 fathoms high above the ſurface. This was at Waigats Strait, in the months of July and Auguſt. He found there ſome Ruſſian fiſhermen from Petzorah, who navigated theſe Seas, covered with floating rocks of ice, in a boat made of the bark of trees ſewed together. Theſe poor people made preſents of fat geeſe to the Dutch mariners, with ſtrong demonſtrations of friendſhip; for calamity

* Conſult the ſecond and third Voyages of the Dutch by the North, in the firſt volume of the Voyages of the Eaſt-India Company.

has, in all Climates, a powerful tendency to conciliate affection between man and man. They informed him, that this ſame Strait of Waigats, which was then diſgorging ſuch immenſe quantities of ice, would be entirely ſhut up toward the end of October, and that it would be poſſible to go into Tartary over the ice, by what they called the Sea of Marmara.

It is incontrovertible, that all theſe effects which I have been relating, can proceed only from the effuſions of the ices which ſurround the Pole. I ſhall here remark, by the way, that theſe ices, which flow with ſuch rapidity to the north of America and of Europe, towards the months of July and Auguſt, greatly contribute to our high equinoctial tides, in September; and that when their effuſions are ſtopped in the month of October, like thoſe of Waigats, this too is the time when our Tides begin to diminiſh.

I may now be aſked, Why the tides come from the North and the Eaſt to the north of America, and of Europe; and from the South, on our coaſts, and on thoſe of America which are under the ſame Latitudes?

I might ſatisfy myſelf with having ſaid enough to demonſtrate, that all the Tides do not proceed from

from the preſſure, or the attraction of the Sun, and of the Moon, on the Equator; I ſhould have proved the imperfection of our ſcientific ſyſtems which aſcribe them to theſe cauſes: but I proceed to repair what I have been pulling down, by other obſervations; and to demonſtrate, that there is no one Tide, on any coaſt whatever, but what owes it's origin to polar effuſions.

An obſervation of *Dampier*'s * will ſerve, at firſt, as a baſis to my reaſonings. That careful and ingenious obſerver diſtinguiſhes between Currents and Tides. He lays it down as a principle, founded on many experiments, of which he gives the hiſtory, that *Currents are ſcarcely ever felt but out at Sea, and Tides upon the Coaſts.* This being laid down: the polar effuſions, which are the Tides of the North and of the Eaſt, to thoſe who are in the vicinity of the Poles, or of bays which have a communication with it, take their general courſe to the middle of the channel of the Atlantic Ocean, attracted toward the Line by the diminution of the waters, which the Sun is there inceſſantly evaporating. They produce, by their general Current, two contrary Currents, or collateral Whirlpools, ſimilar to thoſe which rivers produce on their banks.

* See *Dampier*'s Treatiſe on Winds and Tides.

I am not taking for granted, without any foundation, the exiſtence of theſe counter-currents, or *vortices*, after the manner of Syſtem-makers, who create new cauſes, in proportion as Nature preſents them with new effects. Theſe *vortices* are hydraulic re-actions, the laws of which Geometry explains, and the reality of which is completely aſcertained by experience. If you look at a ſmall running brook, you will frequently ſee ſtraws floating along the brink, and carried upward in a direction oppoſite to the general current of the ſtream; and on arriving at the points, where the counter-currents croſs the general, you obſerve them agitated by theſe two oppoſed powers turning and ſpinning round a conſiderable time, till they are at laſt carried down the general current.

Theſe counter-currents are ſtill more perceptible, when ſuch a rivulet flows through a baſon which has itſelf no flux; for the re-action is, in that caſe, ſo conſiderable round the whole circumference of the baſon, that the counter-currents carry about all bodies floating in it, to the very place where the rivulet diſengages itſelf

Theſe lateral counter-currents are ſo perceptible on the banks of rivers, that the watermen frequently take the advantage of them, to make their way in the direction oppoſite to the general courſe. They

They are ſtill more decidedly remarkable on the banks of lakes. Father *Charlevoix*, who has given us many judicious obſervations reſpecting Canada, informs us, that when he embarked on Lake Michigan, he made out eight good leagues a day, by the aſſiſtance of theſe lateral counter-currents, though the wind was contrary. He ſuppoſes, and with good reaſon, that the rivers which throw themſelves into this lake, produce, in the middle of it's waters, ſtrong contrary currents: "But "theſe ſtrong currents," ſays he,* "are percep- "tible only in the middle of the channel, and "produce on the banks, *vortices*, or counter-cur- "rents, of which thoſe avail themſelves who have "to coaſt along the ſhore, as is the caſe with per- "ſons who are obliged to take the water in canoes "made of bark."

Dampier's Work is filled with obſervations on the counter-currents of the Ocean, which are very common, eſpecially in the ſtraits of iſlands ſituated between the Tropics. He ſpeaks frequently of the extraordinary effects produced by the meeting of the particular currents which occaſions them; but as he does not conſider the Tides themſelves, as *vortices* of the general Current of the Atlantic Ocean; and as I believe he did not ſo

* *Charlevoix*, Hiſtory of New France. Vol. vi. page 2.

much

much as ſuſpect the exiſtence of it's general Current, though he has thoroughly inveſtigated the two Currents, or Monſoons, of the Indian Ocean, I ſhall proceed to adduce certain facts, which eſtabliſh the moſt perfect conformity between the Atlantic Current and thoſe which he himſelf obſerved in the Indian Ocean, and in the South Sea.

Theſe facts will farther prove, to a demonſtration, the exiſtence of theſe polar effuſions: for, univerſally, wherever theſe effuſions happen to meet, in their progreſs ſouthward, their own counter-currents which are ſetting in toward the North, they produce, by their colliſion, Tides the moſt tremendous, and whoſe direction is diametrically oppoſite.

Let us conſider them only at their point of departure to the North of Europe, where they begin to leave our coaſts, and to ſtretch out into the open Sea. *Pont Oppidan* ſays, in his Hiſtory of Norway, that there is above Berghen a place called *Maleſtrom*, very formidable to mariners, where the Sea forms a prodigious *vortex* of ſeveral miles diameter, in which a great many veſſels have been ſwallowed up. *James Beverell* * ſays poſitively, that there are in the Orkney iſlands two oppoſite

* See *James Beverell*, Beauties of Scotland, vol. vii. page 1405.

Tides,

Tides, the one running from the North-Weſt, and the other from the South-Eaſt; that they daſh their roaring billows up to the clouds, and convert the ſeparating ſtrait into an enormous maſs of foam. The Orkneys lie a little under the Latitude of Berghen, and in the prolongation of the northern coaſt of Norway, that is, at the confluence of the polar effuſions and of their counter-currents.

Other iſlands of the Sea are in ſimilar poſitions, as we could prove, did room permit. The channel of Bahama, for example, which runs with ſo much rapidity to the North, between the Continent of America and the Lucayo iſlands, produces, round thoſe iſlands, by it's encountering the general Current of that Sea, Tides the moſt tumultuous, and ſimilar to thoſe of the Orkneys.

Theſe counter-currents to the courſe of the Atlantic Ocean produce, then, our European and American Tides, which ſet in to the North on the coaſt, while it's general Current runs ſouthward, at leaſt in the Summer time. I could adduce a thouſand other obſervations reſpecting the exiſtence of theſe contrary Currents; but a ſingle one, more general than thoſe which I have quoted, will be ſufficient for my purpoſe, both from it's importance and it's authenticity, being the firſt of all thoſe which

which have been made in Europe, and perhaps the only one: it is that of *Chriſtopher Columbus*, ſetting out on the diſcovery of the New World.

He ſet ſail from the Canaries about the beginning of September, and ſteered to the Weſt. He found, during the firſt days of his voyage, that the currents carried him to the North-Eaſt. When he had advanced two or three hundred leagues from land, he perceived that their direction was ſouthward. This greatly terrified his companions, who believed that the Sea was there driving to a precipice. Finally, as he approached the Lucayo Iſlands, he again found the currents ſetting in northward. The journal of this important voyage may be found in *Herrera*.

My opinion is, that this general Current, which flows from our Pole, in Summer, with ſo much rapidity, and which is ſo violent toward it's ſource, according to the experience of *Ellis* and *Linſchotten*, croſſes the equinoctial Line, in as much as it's flux is not ſtemmed by the effuſions of the South Pole, which, at that ſeaſon are conſolidated into ice. I preſume, for the ſame reaſon, that it extends beyond the Cape of Good Hope, from whence it is directed toward the torrid Zone, to which it is attracted by the diminution of the waters, which the Sun is there inceſſantly pumping up;

up; and that being directed eaſtward by the poſition of Africa and of Aſia, it forces the Indian Ocean into the ſame direction, contrary to it's uſual motion. I conſider it, therefore, as the prime mover of the weſterly Monſoon, which takes place in the Seas of India, in the month of April, and ends not till the month of September.

I am likewiſe of opinion, that the general Current which iſſues, during our Winter, from the South Pole, at that time heated by the rays of the Sun, reſtores the Indian Ocean to it's natural motion weſtward, which is beſides determined, on this ſide, by the general impulſions of the eaſterly winds, which uſually blow in the torrid Zone, when nothing deranges their courſe. I, farther, preſume, that this current, in it's turn, penetrates into our Atlantic Ocean, directs it's motion northward by the poſition of America, and produces various other changes in our Tides.

In fact, *Froger* ſays that, in Braſil, the Currents follow the Sun. They run ſouthward when he is in the South, and northward when he is to the North *. Thoſe who have had experience of theſe effuſions of the South Pole, beyond Cape Horn, have found, that, in the Summer of the

* Voyage to the South Sea.

Southern

Southern Hemiſphere, the Tides ſet in northward, as was obſerved by *William Schouten*, who, in January 1661, diſcovered Maires Strait. But ſuch, on the contrary, as have gone thither in the Winter of thoſe regions, have found that the Tides run ſouthward, and came from the North, as was obſerved by *Fraſer* in the month of May of the year 1712.

It now ſeems, to me, poſſible to explain the principal phenomena of our Tides, from theſe polar effuſions. It will be evident, for example, why thoſe of the evening ſhould be ſtronger, in Summer, than thoſe of the morning; becauſe the Sun acts more powerfully by day than by night, on the ices of the Pole, which are on the ſame Meridian with ourſelves. This effect reſembles the intermittance of certain fountains which are ſupplied from mountains of ice, and flow more abundantly in the evening than in the morning. It will, farther be evident, how it happens that our morning Tides, in Winter, riſe higher than thoſe of the evening; and why the order of our Tides changes, at the end of every ſix months, as *Bouguer* * has well remarked, who thought the fact aſtoniſhing, but without aſſigning any reaſon for it; becauſe the Sun being alternately toward both

* *Bouguer*, Treatiſe of Navigation, page 153.

Poles,

Poles, the effects of the Tides muſt neceſſarily be oppoſite, like the cauſes which produce them.

But I beg leave to ſuggeſt harmonies, between the Ocean and the Poles, ſtill more extenſive and more ſtriking. At the Solſtices the Tides are lower than at any other ſeaſon of the year; and theſe, likewiſe, are the ſeaſons when there is moſt ice on the two Poles, and, conſequently, leaſt water in the Sea. The reaſon is obvious. The Winter Solſtice is, with reſpect to us, the ſeaſon of the greateſt cold; there is, accordingly, at that time, on our Pole, and on our Hemiſphere, the greateſt poſſible accumulation of ice. It is, indeed, at the South Pole, the Summer Solſtice; but there is little ice melted on this Pole, becauſe the action of the greateſt heat is not felt there, as with us, but when the Earth has an acquired heat, ſuperadded to the actual heat of the Sun, which takes place only in the ſix weeks that follow the Summer Solſtice; and theſe give us, likewiſe, in our Summer, the hotteſt ſeaſon of the year, which we call the Dog-Days.

At the Equinoxes, on the contrary, we have the higheſt Tides. And theſe are preciſely the ſeaſons when there is the leaſt ice at the two Poles, and, of courſe, the greateſt maſs of water in the Ocean. At our autumnal Equinox, in September, the

the greateſt part of the ices of the North Pole, which has undergone all the heats of Summer, is melted, and thoſe of the South Pole begin to diſſolve. It is farther remarkable, that the tides at our vernal Equinox, in March, riſe higher than thoſe of September, becauſe it is the end of Summer to the South Pole, which contains much more ice than ours, and, conſequently, ſends to the Ocean, a much greater maſs of water. And it contains more ice, becauſe the Sun is ſix days leſs in that Hemiſphere, than in ours. If I am aſked, Why the Sun does not communicate his light and heat, in exactly equal proportions, to both Poles? I ſhall leave it to the learned to aſſign the *cauſe*, but ſhall aſcribe the *reaſon* of it to the Divine Goodneſs, which has been pleaſed to beſtow the larger ſhare of theſe bleſſings, on that half of the Globe which contains the greateſt quantity of dry land, and the greateſt number of inhabitants.

I ſhall ſay nothing of the intermittance of theſe polar effuſions, which produce, on our coaſts, two fluxes and two refluxes, nearly in the ſame time that the Sun, making the circuit of the Globe, over our Hemiſphere, alternately heats two Continents and two Oceans, that is, in the ſpace of twenty-four hours, during which his influence twice acts, and is twice ſuſpended. Neither ſhall I ſpeak of their retardation, which is nearly three quarters

quarters of an hour from one day to another, and which ſeems to be regulated by the different diameters of the polar cupola of ice, the extremities of which, melted by the Sun, diminiſh and retire from us every day, and whoſe effuſions muſt, conſequently, require more time to reach the Line, and to return from the Line to us. Neither ſhall I dwell on the other relations which theſe polar periods have to the phaſes of the Moon, eſpecially when ſhe is at the full; for her rays poſſeſs an evaporating heat, as the late experiments, made at Rome and at Paris, have demonſtrated: for this would lay me under the neceſſity of detailing a ſeries of obſervations and facts, which might carry me too far.

Much leſs ſhall I involve myſelf in a diſcuſſion of the Tides of the South Pole, which, in the Summer of that Pole, in the open Sea, come immediately from the South and South-weſt, in vaſt ſurges, conformably to the experience of the Dutch Navigator, *Abel Taſman*, in the months of January and February 1692; and of their irregularity on the coaſts of that Hemiſphere, ſuch as thoſe on the coaſts of New Holland, where *Dampier*, in the month of January 1688, found, to his great aſtoniſhment, that the higheſt Tide, which ſet in from eaſt-quarter-north, did not come till three days after full moon, and where his ſhip's com-

pany, ſtruck with conſternation, were, for ſeveral days together, under the apprehenſion that their veſſel, which they had hauled up on the beach to be refitted, could never be got afloat again *. I ſhall ſay nothing of thoſe of New Guinea, where, toward the end of April, the ſame Navigator experienced ſeveral, on the contrary, in the ſpace of a ſingle night, which extended, in direct oppoſition to ours, from North to South, and came from the Weſt in very rapid ſwells, tumultuous, and preceded by enormous ſurges, which did not break; nor of the inconſiderable elevation of theſe Tides on the coaſt of Braſil, and in moſt of the iſlands of the South-Sea, and of the Eaſt-Indies, where they riſe only to 5, 6, 7, feet, whereas *Ellis* found them 25 feet high at the entrance of Hudſon's-Bay, and the *Chevalier Narbrough*, 20 feet at the entrance of Magellan's Straits.

Their courſe toward the Equator in the South-Sea, their retardations and accelerations on theſe ſhores, their directions, ſometimes eaſtward, ſometimes weſtward, according to the Monſoons; finally, their riſe, which increaſes in proportion as we approach the Pole, and diminiſh in proportion to our diſtance from it, even between the Tropics,

* *Dampier's* Voyages: Treatiſe on Winds and Tides, pages 378 and 379.

demonſtrate,

demonſtrate, that their focus is not under the Line. The cauſe of their motions depends not on the attraction, or the preſſure, of the Sun and of the Moon, on that part of the Ocean; for theſe forces would, undoubtedly, act there with the greateſt energy, and in periods as regular as the courſe of theſe two luminaries; but it ſeems to depend entirely on the combined heat of theſe ſame luminaries, on the Poles of the Globe, the irregular effuſions of which, not being narrowed in the ſouthern Hemiſphere, as in ours, by the channel of two adjacent Continents, produce, on the ſhores of the Indian Ocean and South Sea, expanſions vague and intermitting.

It is ſufficient, therefore, to admit theſe alternate effuſions of the polar ices, which it is impoſſible to call in queſtion, to explain, with the greateſt facility, all the phenomena of the Tides, and of the Currents of the Ocean. Theſe phenomena preſent, in the journals of Navigators the moſt enlightened, a perpetual obſcurity, and a multitude of contradictions, as often as theſe ſame Navigators perſiſt in aſcribing the cauſes of them to the conſtant preſſure of the Moon and of the Sun on the Equator, without paying attention to the alternate Currents from the Poles, which direct their courſe to that ſame Equator; to their counter-currents, which returning toward the Poles,

produce Tides; and to the revolutions which Winter and Summer effect on these two movements.

It has been supposed, indeed, in modern times, that the Sea must be clear of ice under the Poles, and this is founded on the groundless assertion, that the Sea freezes only along the shore; but this supposition is the creature of men in their closets, in contradiction to the experience of the most celebrated Navigators. The efforts of Captain *Cook*, toward the South Pole, demonstrate it's erroneousness. That intrepid mariner, in the month of February, the Dog-Days of the Southern Hemisphere, never could approach nearer to that Pole, where there is no land, than the 70th degree of Latitude, that is, no nearer than five hundred leagues, though he had coasted round it's cupola of ice for a whole Summer; besides this distance did not compose half the magnitude of the cupola, for he was permitted to advance so far only under favour of a bay, opened in a part of it's circumference, which every where else was of much greater extent.

These bays, or openings, are formed in the ice, merely by the influence of the nearest adjacent lands, where Nature has distributed sandy zones, to assist in accelerating the fusion of the polar ices, at the proper season. Such are, to throw it out only

only on our way, for time permits me not here to unfold all the plans of this wonderful Architecture; ſuch, I ſay, are thoſe long belts of ſand which encompaſs South America, in Magellan's Land; and thoſe of Tartary, which commence in Africa, at Zara, or the Deſert, and proceed forward till they terminate in the north of Aſia. The winds, in Summer, convey the igneous particles, with which thoſe Zones are filled, toward the Poles, where they accelerate the action of the Sun upon the ices.

It is eaſy to conceive, independent of experience, that the ſands multiply the heat of the Sun, by the reflections of their ſpecular and brilliant parts, and preſerve it a long time in their interſtices. It is certain, at leaſt, that the greateſt openings in the polar ices are always to be found in the direction of the warm winds, and under the influence of theſe ſandy tracks of land, as I could eaſily demonſtrate, were this the proper place. But we may ſee examples of it, without quitting our own Continent, nay, in our very gardens. In Ruſſia, the rivers and lakes always begin to thaw at the banks, and the fuſion of their ices is accelerated, in proportion as the ſtrand is more or leſs gravelly, and as they meet, relatively to the ſtrand, in the direction of the South wind.

We obſerve the ſame effects in our own gardens, toward the cloſe of Winter. The ice which covers the gravel on the alleys, melts firſt; afterward that which is on the earth, and laſt of all, that which is in the baſons. The fuſion of this, too, begins at the brink, and the length of time neceſſary to complete it, is in proportion to the extent of the baſon; ſo that the central part, or that which is fartheſt from the earth, is, likewiſe, the laſt that diſſolves.

There can remain, therefore, not the ſlighteſt ſhadow of doubt, that the Poles are covered with a cupola of ice, conformably to the experience of Navigators, and the dictates of natural reaſon. We have taken a glance of the icy dome of our own Pole, which covers it, in Winter, to an extent of more than two thouſand leagues over the Continents. It is not ſo eaſy to determine it's elevation at the centre, and under the very Pole; but the height muſt be immenſe.

Aſtronomy ſometimes preſents, in the Heavens, an image of it ſo conſiderable, that the rotundity of the Earth ſeems to be remarkably affected by it.

I take the liberty of quoting, what I find, on this ſubject, in an Engliſh Author of note,

Childrey.

Childrey *. This Naturaliſt ſuppoſes, as I do, that the Earth, at the Poles, is covered with ice, to ſuch a height, that it's figure is thereby rendered ſenſibly oval. This he proves by two very curious aſtronomical obſervations. "What obliges me, "beſides," ſays he, "to embrace this paradox, is, "that it ſerves to reſolve admirably well, a diffi- "culty of no ſmall importance, which has greatly "embarraſſed *Tycho Brhaë* and *Kepler*, reſpecting "central eclipſes of the Moon, which take place "near the Equator; as that was which *Tycho* ob- "ſerved in the year 1588, and that obſerved by "*Kepler* in the year 1624: of which he thus "ſpeaks: *Notandum eſt hanc Lunæ eclipſim (inſtar "illius quam Tycho, anno* 1588, *obſervavit totalem, "& proximam centrali) egregiè calculum fefelliſſe; nam "non ſolum mora totius Lunæ in tenebris brevis fuit, "ſed et duratio reliqua multò magis; perindè quaſi "tellus elliptica eſſet, demetientem breviorem habens "ſub Æquatore, longiorem a polo uno ad alteram.* "That is, *It is worthy of remark, that this eclipſe "of the Moon,*" (he is ſpeaking of that of the 26th "September, 1624) *like the one which* Tycho *ob- "ſerved, in the year* 1588, *which was total, and very "nearly central, differed widely from the calculation; "for not only was the duration of total darkneſs ex- "tremely ſhort, but the reſt of the duration, previous,*

* Natural Hiſtory of England, pages 246 and 247.

" *and poſterior, to the total obſcuration, was ſtill ſhort-*
" *er; as if the figure of the Earth were elliptical,*
" *having the ſmaller diameter under the Equator, and*
" *the greater, from Pole to Pole.*"

The detached maſſes, half melted, which are every year torn from the circumference of this cupola, and which are met with, floating at ſea, prodigiouſly diſtant from the Pole, about the 55th degree of Latitude, are of ſuch an elevation, that *Ellis*, *Cook*, *Martens*, and other Navigators of the North, and of the South, the moſt accurate in their details, repreſent them as, at leaſt, as lofty as a ſhip under ſail: nay, *Ellis*, as has already been mentioned, does not heſitate to aſſign to them an elevation of from 1500 to 1800 feet. They are unanimous in affirming, that theſe vaſt fragments emit corruſcations, which render them perceptible before they come to the Horizon. I ſhall remark, by the way, that the *Aurora Borealis*, or Northern Light, may, very probably, owe it's origin to ſimilar reflections from the polar ices, the elevation of which may, perhaps, one day be determined by the extent of theſe very lights.

Whatever may be in this, *Denis*, Governor of Canada, ſpeaking of the ices which deſcend, every Summer, from the North, upon the great bank of Newfoundland, ſays that they are higher than the turrets

turrets of Notre-Dame, and that they may be ſeen at the diſtance of from 15 to 18 leagues. Their cold is felt on ſhip-board at a ſimilar diſtance. "They are," according to his account *, "ſometimes in ſuch numbers, being all carried forward by the ſame wind, that there have been veſſels, making toward the land to fiſh, which fell in with ſome of them, in a ſeries of a hundred and fifty leagues in length, and upward; which coaſted along them for a day or two, the night included, with a freſh breeze, and every ſail ſet, without being able to reach the extremity. In this manner they keep on under way, looking for an opening through which the veſſel may paſs; if they find one, they croſs it, as through a ſtrait; otherwiſe, they muſt get on, till they have outſailed the whole chain, in order to make good their paſſage; for the way is throughout blocked up with ice. Theſe ices do not melt, till they meet the warm water toward the South, or are forced by the wind on the land ſide. Some of them run aground in from 25 to 30 fathoms of water; judge of their height, excluſive of what is above water. The fiſhermen have aſſured me, that they ſaw one aground, on the great bank, in 45 fathom water, and

* Natural Hiſtory of North-America. Vol. ii. chap. 1: page 44 and 45.

which

" which was, at leaſt, ten leagues round. It muſt " have been of a great height. Ships do not " come near theſe ices, for there is danger leſt " they ſhould overturn, according as they diſſolve " on the ſide expoſed to the greateſt heat."

It is to be obſerved, that the ices in queſtion are already more than half melted by the time they reach the banks of Newfoundland; for, in fact, they ſcarcely go any farther. It is the Summer's heat which detaches them from the North, and they are enabled to make even ſuch a progreſs ſouthward, only by means of their floating down the current, which carries them toward the Line, where they arrive, in a ſtate of diſſolution, to replace the waters which the Sun is continually evaporating in the torrid Zone.

Theſe polar ices, of which our mariners ſee only the borders and the crumbs, muſt have, at their centre an elevation proportioned to their extent. For my own part, I conſider the two Hemiſpheres of the Earth as two mountains with their baſes applied to each other at the Line, the Poles as the icy ſummits of theſe mountains, and the Seas as rivers flowing from theſe ſummits.

If, then, we repreſent to ourſelves the proportions which the glaciers of Switzerland have to their

their mountains, and to the rivers which flow from them, we shall be able to form some faint idea of those proportions which the glaciers of the Poles bear to the whole Globe and to the Ocean. The Cordeliers of Peru, which are only mole-hills, compared to the two Hemispheres, and the rivers, which issue from them, only rills of water compared to the Sea, have selvages of ice, from twenty to thirty leagues broad, bristled, at their centre, with pyramids of snow from twelve to fifteen hundred fathoms high. What, then, must be the elevation of these two domes of polar ice, which have, in Winter, bases of two thousand leagues in diameter? I can have no doubt, that their thickness, at the Poles, must have represented the Earth as oval, in central eclipses of the Moon, conformably to the observations of *Kepler* and *Tycho Brhaë*.

I deduce another consequence from this configuration. If the elevation of the polar ices is capable of changing in the Heavens the apparent form of the Globe, their weight must be sufficiently considerable to produce some influence on it's motion in the Ecliptic. There is, in fact, a very singular correspondence between the movement, by which the Earth alternately presents it's two Poles to the Sun, in one year, and the alternate effusions of the polar ices, which take place in the course of the same year. Let me explain my

my conception of the way in which this motion of the Earth is the effect of theſe effuſions.

Admitting, with Aſtronomers, the laws of Attraction among the heavenly bodies, the Earth muſt certainly preſent to the Sun, which attracts it, the weightieſt part of it's Globe. Now, this weightieſt part muſt be one of it's Poles, when it is ſurcharged with a cupola of ice, of an extent of two thouſand leagues, and of an elevation ſuperior to that of the Continents. But as the ice of this Pole, which it's gravity inclines toward the Sun, melts in proportion to it's vertical approximation to the ſource of heat, and as, on the contrary, the ice, of the oppoſite pole, increaſes in proportion to it's removal, the neceſſary conſequence muſt be, that the firſt Pole becoming lighter, and the ſecond heavier, the centre of gravity paſſes alternately from the one to the other, and from this reciprocal preponderancy muſt enſue that motion of the Globe in the Ecliptic, which produces our Summer and Winter.

From this alternate preponderancy, it muſt likewiſe happen, that our Hemiſphere, containing more land than the ſouthern Hemiſphere, and being, conſequently, heavier, it muſt incline toward the Sun for a greater length of time; and this, too, correſponds to the matter of fact, for our Summer

Summer is five or six days longer than our Winter. A farther conſequence is, that our Pole cannot loſe it's centre of gravity, till the oppoſite Pole becomes loaded with a weight of ice ſuperior to the gravity of our Continent, and of the ices of our Hemiſphere; and this, likewiſe, is agreeable to fact, for the ices of the South Pole are more elevated, and more extenſive than thoſe of the northern; for mariners have not been able to penetrate farther than to the 70th degree of South Latitude, whereas they have advanced no leſs than 82° North.

Here we have a glimpſe of the reaſons by which Nature was determined to divide this Globe into two Hemiſpheres, of which the one ſhould contain the greateſt quantity of dry land, and the other the greateſt quantity of water; to the end that this movement of the Globe ſhould poſſeſs, at once, conſiſtency and verſatility. It is farther evident, why the South Pole is placed immediately in the midſt of the Seas, far from the vicinity of any land; that it might be able to load itſelf with a greater maſs of marine evaporations, and that theſe evaporations accumulated into ice around it, might balance the weight of the Continents with which our Hemiſphere is ſurcharged.

And here I lay my account with being oppoſed by a very formidable objection. It is this. If the polar

polar effuſions occaſion the Earth's motion in the Ecliptic, the moment would come in which, it's two Poles being in equilibrio, it could preſent to the Sun the Equator only.

I acknowledge that I have no reply to make to that difficulty, unleſs this be one; We muſt have recourſe to an immediate will of the AUTHOR of Nature, who is pleaſed to deſtroy the inſtant of this equilibrium, and who re-eſtabliſhes the balancing of the Earth on it's Poles, by laws with which we are unacquainted. Now, this conceſſion no more weakens the probability of the hydraulic cauſe, which I apply to it, than that of the principle of the attraction of the heavenly bodies, which attempts to explain it, I am bold to ſay, with much leſs clearneſs. This very attraction would ſoon deprive the Earth of all manner of motion, if it alone acted in the ſtars. If we would be ſincere, it is in the acknowledgment of an intelligence, ſuperior to our own, that all the mechanical cauſes, of our moſt ingenious ſyſtems, muſt iſſue. The will of GOD is the *ultimatum* of all human knowledge.

From this objection, however, I ſhall deduce conſequences, which will diffuſe new light on the ancient effects of polar effuſions, and on the manner

ner in which they might have produced the Deluge *.

* The Prieſts of Egypt maintain, according to Herodotus, that the Sun had ſeveral times deviated from his courſe, accordingly our hypotheſis has nothing new in it. They had, perhaps, deduced the ſame conſequences from this, that we have done. One thing is certain; they believed that the Earth would, one day, periſh by a general conflagration, as it had been overwhelmed by an univerſal deluge. Nay, I believe it was one of their Kings, who, as a ſecurity againſt either one or the other of theſe calamities, had two pyramids built, the one of brick, a preſervative againſt fire; the other of ſtone, a preſervative againſt an inundation. The opinion of a future conflagration of Nature is diffuſed over many nations. But effects ſo terrible, which would ſpeedily reſult from the mechanical cauſes, by which Man endeavours to explain the laws of Nature, can take place only by an immediate order of the DEITY. He preſerves his works conformably to the ſame Wiſdom with which they were created. Aſtronomers have, for many Ages, been obſerving the annual motion of the Earth in the Ecliptic, and never have they ſeen the Sun ſo much as a ſingle ſecond ſhort of, or beyond, the Tropics. GOD governs the World by variable powers, and deduces from theſe, harmonies which are invariable. The Sun neither moves in the circle of the Equator, which would ſet the Earth on fire, nor in that of the Meridian, which would produce an inundation of water; but his courſe is traced in the Ecliptic, deſcribing a ſpiral line between the two Poles of the World. In this harmonious courſe, he diſpenſes cold and heat, dryneſs and humidity, and derives from theſe powers, each of them deſtructive by itſelf, Latitudes ſo varied, and ſo temperate, all over the Globe, that an infinite number of creatures, of an extreme delicacy, find in them, every degree of temperature adapted to the nature of their frail exiſtence.

On

On the ſuppoſition, then, of the re-eſtabliſhment of the equilibrium between the Poles, and of the Earth's conſtantly preſenting it's Equator to the Sun, it is extremely probable, that, in this caſe, it would be ſet on fire. In fact, on this hypotheſis, the waters which are under the Equator, being evaporated by the unremitting action of the Sun, would become irrevocably fixed in ice at the Poles, where they would receive, without effect, the influence of that luminary, which would be to them conſtantly in the Horizon. The Continents being thus dried up, under the torrid Zone, and inflamed by a heat every day increaſing, would quickly catch fire. Now, if it be probable that the Earth would periſh by fire, were the Sun's motion confined to the Equator, it is no leſs probable, that it muſt be deluged with water, if the courſe of the Sun were in the direction of the Meridian. Oppoſite means produce contrary effects.

We have juſt ſeen, that the alternate effuſions of part of the polar ices merely, are ſufficient for renewing all the waters of the Ocean, for producing all the phenomena of the Tides, and for effecting the balancing of the Earth in the Ecliptic. We believe them capable of entirely inundating the Globe, were the fuſion to take place all at once. Let it but be remarked, that the effuſion of only a part of the ices of the Cordeliers, in Peru, is ſufficient

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to produce an annual overflow of the Amazon, of the Oroonoko, and of several other great rivers of the New World, and to inundate a great part of Brasil, of Guiana, and of the *Terra Firma* of America; that the melting of part of the snows on the mountains of the Moon in Africa, occasions every year the inundations of Senegal, contributes to those of the Nile, and overflows vast tracks of country in Guinea, and the whole of Lower Egypt; and that similar effects are annually reproduced in a considerable part of southern Asia, in the kingdoms of Bengal, of Siam, of Pegou, and of Cochin-China, and in the districts watered by the Tigris, the Euphrates, and many other rivers of Asia, which have their sources in chains of mountains perpetually covered with ice, namely, Taurus and Imaüs. Who, then, can entertain a doubt, that the total fusion of the ices of both Poles, would be sufficient to swell the Ocean above every barrier, and completely to inundate the two Continents?

The elevation of these two cupolas of polar ice, vast as Oceans, must it not far surpass the height of the highest land, when the simple fragments of their extremities, after they are half dissolved, are as high as the turrets of Notre-Dame; nay, rise to the height of from fifteen to eighteen hundred feet above the Sea? The ground on which Paris stands,

at forty leagues diſtance from the ſhore of the Sea, is only twenty-two fathom above the level of neap-tides, and no more than eighteen above the higheſt ſpring-tides. A great part of both the Old and New World is of an elevation much inferior even to this.

For my own part, if I may venture to declare my opinion, I aſcribe the general Deluge to a total effuſion of the polar ices, to which may be added that of the icy mountains, ſuch as the ices of the Cordeliers and of Mount Taurus, the chains of which extend from twelve to fifteen hundred leagues in length, with a breadth of twenty or thirty leagues, and an elevation of from twelve to fifteen hundred fathom. To theſe may be ſtill farther added the waters diffuſed over the Atmoſphere, in clouds, and imperceptible vapours, which would not fail to form a very conſiderable maſs of water, were they collected on the Earth.

My ſuppoſition then is, that, at the epocha of this tremendous catraſtophe, the Sun, deviating from the Ecliptic, advanced from South to North*, and

* I find an hiſtorical teſtimony in ſupport of this hypotheſis, in the Hiſtory of China by Father *Martini*, Book I. "During "the reign of *Yaüs*, the ſeventh Emperor, the Annals of the "Country relate, that for ſix days together the Sun never ſet, "ſo

and purſued the direction of one of the Meridians which paſſes through the middle of the Atlantic Ocean and of the South-Sea. In this courſe he heated only a Zone of water, frozen as well as fluid, which, through the greateſt part of the circumference has a breadth of four thouſand five hundred leagues. He extracted long belts of land and ſea fogs, which accompany the melting of all ices, of the chain of the Cordeliers, of the different branches of the icy mountaints of Mexico, of Taurus, and of Imaüs, which like them run South and North; of the ſides of Atlas, of the ſummits of Teneriff, of Mount Jura, of Ida, of Lebanon, and of all the mountains covered with ſnow, which lay expoſed to his direct influence.

He quickly ſet on fire, with his vertical flame, the Conſtellation of the Bear, and that of the Croſs of the South; and, preſently, the vaſt cupolas of ice, on both Poles, ſmoked on every ſide. All theſe vapours, united to thoſe which aroſe out

" ſo that a general conflagration was apprehended." The reſult, on the contrary, was a deluge which inundated the whole of China. The epoch of this Chineſe deluge, and that of the Univerſal Deluge, are in the ſame century. *Yaüs* was born 2307 years before CHRIST, and the Univerſal Deluge happened 2348 years before the ſame epoch, according to the Hebrew computation. The Egyptians, likewiſe, had traditions reſpecting theſe ancient alterations of the Sun's courſe.

of the Ocean, covered the Earth with an univerſal rain. The action of the Sun's heat was farther augmented by that of the burning winds of the ſandy Zones of Africa and Aſia, which blowing, as all winds do, toward the parts of the Earth where the air is moſt rarefied, precipitated themſelves, like battering rams of fire, toward the Poles of the World, where the Sun was then acting with all his energy.

Innumerable torrents immediately burſt from the North Pole, which was then the moſt loaded with ice, as the Deluge commenced on the 17th of February, that ſeaſon of the year, when Winter has exerted it's full power over our Hemiſphere. Theſe torrents iſſued all at once from every floodgate of the North; from the ſtraits of the Sea of Anadir, from the deep gulf of Kamſchatka, from the Baltic Sea, from the ſtrait of Waigats, from the unknown ſluices of Spitzbergen and Greenland, from Hudſon's-Bay, and from that of Baffin, which is ſtill more remote. Their roaring currents ruſhed furiouſly down, partly through the channel of the Atlantic Ocean, hurled it up from the abyſſes of it's profound baſon, drove impetuouſly beyond the Line, and their collateral counter-tides forced back upon them, and increaſed by the Currents from the South Pole, which had been ſet a flowing at the ſame time, poured upon our

our coaſts the moſt formidable of Tides. They rolled along, in their ſurges, a part of the ſpoils of the Ocean, ſituated between the ancient and the new Continent. They ſpread the vaſt beds of ſhells which pave the bottom of the Seas at the Antilles and Cape-Verd Iſlands, over the plains of Normandy; and carried even thoſe which adhere to the rocks of Magellan's Strait, as far as to the plains which are watered by the Saône. Encountered by the general Current of the Pole, they formed at their confluences horrible counter-tides, which conglomerated, in their vaſt funnels, ſands, flints, and marine bodies, into maſſes of indigeſted granite, into irregular hills, into pyramidical rocks, whoſe protuberances variegate the ſoil in many places of France and Germany. Theſe two general Currents of the Poles happening to meet between the Tropics, tore up, from the bed of the Seas, huge banks of madrépores, and toſſed them, unſeparated, on the ſhores of the adjacent iſlands, where they ſubſiſt to this day *.

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* I have ſeen in the Iſle of France, ſome of theſe great beds of madrépores, of the height of ſeven or eight feet, reſembling ramparts, left quite dry, more than three hundred paces from the ſhore. The Ocean has left, on every land, ſome traces of it's ancient excurſions. There have been found, on the ſteep ſtrand of the diſtrict of Caux, ſome of the ſhells peculiar to the Antilles Iſlands, particularly a very large one, called the *Thuilée*;

In other places, their waters, ſlackened at the extremity of their courſe, ſpread themſelves over the ſurface of the ground in vaſt ſheets, and depoſited, by repeated undulations, in horizontal layers,

in the vineyards of Lyons, that which they call the cock and hen, which is caught alive in no Sea whatever but the Straits of Magellan; the teeth and jaws of ſharks, in the ſands of Eſtampes. Our quarries are filled with the ſpoils of the Southern Ocean. On the other hand, if we may believe the Memoirs of Father *le Comte*, the Jeſuit, there are in China ſtrata of vegetable earth from three to four hundred feet deep. This Miſſionary aſcribes to theſe, and with good reaſon, the extreme fertility of that country. Our beſt ſoils in Europe are not above three or four feet deep. If we had Geographical Charts which ſhould repreſent the different layers of our foſſil ſhells, we might diſtinguiſh in them the directions and the ſources of the ancient currents which lodged them. I ſhall purſue this idea no further; but here is another, which may preſent new objects of curioſity to the learned, who put greater value on the monuments raiſed by Man, than on thoſe of Nature. It is this, As we find in the foſſils of theſe weſtern regions, a multitude of the monuments of the Sea, we might, perhaps, be able to trace thoſe of our ancient Continent, in thoſe ſtrata of vegetable earth, of three and four hundred feet depth, in the countries of the Eaſt. Firſt, it is certain, from the teſtimony of the Miſſionary above quoted, that pit-coal is ſo common in China, that moſt of the Chineſe make uſe of no other fuel. Now, it is well known that pit-coal owes it's origin to the foreſts which have been buried in the bowels of the Earth. It might be poſſible, therefore, to find amidſt theſe wrecks of the vegetable creation, thoſe of terreſtrial animals, of men, and of the firſt arts of the World, ſuch, at leaſt, as poſſeſſed ſome degree of ſolidity.

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the wreck and the viſcidities of an infinite number of fiſhes, ſea-urchins, ſea-weeds, ſhells, corals, and formed them into ſtrata of gravel, paſtes of marble, of marle, of plaſter and calcareous ſtones, which conſtitute, to this day, the ſoil of a conſiderable part of Europe. Every layer of our foſſils was the effect of an univerſal Tide. While the effuſions of the polar ices were covering the weſterly extremities of our Continent with the ſpoils of the Ocean, they were ſpreading over it's eaſterly extremities thoſe of the Land, and depoſited on the ſoil of China, ſtrata of vegetable earth, from three to four hundred feet deep.

Then it was that all the plans of Nature were reverſed. Complete iſlands of floating ice, loaded with white bears, run aground among the palm-trees of the torrid Zone, and the elephants of Africa were toſſed amidſt the fir-groves of Siberia, where their large bones are ſtill found to this day. The vaſt plains of the Land, inundated by the waters, no longer preſented a career to the nimble courſer, and thoſe of the Sea, rouſed into fury, ceaſed to be navigable. In vain did Man think of flying for ſafety to the lofty mountains. Thouſands of torrents ruſhed down their ſides, and mingled the confuſed noiſe of their waters with the howling of the winds, and the roaring of the thunder. Black tempeſts gathered round their ſummits, and

diffuſed a night of horror in the very midſt of day. In vain did he turn an eager eye toward that quarter of the Heavens where Aurora was to have appeared: he perceives nothing in the whole circuit of the Horizon but piles of dark clouds heaped upon each other; a pale glare here and there furrows their gloomy and endleſs battalions; and the Orb of Day, veiled by their lurid coruſcations, emits ſcarcely light ſufficient to afford a glimpſe, in the firmament, of his bloody diſk, wading through new Conſtellations.

To the diſorder reigning in the Heavens, Man, in deſpair, yields up the ſafety of the Earth. Unable to find in himſelf the laſt conſolation of Virtue, that of periſhing free from the remorſe of a guilty conſcience, he ſeeks, at leaſt, to conclude his laſt moments in the boſom of Love, or of Friendſhip. But in that age of criminality, when all the ſentiments of Nature were ſtifled, friend repelled friend, the mother her child, the huſband the wife of his boſom. Every thing was ſwallowed up of the waters: cities, palaces, majeſtic pyramids, triumphal arches, embelliſhed with the trophies of Kings: and ye, alſo, which ought to have ſurvived the ruin even of a World, ye peaceful grottos, tranquil bowers, humble cottages, the retreats of innocence! There remained on the Earth no trace of the glory and felicity of the Human Race,

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in thoſe days of vengeance, when Nature involved in one ruin all the monuments of her greatneſs.

Such convulſions, of which traces without number ſtill remain, on the ſurface, and in the bowels of the Earth, could not poſſibly have been produced ſimply by the action of an univerſal rain.

I am aware that the letter of Scripture is expreſs in reſpect to this; but the circumſtances which the Sacred Hiſtorian combines, ſeem to admit the means which, on my hypotheſis, effected that tremendous revolution.

In the book of Geneſis it is ſaid, that it rained, over the whole Earth, for forty days and forty nights. That rain, as we have alleged, was the reſult of the vapours produced by the melting of the ices, both of the Land and of the Sea, and by the Zone of Water which the Sun paſſed over, in the direction of the Meridian. As to the period of forty days, that quantity of time appears to me abundantly ſufficient to the vertical action of the Sun on the polar ices, to reduce them to the level of the Seas, as ſcarcely more than three weeks are neceſſary, of the proximity of the Sun to the Tropic of Cancer, to melt a conſiderable part of thoſe on our Pole. Nay, at that ſeaſon, nothing more ſeems to be wanting but a few puffs of ſoutherly,

or

or ſouth-weſt wind, for a few days, to diſengage from the ice the ſouthern coaſt of Nova-Zembla, and to clear the ſtrait of Waigats, as has been obſerved by *Martens*, *Barents*, and other Navigators of the North.

It is farther ſaid, in the Book of Geneſis, "all "the *fountains of the great Deep* were broken up, "and the *windows of Heaven* were opened." The expreſſion, *the fountains of the great Deep*, can, in my opinion, be applied only to an effuſion of the polar ices, which are the real ſources of the Sea, as the effuſions of the ice on mountains are the ſources of all the great rivers. The expreſſion, *the windows*, or cataracts, *of Heaven*, denotes likewiſe, if I am not miſtaken, the univerſal reſolution of the waters diffuſed over the Atmoſphere, which are there ſupported by the cold, the focuſes of which were then deſtroyed at the Poles.

It is afterwards ſaid, in Geneſis, that after it had rained for forty days, GOD *made a wind to blow*, which cauſed the waters that covered the Earth to diſappear. This wind, undoubtedly, brought back to the Poles the evaporations of the Ocean, which fixed themſelves a-new in ice. The Moſaic account, finally, adds circumſtances which ſeem to refer all the effects of this wind to the Poles of the World, for it is ſaid Gen. viii. 2, 3. "The foun-

"tains

" tains alſo of the Deep, and the windows of " Heaven, were ſtopped, and the rain from Hea- " ven was reſtrained; and the *waters returned from* " *off the Earth continually*, and after *the end of the* " *hundred and fifty days* the waters were abated."

The agitation of theſe waters from ſide to ſide continually, perfectly agrees to the motion of the Seas, from the Line to the Poles, which muſt then have been performed without any obſtacle, the Globe being, on that occaſion, entirely aquatic; and it being poſſible to ſuppoſe that it's annual balancing in the Ecliptic, of which the polar ices are at once the moving powers and the counter-poiſe, had degenerated, at that time, into a diurnal titubation, a conſequence of it's firſt motion. Theſe waters retired, then, from the Ocean, when they came to be converted a-new into ice upon the Poles; and it is worthy of remark, that the ſpace of a hundred and fifty days, which they took to fix themſelves in their former ſtation, is preciſely the time which each of the Poles annually employs, to load itſelf with it's periodical congelations.

We find, beſides, in the ſequel of this hiſtorical account of the Deluge, expreſſions analogous to the ſame cauſes: " GOD ſaid again to Noah, " while the Earth remaineth, ſeed time and har- " veſt

" veſt, and cold and heat, and Summer and Win-
" ter, and day and night, ſhall not ceaſe *."

There muſt he nothing ſuperfluous in the *Words* of the AUTHOR of Nature, as there is nothing of this deſcription in his *Works*. The Deluge, as has been already mentioned, commenced on the ſeventeenth day of the ſecond month of the year, which was among the Hebrews, as with us, the month of February. Man had by this time caſt the ſeed into the ground, but reaped not the harveſt. That year, cold ſucceeded not to the heat, nor Summer to Winter, becauſe there was neither Winter nor cold, from the general fuſion of the polar ices, which are their natural focuſes; and the night, properly ſo called, did not follow the day, becauſe then there was no night at the Poles, where there is alternately one of ſix months, becauſe the Sun, purſuing the direction of a Meridian, illuminated the whole Earth, as is the caſe now, when he is in the Equator.

To the authority of Geneſis, I ſhall ſubjoin a very curious paſſage from the Book of Job †, which deſcribes the Deluge, and the Poles of the World, with the principal characters of them which I have juſt been exhibiting.

* Gen. ch. viii. ver. 22. † Ch. xxxviii.

4. Ubi

4. Ubi eras quando ponebam fundamenta Terræ? Indica Mihi, si habes intelligentiam.

5. Quis posuit mensuras ejus, si nôsti? Vel quis tetendit super eam, lineam?

6. Super quo bases illius solidatæ sunt? Aut quis demisit lapidem angularem ejus,

7. Cum manè laudarent simul Astra matutina, & jubilarent omnes Filii DEI?

8. Quis conclusit ostiis * Mare, quando erumpebat quasi ex utero procedens:

* Though the sense which I affix to this passage, does not greatly differ from that of M. *de Saci*, in his excellent translation of the Bible, there are, at the same time, several expressions, to which I assign a meaning rather opposite to that of this learned Gentleman.

1st. *Ostium*, properly speaking, signifies an opening, a disgorging, a sluice, a flood-gate, a mouth; and not a barrier, according to *Saci*'s Translation. Observe how admirably the sense of this verse, and of that which follows, is adapted to the state of constraint and inactivity to which the Sea is restricted at the Poles, surrounded with clouds and darkness, like a child in swaddling clothes in his cradle. They are, likewise, expressive of the thick fogs which surround the basis of the polar ices, as is well known to all the mariners of the North.

2dly. The preceding epithets of *the foundations of the Earth*; of the *fastening of the foundations*; of *stretching the line upon it*; of the Sea's *breaking forth*, as if issuing from the womb, determine particularly the Poles of the World, from whence the Seas flow over the rest of the Globe. The epithet of *corner stone*, seems, likewise, to denote more particularly the North Pole, which, by it's magnetic attraction, distinguishes itself from every other point of the Earth.

9. Cum

9. Cum ponerem nubem vestimentum ejus, & caligine, illud, quasi pannis infantiæ, obvolverem?

10. Circumdedi illud terminis meis, & posui vectem & ostia:

11. Et dixi: usque huc venies, sed non procedes ampliùs; & hìc confringes tumentes fluctus tuos.

12. Numquid post ortum tuum præcepisti diliculo, & ostendisti Auroræ *, locum suum?

13. Et tenuisti concutiens extrema Terræ, & excussisti impios ex ea?

14. Restituetur ut lutum † signaculum, & stabit sicut vestimentum.

15. Auferetur ab impiis lux sua, & brachium excelsum confringetur.

* *Auroræ locum suum*, the place of the Aurora. The *Aurora Borealis* is, perhaps, here intended. The cold of the Poles produces the Aurora, for there is scarce any such thing between the Tropics. The Pole is, accordingly, properly speaking, the natural place of the Aurora. In the verse following, the expression, *tenuisti concutiens extrema Terræ*, evidently characterizes the total effusions of the polar ices, situated at the extremities of the Earth, which occasioned the Universal Deluge.

† *Restituetur ut lutum signaculum*. This verse is very obscure in the Translation of M. *de Saci*. It appears to me here descriptive of the fossil shells, which, over the whole Earth, are monuments of the Deluge.

16. Num-

16. Numquid ingreſſus es profunda Maris, & in noviſſimis Abyſſi * deambulâſti?

17. Numquid apertæ ſunt tibi portæ Mortis †, & oſtia tenebroſa vidiſti?

18. Numquid conſiderâſti latitudinem Terræ ‡? Indica Mihi, ſi nôſti omnia.

* *In noviſſimis Abyſſi, in the ſearch* (at the ſources) *of the Depth. Saci* tranſlates it, *in the extremities of the Abyſs.* This verſion deſtroys the correſpondence, of the expreſſion under review, with that of the other polar characters, ſo clearly explained before; and the antitheſis of *noviſſima*, with that of *profunda Maris*, which goes before, by affixing the ſame meaning to it. Antitheſis is a figure in frequent uſe among the Orientals, and eſpecially in the Book of Job. *Noviſſima Abyſſi*, literally denote, the places which renovate the Abyſs, the ſources of the Sea, and, conſequently, the polar ices.

† *Portæ Mortis, & oſtia tenebroſa; the gates of Death, and the doors of the ſhadow of Death*, or, *the gates of Darkneſs.* The Poles, being uninhabitable, are, in reality, the gates of Death. The epithet *dark* here denotes the nights of ſix months duration, which hold their empire at the Poles. This ſenſe is farther confirmed by what is ſubjoined in the following verſes; the *locus tenebrarum*, place of darkneſs, and the *theſaurus nivis*, treaſures of the ſnow. The Poles are, at once, the place of darkneſs, and that of the Aurora.

‡ *Latitudinem Terræ.* Literally: *Haſt thou perceived the breadth* (the Latitude) *of the Earth?* In truth, all the characters of the Pole could be known only to thoſe who had courſed over the Earth in it's Latitude. There were, in the times of Job, many Arabian travellers who went eaſtward, and weſtward, and ſouthward, but very few who had travelled northward, that is to ſay, in Latitude.

19. In

19. In quâ viâ lux habitet, & tenebrarum quis locus ſit.

20. Ut ducas unumquodque ad terminos ſuos, & intelligas ſemitas domûs ejus.

21. Sciebas tunc quòd naſciturus eſſes? Et numerum dierum tuorum noveras?

22. Numquid ingreſſus es theſauros nivis, aut theſauros grandinis aſpexiſti?

23. Quæ preparavi in tempus hoſtis, in diem pugnæ & belli.

Common Verſion of the Bible.

4. Where waſt thou, when I laid the foundations of the Earth? Declare, if thou haſt underſtanding.

5. Who hath laid the meaſures thereof, if thou knoweſt? Or who hath ſtretched the line upon it?

6. Whereupon are the foundations thereof faſtened? Or who laid the corner-ſtone thereof?

7. When the morning ſtars ſang together, and all the Sons of GOD ſhouted for joy.

Tranſlation of Saint-Pierre's *Verſion.*

4. Where waſt thou, when I laid the foundations of the Earth? Tell it Me, if thou haſt any knowledge.

5. Knoweſt thou who it is that determined it's dimenſions, and who regulated it's levels?

6. On what are it's baſes ſecured; and who fixed it's corner-ſtone?

7. When the Stars of the morning praiſed Me all together, and when all the Sons of GOD were tranſported with joy.

8. Or,

8. Or who ſhut up the Sea with doors, when it brake forth, as if it had iſſued out of the womb?

9. When I made the cloud the garment thereof, and thick darkneſs a ſwaddling band for it,

10. And brake up for it my decreed place, and ſet bars and doors,

11. And ſaid, Hitherto ſhalt thou come, but no farther: and here ſhall thy proud waves be ſtaid.

12. Haſt thou commanded the morning ſince thy days? and cauſed the day-ſpring to know his place,

13. That it might take hold of the ends of the Earth, that the wicked might be ſhaken out of it?

14. It is turned as clay to the ſeal, and they ſtand as a garment.

8. Who appointed gates to the Sea, to ſhut it up again, when it inundated the Earth, ruſhing as from it's mother's womb;

9. When I gave it the clouds for a covering, and wrapped it up in darkneſs, as a child is wrapped up in ſwaddling-clothes?

10. I ſhut it up within bounds well-known to me; I appointed for it a bulwark and ſluices,

11. And ſaid to it, Thus far ſhalt thou come, but farther thou ſhalt not paſs, and here the pride of thy billows ſhall be broken.

12. Is it thou who, in opening thine eyes to the light, haſt given commandment to the dawning of the day to appear, and haſt ſhewn to Aurora the place where ſhe ought to ariſe?

13. Is it thou who, holding in thy hands the extremities of the Earth, haſt convulſed it, and ſhaken the wicked out of it?

14. A multitude of minute monuments of this event ſhall remain impreſſed in the clay, and ſhall ſubſiſt as the memorials of that devaſtation.

15. And from the wicked their light is with-holden, and the high arm ſhall be broken.

16. Haſt thou entered into the ſprings of the Sea? or haſt thou walked in the ſearch of the Depth?

17. Have the gates of Death been opened unto thee? or haſt thou ſeen the doors of the ſhadow of Death?

18. Haſt thou perceived the breadth of the Earth? Declare if thou knoweſt it all.

19. Where is the way where light dwelleth? and as for darkneſs, where is the place thereof?

20. That thou ſhouldeſt take it to the bound thereof, and that thou ſhouldeſt know the paths to the houſe thereof?

21. Knoweſt thou it, becauſe thou waſt then born? or, becauſe the number of thy days is great?

22. Haſt thou entered into the treaſures of the ſnow? Or haſt thou ſeen the treaſures of the hail?

23. Which

15. The light of the wicked ſhall be taken from them, and their lifted-up arm ſhall be broken.

16. Haſt thou penetrated to the bottom of the Sea, and walked over the ſources which renovate the Abyſs?

17. Have theſe gates of Death been opened to thee; and haſt thou ſurveyed the dark diſgorgings of the Depth?

18. Haſt thou obſerved where the breadth of the Earth terminates? If thou knoweſt all theſe things, declare them unto Me.

19. Tell me where the light inhabits, and what is the place of darkneſs,

20. That thou mayeſt conduct each to it's deſtination, ſeeing thou knoweſt their habitation, and the way that leads to it.

21. Didſt thou know, as theſe things already exiſted, that thou thyſelf wert to be born; and hadſt thou then diſcovered the fleeting number of thy days?

22, 23. Haſt thou, I ſay, entered into the treaſures of the ſnow, and ſurveyed thoſe tremendous reſervoirs of hail,

which

23. Which I have reſerved againſt the time of trouble, againſt the day of battle and war?	which I have prepared againſt the time of the adverſary, and for the day of battle and war?

The Reader, I flatter myſelf, will not be diſpleaſed at my having deviated ſomewhat from my ſubject, that I might exhibit to him the agreement between my hypotheſis and the traditions of the Holy Scriptures; and eſpecially between it and thoſe, though not free from obſcurity, of a Book, perhaps, the moſt ancient that exiſts. Our moſt learned Theologians agree in thinking, that Job wrote prior to Moſes. Whether this be the caſe or not, ſurely no one ever painted Nature with greater ſublimity.

We may, farther, arrive at complete aſſurance of the general effect of the polar effuſions on the Ocean, from the particular effects of the icy effuſions of mountains, on the lakes and rivers of the Continent. I ſhall here relate ſome examples of theſe laſt; for the human mind, from it's natural weakneſs, loves to particularize all the objects of it's ſtudies. And this is the reaſon why it apprehends, much more quickly, the laws of Nature, in ſmall objects, than in thoſe which are great.

Addiſon, in his remarks on *Miſſon*'s Tour to Italy, page 322, ſays, that there is in the Lake of Geneva, in Summer, towards evening, a kind of flux and reflux, occaſioned by the melting of the ſnows, which fall into it in greater quantities after noon, than at other ſeaſons of the day. He explains, beſides, with much clearneſs, as he generally does, from the alternate effuſions of the ices on the mountains of Switzerland, the intermittance of certain fountains of that country, which flow only at particular hours of the day.

If this digreſſion were not already too long, I could demonſtrate, that there is no one fountain, nor lake, nor river, ſubject to a particular flux and reflux, but what is indebted for it to icy mountains, which ſupply their ſources. I ſhall ſubjoin but a very few words more reſpecting thoſe of the Euripus; the frequent and irregular movements of which ſo much embarraſſed the Philoſophers of Antiquity, and which may be ſo eaſily explained from the icy effuſions of the neighbouring mountains.

The Euripus, it is well known, is a ſtrait of the Archipelago, which ſeparates the ancient Beotia from the iſland of Eubea, now Negropont. About the middle of this ſtrait, where it is moſt narrow, the water is known to flow, ſometimes to the North,

North, ſometimes to the South, ten, twelve, fourteen times a day, with the rapidity of a torrent. Theſe multiplied, and, very frequently, unequal movements, cannot poſſibly be referred to the tides of the Ocean, which are ſcarcely perceptible in the Mediterranean. A Jeſuit quoted by *Spon* *, endeavours to reconcile theſe to the phaſes of the Moon; but ſuppoſing the table of them, which he produces, to be accurate, their regularity and irregularity will always remain a difficulty of no eaſy ſolution. He refutes *Seneca*, the Tragic Poet, who aſcribes to the Euripus but ſeven fluxes, in the day time only:

Dùm laſſa Titan mergat Oceano juga.

Till Titan's tired ſteeds in th' Ocean plunge.

He adds farther, I know not after whom, that in the Sea of Perſia the flux never takes place but in the night-time; and that under the Arctic Pole, on the contrary, it is perceptible twice in the day-time, without being ever obſerved in the night. It is not ſo, ſays he, with the Euripus.

I ſhall obſerve, by the way, that his remark with reſpect to the Pole, ſuppoſing it true, evinces that it's two diurnal fluxes are the effects of the

* Voyage to Greece and the Levant, by *Spon*, vol. ii. page 340.

Sun, who acts, only during the day, on the two icy extremities of the Continents of the New World, and of the Old. As to the Euripus, the variety, the number, and the rapidity of it's fluxes, prove that they have their origin, in like manner, in icy mountains, situated at different distances, and under different aspects of the Sun. For, according to that same Jesuit, the Island of Eubea, which is on one side of the strait, contains mountains covered with snow for six months of the year; and we know equally well, that Beotia, which is on the other side, contains several mountains of an equal elevation, and even some which are crowned with ice all the year round, such as Mount Oëta. If these fluxes and refluxes of the Euripus take place as frequently in Winter, which is not affirmed, the cause of them must be ascribed to the rains which fall, at that season of the year, on the summits of these lofty collateral mountains.

I shall enable the Reader to form an idea of these, not very apparent, causes of the movements of the Euripus, by here transcribing what *Spon* relates, in another place *, of the Lake of Livadia, or Copaïde, which is in it's vicinity. This lake receives the first fluxes of the icy effusions of

* Voyage to Greece and the Levant, by *Spon*, vol. ii. pages 88 and 89.

the

the mountains of Beotia, and communicates them, undoubtedly, to the Euripus, through the mountain which separates them. "It receives," says he, "several small rivers, the Cephisus and others, "which water that beautiful plain, whose circum-"ference is about fifteen leagues, and abounds "in corn and pasture. Besides, it was formerly "one of the most populous regions of Beotia. "But the water of this lake, sometimes, swells so "violently, by the rains and melted snows, that it "once inundated two hundred villages of the plain. "It would even be capable of producing a regular "annual inundation, if Nature, assisted, per-"haps, by Art *, had not contrived for it an out-"let,

* *Spon*, undoubtedly, did not consider what he was saying, when he suggested an idea of the possibility of Art assisting Nature in the construction of five subterranean canals, each ten miles long, through a solid rock. These subterranean canals are frequently met with in mountainous countries, of which I could produce a thousand instances. They contribute to the circulation of waters, which could not otherwise force a passage through extended chains of mountains. Nature pierces the rocks, and sends rivers through the apertures, just as she has pierced several of the bones of the human body, for the purpose of transmitting certain veins. I leave to the Reader the prosecution of this new idea. I have said enough to convince him, that this Globe is not the production of disorder or chance.

I shall conclude these observations, with a reflection respecting the two Travellers, whom I have been quoting: it may, perhaps, have a good moral effect. *Spon* was a Frenchman, and

"let, by five great canals, under the adjacent "mountain of the Euripus, between Negropont "and Talanda, through which the water of the

George Wheeler Engliſh. They travelled in company over the Archipelago. The former brought home with him a great collection of Greek inſcriptions and epitaphs; and the literati of the laſt age cried him up highly. The other has given us the names and characters of a great many very curious plants, which grow on the ruins of Greece, and which, in my opinion, convey a very affecting intereſt into his relations. He is little known amopg us.

According to the deſcriptive titles which each of theſe Gentlemen aſſumed, *Jacob Spon* was a Phyſician aſſociate of Lyons, and an eager inveſtigator of the monuments of men. *George Wheeler* was a Country Gentleman, and enthuſiaſtically attached to thoſe of Nature. Their taſtes, to judge from ſituations, ought to have been reverſed; and that the Gentleman ſhould have been fond of monumental inſcriptions, and the Phyſician of plants; but, as we ſhall have occaſion to obſerve, in the ſequel of theſe Studies, our paſſions ſpring out of contrarieties, and are, almoſt always, in oppoſition to our conditions. It was from an effect of this harmonic law of Nature, that, though theſe Travellers were, the one Engliſh, and the other French, they lived in the moſt perfect union. I remark, to their honour, that they quote each other in terms of the higheſt reſpect and approbation.

Miniſters of State, would you form Societies which ſhall be cordially united among themſelves, do not aſſort Academicians with Academicians, Soldiers with Soldiers, Merchants with Merchants, Monks with Monks, but aſſociate Men of oppoſite conditions, and you will behold harmony pervade the aſſociation; provided, however, that you exclude the ambitious, which is, indeed, no eaſy taſk, ambition being one of the firſt vices which our mode of education inſtils.

"lake

" lake is gulped up, and throws itſelf into the Sea
" on the oppoſite ſide of the mountain. The
" Greeks call this place *Catabathra:* (the whirl-
" pools.) Strabo, ſpeaking of this lake, ſays,
" nevertheleſs, that there appeared no outlet in his
" time, unleſs it be, that the Cephiſus, ſometimes,
" forced a paſſage under ground. But it is only
" neceſſary to read the account which he gives of
" the changes that take place in this morafs, not
" to be ſurpriſed at what he has affirmed of it's
" outlets. Mr. *Wheeler*, who went to examine
" this ſpot after my departure from Greece, ſays
" it is one of the greateſt curioſities in the coun-
" try, the mountain being near ten miles broad,
" and almoſt entirely one maſs of ſolid rock."

I have no doubt that ſeveral objections may be ſtarted againſt the haſty explanation which has been given of the courſe of the Tides, of the Earth's motion in the Ecliptic, and of the Univerſal Deluge, by the effuſions of the polar ices; but, I have the courage to repeat it, theſe phyſical cauſes preſent themſelves with a higher degree of probability, of ſimplicity, and of conformity to the general progreſs of Nature, than the aſtronomical cauſes, ſo far beyond our reach, by which attempts have been made to explain them. It belongs to the impartial Reader to decide. If he is on his guard againſt the novelty of ſyſtems, which

are

are not yet ſupported by puffers, he ought to be no leſs ſo, againſt the antiquity of thoſe which have many ſuch ſupporters.

Let us now return to the form of the great baſon of the Ocean. Two principal Currents croſs it from Eaſt to Weſt, and from North to South. The firſt, coming from the South Pole, puts in motion the Seas of India, and, directed along the eaſtern extent of the Old Continent, runs from Eaſt to Weſt, and from Weſt to Eaſt, in the courſe of the ſame year, forming, in the Indian Ocean, what are called the Monſoons. This we have already remarked; but what has not been hitherto brought forward, though it well deſerves to be ſo, is, that all the bays, creeks, and mediterraneans of ſouthern Aſia, ſuch as the gulfs of Siam and Bengal, the Perſian Gulf, the Red Sea, and a great many others, are directed, relatively to this Current, North and South, ſo as not to be ſtemmed by it.

The ſecond Current, in like manner, iſſuing from the North Pole, gives an oppoſite movement to our Ocean, and, incloſed between the Continent of America and ours, proceeds from North to South, and returns from South to North in the ſame year, forming, like that of India, real Monſoons, though not ſo carefully obſerved by Navigators.

gators. All the bays and mediterraneans of Europe, as the Baltic, the Channel, the Bay of Biſcay, the Mediterranean properly ſo called; and all thoſe on the eaſtern coaſt of America, as the Bay of Baffin, Hudſon's-Bay, the Gulf of Mexico, as well as many others which might be mentioned, are directed, relatively to this Current, Eaſt and Weſt; or, to ſpeak with more preciſion, the axes of all the openings of the Land in the Old and New Worlds, are perpendicular to the axes of theſe general Currents, ſo that their mouth only is croſſed by them, and their depth is not expoſed to the impulſions of the general movements of the Ocean.

It is becauſe of the calmneſs of bays, that ſo many veſſels run thither in queſt of anchoring ground; and it is for this reaſon that Nature has placed, in their bottoms, the mouths of moſt rivers, as we before obſerved, that their waters might be diſcharged into the Ocean, without being driven furiouſly back by the direction of it's Currents. She has employed ſimilar precautions for the ſecurity of even the ſmalleſt ſtreams which empty themſelves into the Sea. There is not a ſingle experienced ſeaman who does not know, that there is ſcarcely a creek but what has it's little rivulet. But for the Wiſdom apparent in theſe diſpoſitions, the

the ſtreams, deſtined to water the Earth, muſt frequently have deluged it.

Nature employs ſtill other means for ſecuring the courſe of rivers, and eſpecially for protecting their diſcharges into the Sea. The chief of theſe are iſlands. Iſlands preſent, to the rivers, channels of different directions, that if the Winds, or the Currents of the Ocean, ſhould block up one of their outlets, the waters might have a free paſſage through another. It may be remarked, that ſhe has multiplied iſlands at the mouths of rivers the moſt expoſed to this twofold inconveniency; ſuch as, for example, at that of the Amazon, which is for ever attacked by the Eaſt wind, and ſituated on one of the moſt prominent parts of America. There they are ſo many in number, and form with each other channels of ſuch different courſes, that one outlet points North-eaſt, and another South-eaſt, and from the firſt to the laſt the diſtance is upward of a hundred leagues.

Fluviatic iſlands are not formed, as has been currently believed, of ſolid ſubſtances waſhed down by rivers, and aggregated: they are, on the contrary, for the moſt part, very much elevated above the level of theſe rivers, and many of them contain rivers and mountains of their own Such

elevated

elevated iſlands are, beſides, frequently found at the confluence of a ſmaller and a greater river. They ſerve to facilitate their communication, and to open a double paſſage to the current of the ſmaller river. As often then as you ſee iſlands in the channel of a great river, you may be aſſured there is ſome lateral inferior river, or rivulet, in the vicinity.

There are, in truth, many of theſe confluent rivulets which have been dried up by the ill-adviſed labours of men, but you will always find oppoſite to the iſlands which divided their confluence, a correſpondent valley, in which you may trace their ancient channel. There are, likewiſe, ſome of theſe iſlands in the midſt of the courſe of rivers, in places expoſed to the winds. I ſhall obſerve, by the way, that we recede very widely from the intentions of Nature, in re-uniting the iſlands of a river to the adjoining Continent; for it's waters, in this caſe, flow in only one ſingle channel, and when the winds happen to blow in oppoſition to the current, they can eſcape neither to the right nor to the left; they ſwell, they overflow, inundate the plains, carry away the bridges, and occaſion moſt of the ravages which, in modern times, ſo frequently endamage our cities.

We

We do not, then, find bays or gulfs at the extremities of the Currents of the Ocean; but, on the contrary, iſlands. At the extremity of the great eaſtern Current of the Indian Ocean is placed the Iſland of Madagaſcar, which protects Africa againſt it's violence. The iſlands of the Terra-del-Fuego defend, in like manner, the ſouthern extremity of America, at the confluence of the eaſtern and weſtern Currents of the South Seas. The numerous archipelagos of the Indian Ocean and South Sea are ſituated about the Line, where the two general Currents of the North and South Seas meet.

With Iſlands, too, it is that Nature protects the inlets of bays and mediterraneans. Great Britain and Ireland cover that of the Baltic; the iſlands of Welcom and Good-fortune cover Hudſon's-Bay; the iſland of St. Laurence protects the entrance of the gulf which bears that name; the chain of the Antilles, the gulf of Mexico; the iſles of Japan, the double gulf formed by the peninſula of Gorée with the country adjacent. All currents bear upon iſlands. Moſt of theſe are, for this reaſon, noted from their prodigious ſwells, and their guſts of wind: ſuch are the Azores, the Bermudas, the iſland of Triſtan, of Acunhah, &c. Not that they contain within themſelves the cauſes

cauſes of ſuch phenomena, but from their being placed in the focuſes of the revolutions of the Ocean, and even of the Atmoſphere, for the purpoſe of weakening their effects. They are in poſitions nearly ſimilar to thoſe of Capes, which are all celebrated for the violent tempeſts which beat upon them: as Cape Finiſterre, at the extremity of Europe; the Cape of Good-Hope, at that of Africa; and Cape Horn, at that of America. Hence comes the ſea proverb to *double the Cape*, to expreſs the ſurmounting of ſome great difficulty. The Ocean, accordingly, inſtead of beating upon the retiring parts of the Continent, ſets in upon thoſe which are moſt prominent; and it muſt ſpeedily have deſtroyed theſe, had not Nature fortified them in a moſt wonderful manner.

The weſtern coaſt of Africa is defended by a long bank of ſand, on which the billows of the Atlantic Ocean are continually breaking. Braſil, in the whole extent of it's ſhores, oppoſes to the winds, which blow continually from the Eaſt, and to the Currents of the Sea, a prodigious rampart of rocks, more than a thouſand leagues long, twenty paces broad at the ſummit, and of an unknown thickneſs at the baſe. It is a muſket-ſhot diſtant from the beach. It is entirely covered at high-water, and on the retreating of the tide, it exhibits the elevation of a peak. This enormous dike is

compoſed

compoſed of one ſolid maſs lengthwiſe, as has been aſcertained by repeated borings; and it would be impoſſible for a veſſel to get into Braſil, were it not for the ſeveral inlets which Nature has formed *.

Go from South to North, and you find ſimilar precautions employed. The coaſt of Norway is provided with a bulwark nearly reſembling that of Braſil. *Pont Oppidan* tells us, that this coaſt, which is nearly three hundred leagues in length, is, for the moſt part, ſteep, angular, and pendant; ſo that the Sea, in many places, preſents a depth of no leſs than three hundred fathoms cloſe in-ſhore. This has not prevented Nature from protecting theſe coaſts, by a multitude of iſles, great and ſmall. "By ſuch a rampart," ſays that Author, "conſiſting of, perhaps, a million, or more, of "maſſy ſtone pillars, founded in the very depth "of the Sea, the chapiters of which riſe only a few "fathoms above the ſurface, all Norway is de-"fended to the Weſt, equally againſt the enemy, "and againſt the Ocean." There are, however, ſome coaſt-harbours behind this ſpecies of ſea-bulwark, of a conſtruction ſo wonderful. But as there is frequently great danger, adds he, of ſhips being driven aſhore, before they can get into port,

* See Hiſtory of the Troubles of Braſil, by *Peter Moreau*.

from

from the winds and currents which are very violent in the ſtraits of theſe rocks and iſles, and from the difficulty of anchoring in ſuch a vaſt depth of water, Government has been at the expence of faſtening ſeveral hundreds of ſtrong iron rings in the rocks, more than two fathoms above water, by which veſſels may be ſafely moored.

Nature has infinitely varied theſe means of protection, eſpecially in the iſlands themſelves which protect the Continent. She has, for example, ſurrounded the Iſle of France with a bank of madrépores, which opens only at the places where the rivers of that iſland empty themſelves into the Sea. Other iſlands, ſeveral of the Antilles in particular, were defended by foreſts of mangliers which grow in the ſea-water, and break the violence of the waves, by yielding to their motion. To the deſtruction, perhaps, of theſe vegetable fortifications, we ought to aſcribe the irruptions of the Sea, now ſo frequent in ſeveral iſlands, particularly that of Formoſa. There are others which conſiſt of pure rock, riſing out of the boſom of the waves, like huge moles; ſuch is the Maritimo, in the Mediterranean. Others are volcanic, as the Iſle of Fuego, one of the Cape de Verd iſlands, and ſeveral others, of the ſame deſcription, in the South Sea, riſe like pyramids with fiery ſummits, and anſwer the purpoſe of light-houſes to mariners, by

their flame in the night time, and their ſmoke by day.

The Maldivia iſlands are defended againſt the Ocean, by precautions the moſt aſtoniſhing. In truth, they are more expoſed than many others, being ſituated in the very midſt of that great Current of the Indian Ocean, of which mention has been already made, and which paſſes and repaſſes them twice a year. They are, beſides, ſo low, as hardly to riſe above the level of the water; and they are ſo ſmall, and ſo numerous, that they have been computed at twelve thouſand, and ſeveral are ſo near each other, that it is poſſible to leap over the channel which divides them. Nature has firſt collected them into cluſters, or archipelagos, ſeparated from each other by deep channels which go from Eaſt to Weſt, and which preſent various paſſages to the general Current of the Indian Ocean. Theſe cluſters are thirteen in number, and extend, in a row, from the eighth degree of northern to the fourth degree of ſouthern Latitude, which gives them a length of three hundred of our leagues of 25 to a degree.

But let us permit the intereſting and unfortunate *Francis Pyrard*, who there paſſed the flower of his days, in a ſtate of ſlavery, to deſcribe the architecture of them; for he has left us the beſt deſcription

deſcription which we have of theſe iſlands, as if it were neceſſary that, in every caſe, things the moſt worthy of the eſteem of Mankind ſhould be the fruit of ſome calamity. "It is wonderful," ſays he, "to behold each of theſe cluſters encompaſſed "round and round with a great bulwark of ſtone, "ſuch as no human art can pretend to equal in "ſecuring a ſpot of ground within walls *. Theſe "cluſters are all roundiſh, or oval, and are about "thirty leagues each in circumference, ſome a "very little more, others a very little leſs, and are "all in a ſeries, and end to end, without any con-"tact whatever. There are, between every two, "channels of the Sea, ſome broad, others very "narrow. When you are in the centre of a cluſ-"ter, you ſee, all around, that great bulwark of "ſtone, which, as I have ſaid, encompaſſes it, "and defends the iſles againſt the impetuoſity of "the Ocean. But it is truly frightful, even to the "boldeſt, to approach this bulwark, and to behold "the billows coming from afar, to burſt with fury "on every ſide: for then, I aſſure you, as a thing "I have ſeen a thouſand and a thouſand times, "the perturbation, or bubbling over, exceeds the "ſize of a houſe, and is whiter than a fleece of "cotton: ſo that you ſeem ſurrounded with a wall

* Voyage to the Maldivias, chap. x.

" of brilliant whiteneſs, eſpecially when Ocean is " in his majeſty."

Pyrard farther obſerves, that moſt of the iſles, incloſed in theſe ſubdiviſions, are ſurrounded, each in particular, by a particular bank, which farther defends them againſt the Sea. But the Current of the Indian Ocean, which paſſes through the parallel channels of theſe cluſters of iſlands, is ſo violent, that it would be impoſſible for Mankind to keep up a communication between one and another, had not Nature arranged all this in her own wonderful manner. She has divided each of theſe cluſters by two particular channels, which interſect them diagonally, and whoſe extremities exactly terminate at the extremities of the great parallel channels which ſeparate them. So that if you wiſh to paſs from one of theſe archipelagos to another, when the current is eaſterly, you take your departure from that where you happen to be, by the diagonal canal of the Eaſt, where the water is calm, and committing yourſelf afterward to the current which paſſes through the parallel channel, you proceed, in a deflecting courſe, to land on the oppoſite cluſter, into which you enter by the opening of it's diagonal channel, which is to the Weſt. The mode of proceeding is reverſed, when the current changes ſix months afterwards. Through

theſe

these interior communications the islanders, at all seasons, can make excursions from isle to isle, the whole length of the chain, from North to South, notwithstanding the violence of the currents which separate them.

Every isle has it's proper fortification, proportioned, if I may say so, to the danger to which it is exposed from the billows of the Ocean. It is not necessary to suppose the water roused into a tempest, in order to form an idea of their fury. The simple action of the trade-winds, however uniform, is sufficient to give them, unremittingly, the most violent impulsion. Each of these billows, joining, to the constant velocity impressed upon it every instant by the wind, an acquired velocity, from it's particular movement, would form, after running through a considerable space, an enormous mass of water, were not it's course retarded by the currents which cross it, by the calms which slacken it, but, above all, by the banks, the shallows, and the islands which break it.

A very perceptible effect of this accelerated velocity of the waves is visible on the coasts of Chili and Peru, which undergo, however, only the simple concussion and repercussion of the waters of the South Sea. The shores are inaccessible through their whole extent, unless at the bottom

of ſome bay, or under the ſhelter of ſome iſland ſituated near the coaſt. All the iſlands of that vaſt Ocean, ſo peaceful as to have obtained the diſtinctive appellation of Pacific, are unapproachable on the ſide which is expoſed to the Currents occaſioned by the Trade-winds only, unleſs where ſhelves or rocks break the impetuoſity of the billows. In that caſe, it is a ſpectacle at once magnificent and tremendous, to behold the vaſt fleeces of foam, which inceſſantly riſe from the boſom of their dark and rugged windings; and to hear their hoarſe roaring noiſe, eſpecially in the night-time, carried by the winds to ſeveral leagues diſtance.

Iſlands, then, are not fragments ſeparated by violence from the Continents. Their poſition in the Ocean, the manner in which they are there defended, and the length of their duration, conſtitute a complete demonſtration of this. Conſidering how long the Sea has been battering them with it's utmoſt fury, they muſt have been, by this time, reduced to a ſtate of total ruin. Scylla and Carybdis, nevertheleſs, emit to this day their ancient roarings, ſo as to be heard at the extremities of Sicily.

This is not the proper place to indicate the means which Nature employs to preſerve the iſlands, and to repair them; nor the other proofs from

from the vegetable and animal kingdoms, and from Man, which evince that they have exiſted, ſuch as we now ſee them, from the very origin of the Globe: it will be ſufficient for me to give an idea of their conſtruction, in order to produce perfect conviction in every candid mind, that they are in no one reſpect the work of chance. They contain, as Continents themſelves do, mountains, peaks, rivers, and lakes, proportioned to their magnitude. For the purpoſe of demonſtrating this new truth, I ſhall be ſtill under the neceſſity of ſaying ſomewhat reſpecting the diſtribution of the Globe; but I ſhall not be long, and ſhall endeavour to introduce nothing but what is abſolutely needful to make myſelf underſtood.

It is, firſt, to be remarked, that the chains of mountains in both Continents, are parallel to the Seas which waſh their coaſts: ſo that if you ſee the plan of one of theſe chains, with it's different branches, you are able to determine the ſhore of the Sea which correſponds to them; for, as I have juſt ſaid, the mountains and theſe are always parallel. You may, in like manner, on ſeeing the ſinuoſities of a ſhore, determine thoſe of the chains of mountains which are in the interior of a country; for the gulfs of a Sea always correſpond to the valleys of the mountains of the lateral Continent.

Theſe correſpondencies are perceptible in the two great chains of the Old, and of the New Worlds. The long chain of Taurus runs Eaſt and Weſt, as does the Indian Ocean, the different gulfs of which it incloſes by branches prolonged as far as to the extremities of moſt of their Capes. On the contrary, the chain of the Andes, in America, runs North and South, like the Atlantic Ocean. There is, beſides, another thing worthy of remark, nay, I venture to ſay, of admiration, it is, that theſe chains of mountains are oppoſed to the regular winds which croſs thoſe Seas, and which convey the emanations from them; and that their elevation is proportioned to the diſtance at which they are placed from ſuch ſhores: ſo that the farther they are removed from the Sea, the greater is their elevation into the Atmoſphere.

For this reaſon it is, that the chain of the Andes is placed along the South Sea, where it receives the emanations of the Atlantic Ocean, wafted by the Eaſt wind over the vaſt Continent of America. The broader that Continent becomes, the greater is the elevation of that chain. Toward the iſthmus of Panama, where the Continent has no great breadth, and, conſequently, the diſtance from the Sea is ſmall, the elevation of the mountains is inconſiderable: but they ſuddenly riſe, preciſely in proportion as the American Continent widens.

It's

It's higheſt mountains look over the broadeſt expanſion of America, and are ſituated in the Latitude of Cape Saint Auguſtin.

The ſituation, and the elevation, of this chain were equally neceſſary to the fertility of this grand diviſion of the New World. For, if this chain, inſtead of extending lengthwiſe, by the coaſt of the South Sea, had extended along the coaſts of Braſil, it would have intercepted all the vapours conveyed over the Continent by the Eaſt wind; and if it were not elevated to a region of the Atmoſphere, to which no vapour could aſcend, becauſe of the ſubtility of the air, and of the intenſeneſs of the cold, all the clouds borne by the Eaſt wind would be carried beyond it, into the South Sea. On either of theſe two ſuppoſitions, moſt of the rivers of South America would remain dry.

The ſame reaſoning may be applied to the chain of Taurus. It preſents to the Northern and Indian Oceans a double ridge, with oppoſite aſpects, from which flow moſt of the rivers of the ancient Continent, ſome to the North, and others to the South. It's branches are diſpoſed in like manner: they do not coaſt along the peninſulas of India, by their ſhores; but croſs them through the middle at their full length; for the winds of theſe Seas do not blow always from one and the ſame quarter,

as

as the East wind in the Atlantic Ocean; but six months in one direction, and six in another. It was proper, accordingly, to divide to them the land which they were intended to water.

It remains that I subjoin some farther observations respecting the configuration of these mountains, to confirm the use to which they are destined by Nature. They are crowned, from distance to distance, by long peaks similar to lofty pyramids. These peaks, as has been well observed, are of granite, at least most of them. I do not know the component parts of granite; but I know well, that these peaks attract the vapours of the Atmosphere, and fix them around in such a quantity, that they themselves frequently disappear. This is a remark which I have made times without number, with respect to the peak of Piterboth, in the Isle of France, where I have seen the clouds driving before the South-east wind, turn aside perceptibly from their direction, and gather around it, so as sometimes to form a very thick cap, which rendered the summit totally invisible.

I had the curiosity to examine the nature of the rock of which it is composed. Instead of being formed of grains, it is full of small holes, like the other rocks of the island; it melts in the fire, and when melted, you may perceive on it's surface small

ſmall grains of copper. It is impoſſible to doubt that it muſt be impregnated with that metal; and to the copper we muſt, perhaps, aſcribe the virtue which it poſſeſſes of attracting the clouds. For it is known by experience, that this metal, as well as iron, has the propesty of attracting thunder. I do not know of what materials other peaks are compoſed; but it is very remarkable, that at the ſummit of the Andes, and on their ridges, are found the gold and ſilver mines of Chili and Peru, and that in general, all mines of iron and copper are found at the ſource of rivers, and in elevated ſituations, where they diſcover themſelves by the fogs which ſurround them. Whatever may be in this, whether this attractive quality be common to granite, and to rocks of a different nature, or whether it depends on ſome metal which is amalgamated with them, I conſider all the peaks in the world as real electric needles.

But it was not ſufficient that clouds ſhould collect and fix on the tops of mountains, the rivers which have their ſources there, could have only an intermittent courſe. As ſoon as the rainy ſeaſon was at an end, the rivers muſt have ceaſed to flow. Nature, in order to remedy this inconveniency, has contrived, in the vicinity of their peaks, lakes, which are real reſervoirs, or ciſterns, of water, to furniſh a regular and conſtant ſupply to their expenditure.

penditure. Moſt of thoſe lakes are of an incredible depth; they anſwer ſeveral other purpoſes, ſuch as that of receiving the melted ſnows of the adjacent mountains, which would otherwiſe flow with too great rapidity. When they are once full, it requires a very conſiderable time to exhauſt them. They exiſt, either internally or externally, at the ſource of all regular currents of water; but when they are external, they are proportioned, either by their extent, or by their depth and their diſcharges, to the ſize of the river which they are deſigned to emit, as well as the peaks which are in the vicinity. Theſe correſpondencies muſt have undoubtedly been known to Antiquity; for I think I have ſeen ſome very ancient medals, in which rivers were repreſented by figures leaning on an urn, and ſtretched along at the baſis of a pyramid; which was probably deſigned to denote at once their ſource and their diſcharge.

If, then, we come to apply theſe general diſpoſitions of Nature to the particular conformation of iſlands, we ſhall ſee that they have, like Continents, mountains with branches parallel to their bays; that theſe mountains are of an elevation correſponding to their diſtance from the Sea; and that they contain peaks, lakes, and rivers, proportional to the extent of their territory. Like Continents, too, they have their mountains diſpoſed in a ſuit-

a ſuitableneſs to the winds which blow over the Seas whereby they are ſurrounded. Thoſe which are in the Indian Ocean, as the Moluccas, have their mountains toward the centre; ſo as to receive the alternate influence of the two atmoſpheric Monſoons. Thoſe, on the contrary, which are under the regular influence of the Eaſt winds, in the Atlantic Ocean, as the Antilles, have their mountains thrown to the extremity of the iſland which is under the wind, preciſely as the Andes with reſpect to South America. The part of the iſland that is toward the wind, is, in the Antilles, called *cabſterre*, as who ſhould ſay *caput terræ* (the head of the land); and that which is from the wind *baſſeterre* (low land); though, for the moſt part, ſays Father *du Terre* *, this laſt is higher, and more mountainous than the other.

The iſland of Juan Fernandez, which is in the South Sea, but very far beyond the Tropics, being in 33° 40′ of South Latitude, has it's northern part formed of rocks very lofty and very ſteep, and it's South ſide flat and low, to receive the influences of the South wind, which blows there almoſt all the year round. The deſcription of it is to be found in *Anſon*'s Voyage round the World.

* Natural Hiſtory of the Antilles, page 12.

The

The iſlands which deviate from theſe diſpoſitions, and which are but few in number, have remote relations ſtill more wonderful, and certainly well worthy of being ſtudied. They furniſh, beſides, in their vegetable and animal productions, other proofs, that they are ſmall Continents in miniature. But this is not the place to bring them forward. If they were, as is pretended, the remains of a great Continent ſwallowed up by the Ocean, they would have preſerved part, at leaſt, of their ancient and vaſt fabric. We ſhould ſee ariſe immediately out of the middle of the Sea, lofty peaks, like thoſe of the Andes, from twelve to fifteen hundred fathom high, without the mountains which ſupport them. In other places, we ſhould ſee theſe peaks ſupported by enormous mountains, proportioned to their magnitude, and which ſhould contain in their cavities great lakes, like that of Geneva, with rivers iſſuing from them, ſuch as the Rhône, and precipitating themſelves at once into the Sea, without watering any land. There ſhould be, at the bottom of their majeſtic protuberances, no plains, nor provinces, nor kingdoms. Theſe grand ruins of the Continent, in the midſt of the Ocean, would have ſome reſemblance to thoſe enormous pyramids reared in the ſands of Egypt, which preſent to the eye of the traveller only ſo many frivolous and unmeaning ſtructures; or to thoſe vaſt royal palaces, which the hand of time

time has demoliſhed, of which you perceive turrets, columns, triumphal arches; but the habitable parts of which are entirely deſtroyed. The ſage productions of Nature are not uſeleſs and tranſitory, like the works of Men. Every Iſland has it's champaign country, it's vallies, it's hills, it's hydraulick pyramids, and it's Naïads, in proportion to it's extent.

Some iſlands, it is true, but they are very few, contain mountains more elevated than the extent of their territory may ſeem to require. Such is that of Teneriff: it's peak is ſo high, as to be covered with ice a great part of the year. But that iſland contains mountains of no great elevation, which are proportioned to it's bays: that of the mountains which ſupport the peak, ſwells up amidſt the others in form of a dome, not unlike the dome of the Invalids riſing above the adjacent buildings. I myſelf obſerved it with particular attention, and made a drawing of it, on my way to the Iſle of France. The lower mountains are an appertenance to the iſland, and the peak to Africa.

This peak, covered with ice, is ſituated directly oppoſite to the entrance of the great ſandy deſart, called Zara, and contributes, undoubtedly, to refreſh the ſhores and Atmoſphere of it, by the effuſion of it's ſnows, which takes place in the midſt of

of Summer. Nature has placed other glaciers beſides, at the entrance of this burning deſart, ſuch as Mount Atlas. Mount Ida, in the Iſland of Crete, with it's collateral mountains, covered at all ſeaſons with ſnow, is ſituated, according to the obſervation of *Tournefort*, preciſely oppoſite to the burning deſart of Barca, which coaſts along Egypt from North to South. Theſe obſervations will furniſh a farther opportunity of making ſome reflections on the chains of icy mountains, and of the Zones of ſand ſcattered over the Globe.

I ought to beg forgiveneſs of the Reader, for theſe digreſſions, into which I have been inſenſibly drawn; but I will render them as ſhort as I poſſibly can, though, by abridging them, their clearneſs is conſiderably diminiſhed.

The icy mountains appear to be principally deſigned to convey coolneſs to the ſhores of the Seas ſituated between the Tropics; and the Zones of ſand, on the contrary, to accelerate, by their heat, the fuſion of the polar ices. We can indicate, only in a curſory manner, theſe moſt wonderful harmonies; but it is ſufficient to peruſe the journals of Navigators, and to ſtudy geographical charts, to be convinced, that the principal part of the Continent of Africa is ſituated in ſuch a manner, that it is the wind of the North Pole which blows

blows moſt conſtantly on it's coaſts; and that the ſhore of South America projects, beyond the Line, ſo as to be cooled by the wind of the South Pole. The Trade-winds, which prevail in the Atlantic Ocean, always participate of the influence of both Poles; that which is on our ſide draws conſiderably toward the North; and that which is beyond the Line depends greatly on the South Pole. Theſe two winds are not oriental, as has been erroneouſly imagined, but they blow nearly in the directions of the channel which ſeparates America from Africa.

The warm winds of the torrid Zone blow, in their turn, the moſt conſtantly toward the Poles; and it is ſingularly remarkable, that as Nature has placed icy mountains in it's vicinity to cool it's Seas, conjointly with thoſe of the Poles, as Taurus, Atlas, the Peak of Teneriff, Mount Ida, &c. ſhe has, likewiſe, extended a long Zone of ſand, in order to increaſe the heat of the South-wind on it's way to warm the Seas of the North. This Zone commences beyond Mount Atlas, and encompaſſes the Earth like a belt, extending from the moſt weſterly point of Africa to the moſt eaſterly extremity of Aſia, in a reduced diſtance of more than three thouſand leagues. Some branches of it deviate from the general direction, and advance directly toward the North.

We have already remarked, that a region all ſand is ſo hot, even in our Climates, from the multiplied reflection of it's brilliant particles, that we never find the ſnow covering it for any conſiderable time together, even in the middle of our ſevereſt Winters. Thoſe who have croſſed the ſands of Eſtampes, in Summer, and in the heat of the day, know well to what a violent degree the heat is there reverberated. It is ſo ardent certain days in Summer, that, about twenty years ago, four or five paviers, who were at work on the great road leading to that City, between two banks of white ſand, were ſuffocated by it. Hence it may be concluded, from facts ſo obvious, that but for the ices of the Pole, and of the mountains in the vicinity of the torrid Zone, a very conſiderable portion of Africa and Aſia would be abſolutely uninhabitable, and that but for the ſands of Africa and Aſia, the ices of our Pole would never melt.

Every icy mountain, too, has, like the Poles, it's ſandy girdle, which accelerates the fuſion of it's ſnows. This we have occaſion to remark, in the deſcription of all mountains of this ſpecies, as of the Peak of Teneriff, of Mount Ararat, of the Cordeliers, &c. Theſe Zones of ſand ſurround not only their baſes, but there are ſome of them on the higher regions of the mountains, up to the very

very peaks; it frequently requires ſeveral hours walking to get acroſs them.

The ſandy belts have a ſtill farther uſe, that of contributing to the repair of the waſte, which the territory of the mountain, from time to time, undergoes: perpetual clouds of duſt iſſue from them, which riſe, in the firſt inſtance, on the ſhores of the Sea, where the Ocean forms the firſt depoſits of theſe ſands, which are there reduced to an impalpable powder by the inceſſant daſhing of the waves upon them; we afterwards find theſe clouds of duſt in the vicinity of lofty mountains. The conveyance of the ſands is made from the ſhores of the Sea into the interior of the Continent, at different ſeaſons, and in various manners. The moſt conſiderable happens at the Equinoxes, for then the Winds blow from the Sea into the Land. See what *Corneille le Bruyn* ſays of a ſandy tempeſt, in which he was caught, on the ſhore of the Caſpian Sea. Theſe periodical conveyances of the ſand form a part of the general revolution of the Seaſons. But as to the interior of different countries, partial tranſits take place every day, which are very perceptible toward the more elevated regions of the Continents.

All travellers who have been at Pekin, are agreed, that it is not poſſible to go abroad, during

a part of the year, into the ſtreets of that City, without having the face covered with a veil, on account of the ſand with which the air is loaded.

When *Iſbrand-Ides* arrived on the frontiers of China, at the extremity of the outlet of the mountains in the neighbourhood of Xaixigar, that is, at that part of the creſt of the Aſiatic Continent, which is the moſt elevated, from which the rivers begin their courſes, ſome to the North, others to the South, he obſerved a regular period of theſe emanations. "Every day," ſays he*, "at noon "regularly, there blows a ſtrong guſt of wind, "for two hours together, which, joined to the "ſultry heat of the Sun by day, parches the ground "to ſuch a degree, that it raiſes a duſt almoſt in- "ſupportable. I had obſerved this change in the "air ſome time before. About five miles above "Xaixigar, I had perceived the Heavens cloudy, "over the whole extent of the mountains; and "when I was on the point of leaving them, I ſaw "perfect ſerenity. I even remarked at the place "where they terminate, an arch of clouds, which "ſweeped from Weſt to Eaſt, as far as the moun- "tains of Albaſe, and which ſeemed to form a ſe- "paration of climate." Mountains, accordingly, poſſeſs, at once, nebulous and foſſil attractions.

* Journey from Moſcow to China, chap. xi.

The

The firſt furniſh water to the ſources of the rivers which iſſue from them, and the ſecond ſupply them with ſand, for keeping up their territory and their minerals.

The icy and ſandy Zones are found, in a different harmony, on the Continent of the New World. They run, like it's Seas, from North to South, whereas thoſe of the Old Continent are directed, conformably to the lengthwiſe direction of the Indian Ocean, from Weſt to Eaſt.

It is very remarkable, that the influence of icy mountains extends farther over the Ocean than over the Land. We have ſeen thoſe of the two Poles take the direction of the channel of the Atlantic Ocean. The ſnows which cover the long chain of the Andes, in America, ſerve, in like manner, to cool the whole of the South Sea, by the action of the Eaſt-wind which paſſes over it; but as part of that Sea, and of it's ſhores, which is ſheltered from this wind, by the very height of the Andes, would have been expoſed to an exceſſive heat, Nature has formed an elbow weſtward, at the moſt ſoutherly part of America, which is covered with icy mountains, ſo that the freſh breezes, which perpetually iſſue from them, may graze along the ſhores of Chili and Peru. Theſe breezes, denominated the ſoutherly, prevail there all the

year round, if we may believe the teſtimony of every Navigator. They do not, in truth, come from the South-Pole; for if it were ſo, no veſſel could ever double Cape Horn; but they come from the extremity of Magellan's Land, which is evidently bent backward, with relation to the ſhores of the South Sea.

The ices of the Poles, then, renovate the waters of the Sea, as the ices of mountains renovate thoſe of the great rivers. Theſe effuſions of the polar ices preſs toward the Line, from the action of the Sun, who is inceſſantly pumping up the waters of the Sea, in the torrid Zone, and determines, by this diminution of bulk, the waters of the Poles to ruſh thitherward. This is the firſt cauſe of the motion of the South Seas, as has been already obſerved. It would appear highly probable, that the polar effuſions are proportioned to the evaporations of the Ocean. But without loſing ſight of the leading object of our enquiry, we ſhall examine for what reaſon Nature has taken ſtill greater care to cool the Seas, than the Land, of the torrid Zone: for it merits attention, that not only the polar Winds which blow there, but moſt of the rivers which empty themſelves into the South Seas, have their ſources in icy mountains, ſuch as the Zara, the Amazon, the Oroonoko, &c.

The

The Sea was deſtined to receive, by means of the rivers, all the ſpoils of vegetable and animal productions over the whole Earth; and as it's courſe is determined toward the Line, by the daily diminution of it's waters, which the Sun is there continually evaporating, it's ſhores, within the torrid Zone, would have been quickly liable to putrefaction, had not Nature employed theſe different methods to keep them cool. It is for this reaſon, as certain Philoſophers allege, that the Sea is ſalt between the Tropics. But it is likewiſe ſo to the North; nay, more ſo, if we may rely on the recent experiments of the intereſting M. *de Pages*. It is the ſalteſt, and the heavieſt, in the World, according to the teſtimony of an Engliſh Navigator, Captain *Wood*, in 1676.

Beſides, the ſaltneſs of the Sea does not preſerve it's waters from corruption, as is vulgarly believed. All who have been at Sea know well, that if a bottle, or a caſk, is filled, in hot climates, with ſea-water, it ſoon becomes putrid. Sea-water is not a pickle; it is, on the contrary, a real lixivial, which very quickly diſſolves dead bodies. Though ſalt to the taſte, it takes out ſalt ſooner than freſh water, as our common ſailors know, from daily experience, who employ no other, in freſhening their ſalt proviſions. It blanches, on the ſhore, the bones of all animals, as well as the madrépores,

which, when in a ſtate of life, are brown, red, and of various other colours, but which, being rooted up, and put into ſea-water, on the brink of the ſhore, in a little time become white as ſnow. Nay more, if you fiſh in the ſea for a crab, or a ſea-urchin, and have them dried, to preſerve them, unleſs you firſt waſh them in freſh water, all the claws of the crab, and all the prickles of the urchin, will fall off. The joints by which the limbs are attached, diſſolve in proportion as the ſea-water, with which they were moiſtened, evaporates. I myſelf have made this experiment to my coſt. The water of the Sea is impregnated not only with ſalt, but with bitumen, and other ſubſtances beſides, which we do not know; but ſalt is in it, in ſuch a proportion, as to aſſiſt the diſſolution of cadaverous bodies floating in it, as that which we mingle with our food aſſiſts digeſtion. Had Nature made it a pickle, the Ocean would be covered with all the impurities of the Earth, which would thus be kept in a ſtate of perpetual preſervation.

Theſe obſervations will indicate to us the uſe of volcanos. They do not proceed from the internal fires of the Earth, but they derive their origin, and the materials which keep them up, from the waters. In order to be convinced of this, you have only to remark, that there is not a ſingle vol-

cano

cano in the interior of Continents, unleſs it be in the vicinity of ſome great lake, ſuch as that of Mexico. They are ſituated, for the moſt part, in iſlands, at the extremity, or at the confluence of the Currents of the Sea, and in the counter-tide of their waters. This is the reaſon why we find them in ſuch numbers toward the Line, and along the ſhore of the South Sea, where the South-wind, which perpetually blows there, brings back all the ſubſtances ſwimming about in a ſtate of diſſolution.

Another proof that they owe their ſupport to the Sea is this, that, in their eruptions, they frequently vomit out torrents of ſalt water. *Newton* aſcribed their origin, and their duration, to caverns of ſulphur, incloſed in the bowels of the Earth. But that great man had not reflected on the poſition of volcanos in the vicinity of water, nor calculated the prodigious quantity of ſulphur, which the magnitude, and the duration, of their fires muſt have required. Veſuvius alone, which burns night and day, from time immemorial, would have conſumed a maſs of it larger than the whole kingdom of Naples. Beſides, Nature does nothing in vain. What purpoſe could be anſwered by ſuch magazines of ſulphur in the interior of the Earth? We ſhould find them completely entire in places, where they are not conſumed by the fire. Mines of

of ſulphur are no where found but in the vicinity of volcanos. What, beſides, could renovate them when exhauſted? A ſupply ſo conſtant, for keeping up volcanos, is not in the Earth, but in the Sea. It is furniſhed by the oils, the bitumens, and the nitres of vegetables and animals, which the rains and the rivers convey off from every quarter into the Ocean, where the diſſolution of all bodies is completed by its lixivial water. To theſe are joined metallic diſſolutions, and eſpecially thoſe of iron, which, as is well known, abounds all over the earth. Volcanos take fire, and feed themſelves with all theſe ſubſtances.

Lemery, the Chymiſt, has imitated their effects, by a compoſition conſiſting of filings of iron, ſulphur, and nitre, moiſtened with water, which caught fire of itſelf. If Nature had not kindled theſe vaſt furnaces on the ſhores of the Ocean, it's waters would be covered with vegetable and animal oils, which could never evaporate, for they reſiſt the action of the air. You may have frequently obſerved them, when ſtagnated in ſome undiſturbed baſon, from their colour reſembling the pigeon's neck. Nature purifies the waters by the fire of volcanos, as ſhe purifies the air by thoſe of thunder; and as ſtorms are more common in hot countries, ſhe has in theſe, likewiſe, multiplied volcanos, and for the ſame reaſon. She burns on the ſhores

ſhores the impurities of the Sea, as a Gardener burns, at the end of Autumn, the refuſe of his garden.

We find lavas, indeed, in the interior of countries; but a proof that they are indebted to the water for their original is this, that the volcanos which produced them, became extinct whenever the waters failed them. Theſe volcanos were kindled, like thoſe which ſtill ſubſiſt, by vegetable and animal fermentations, with which the Earth was covered after the Deluge, when the ſpoils of ſo many foreſts, and of ſo many animals, whoſe trunks and bones are ſtill found in our quarries, floated on the ſurface of the Ocean, and formed prodigious depoſits, which the currents accumulated in the cavities of the mountains. It cannot be doubted, that, in this ſtate, they caught fire by the effect of fermentation merely, juſt as we ſee ſtacks of damp hay catch fire in our meadows. It is impoſſible to call in queſtion theſe ancient conflagrations, the traditions of which are preſerved in Antiquity, and which immediately follow thoſe of the Deluge. In the ancient Mythology, the hiſtory of the ſerpent Python, produced by the corruption of the waters, and that of Phaëton, who ſet the world on fire, immediately follow the hiſtory of Philemon and Baucis *, eſcaped from

* The Author, undoubtedly, means Deucalion and Pyrrha.

the

waters of the Deluge, and are allegories of the peſtilence, and of the volcanos, which were the firſt reſults of the general diſſolution of animals and vegetables.

All that now remains is, to refute the opinion of thoſe who maintain, that the Earth is a ſecretion from the Sun. The chief arguments by which they ſupport it are it's volcanos, it's granites, the vitrified ſtones ſcattered over it's ſurface, and it's progreſſive refrigeration from year to year. I reſpect the celebrated Author who has advanced this opinion, but I venture to affirm, that the grandeur of the images which this idea preſented to him, has ſeduced his imagination.

We have ſaid enough reſpecting volcanos, to demonſtrate that they do not proceed from the interior of the Earth. As to granites, they do not preſent, in the aggregation of their grains, the remoteſt veſtige of the action of fire. I do not know their origin; but certainly there is no foundation for referring it to that element, becauſe it cannot be aſcribed to the action of water, and becauſe ſhells are not found in them. As this aſſertion is deſtitute of all proof, it is unneceſſary to undertake a refutation of it. I ſhall obſerve, however, that granites do not appear to be the production of fire, on a compariſon with the lavas of volcanos;

nos; the difference of their ſubſtances ſuppoſes different cauſes in their formation.

Agates, flints, and every ſpecies of the ſilex, ſeem to be analogous to vitrifications, from their half-tranſparency, and from their being uſually found in beds of marl, which reſemble banks of lime extinguiſhed; but theſe ſubſtances are not the productions of fire, for lavas never preſent any thing ſimilar. I have picked up, on the flinty hills of lower Normandy, oyſter-ſhells perfectly complete, amalgamated with black flints, which they call *biſets*. Had theſe biſets been vitrified by fire, they would have calcined, or, at leaſt, altered the oyſter-ſhells which adhered to them; but theſe were as found as if juſt taken out of the water. The ſhelving ſea-coaſt along the diſtrict of Caux, are formed of alternate ſtrata of marl and biſets, ſo that, as they are cut perpendicularly, you would call it a great wall, of which the layers had been regulated by an Architect; and with ſo much the greater appearance of probability, that the people of the country build their houſes of the ſame materials, diſpoſed in the ſelf-ſame order.

Theſe banks of marl are from one to two feet broad, and the rows of flints which ſeparate them, are three or four inches thick. I have reckoned ſeventy or eighty of ſuch horizontal ſtrata from the

the level of the Sea up to that of the Land. The thickeſt are undermoſt, and the ſmaller a-top, which, from the ſea-mark, makes the aggregate appear higher than it really is; as if Nature intended to employ a certain degree of perſpective to increaſe the apparent elevation: but, undoubtedly, ſhe has been determined to adopt this arrangement from reaſons of ſolidity, which are perceptible in all her Works. Now, theſe banks of marl and flint are filled with ſhells, which have undergone no alteration from the force of fire, and which would be in perfect preſervation, had not the preſſure of that enormous maſs broken in pieces the largeſt of them. I have ſeen fragments extracted of that which is called the *tuilée*, which is found alive only in the Indian Ocean, and the broken pieces of which, when put together, formed a ſhell much more conſiderable than thoſe of the ſame ſpecies which are uſed for holding the holy water, in the church of Saint-Sulpice, at Paris.

I have, likewiſe, remarked there a bed of flints completely amalgamated, and forming a ſingle table, the ſection of which was perceptibly about one inch thick by more than thirty feet in length. It's depth in the cliff I did not aſcertain; but, with a little art, it might be detached, and faſhioned into the moſt ſuperb agate table in the world. Wherever theſe marls and flints are found, ſhells

ſhells are likewiſe found in great quantities, ſo that as marl has been evidently formed of their wreck, it appears to me extremely probable, that the flints have been compoſed of the very ſubſtance of the fiſhes which were there incloſed.

This opinion will appear leſs extraordinary, if we obſerve that many of the *cornes d'ammon*, and of ſingle-ſhelled foſſils, which, from their form, have reſiſted the preſſure of the ground, and not being compreſſed by it, have not ejected, like the double-ſhelled, the animal matter which they contained, but exhibit it within them, under the form of cryſtals, with which they are uſually filled, whereas the two-ſhelled are totally deſtitute of it.

The animal ſubſtances of theſe laſt, I preſume, confounded with their cruſhed fragments, have formed the different coloured paſtes of marble, and have communicated to them the hardneſs and poliſh of which theſe marbles are ſuſceptible. This ſubſtance preſents itſelf, even in ſhell-fiſh when alive, with the characters of agate, as may be ſeen in ſeveral kinds of mother-of-pearl, and among others, in the half tranſparent, and very hard knob, which terminates what is called the *harp*. Finally, this ſtony ſubſtance is found, beſides, in land animals; for I have ſeen, in Sileſia, the eggs of a ſpecies of the woodcock, which are highly prized in that

that country, not only becauſe they are a great delicacy for the table, but becauſe the white, when dried, becomes hard as a flint, and ſuſceptible of a poliſh ſo beautiful, that they are cut and ſet as rings and other trinkets.

I could eaſily ſwell this article, by demonſtrating the geometrical impoſſibility that our Globe ſhould have been detached from that of the Sun, by the tranſit of a Comet, becauſe it muſt have, on the very hypotheſis of this impulſion, been hurried along in the Sphere of the Comet's attraction, or carried back into that of the Sun. It has, in truth, remained in the ſphere of the Sun's attraction; but it is not eaſy to conceive how it never came to approach nearer, and how it comes to maintain the diſtance of nearly thirty-two millions of leagues, while no Comet prevents it's returning to the place from which it ſet out. The Sun, it is ſaid, has a centrifugal force. The Globe of the Earth, therefore, muſt be retiring from it. No, it is alleged, becauſe the Earth has a conſtant tendency toward that Luminary. It muſt, accordingly have loſt the centrifugal force, which ſhould adhere to it's very nature, as being a portion of the Sun.

I could go on to ſwell the article, by farther demonſtrating the phyſical impoſſibility, that the Earth ſhould contain in it's bowels ſo many heterogeneous

rogeneous ſubſtances; on the ſuppoſition of it's being a ſeparation from a body ſo homogeneous as the Sun; and I could make it appear, that it is impoſſible they ſhould be, in any reſpect, conſidered as the wreck of ſolar and vitrified ſubſtances (if it be poſſible for us to have an idea of the ſubſtances from which light iſſues), ſeeing ſome of our terreſtrial Elements, ſuch as Water and Fire, are abſolutely incompatible. But I ſhall confine myſelf to the refrigeration aſcribed to the Earth, becauſe the evidence on which this opinion reſts, is level to the comprehenſion of all men, and is of importance to their ſecurity.

If the Earth is getting colder and colder, the Sun, from which it is ſaid to have been ſeparated, muſt be getting cold in proportion; and the mutual diminution of the heat in theſe two Globes, muſt become perceptible in a courſe of ages, at leaſt on the ſurface of the Earth, in the evaporations of the Seas, in the diminution of rains, and eſpecially in the ſucceſſive deſtruction of a great number of plants, which are killed every day, merely from the diminution of only a few degrees of heat, when the Climate is changed upon them. Not a ſingle plant, however, has been loſt of all thoſe which were known to Circé, the moſt ancient of Botaniſts, whoſe Herbal Homer has, in ſome meaſure, preſerved for us. The plants cele-

brated in ſong by Orpheus, and their virtues, ſubſiſt to this day. There is not even a ſingle one which has loſt any thing of it's ancient attitude. The jealous Clytia ſtill turns toward the Sun; and the beautiful ſon of Liriope, Narciſſus, continues to admire himſelf on the brink of the fountain.

Such are the teſtimonies adduced from the vegetable kingdom, reſpecting the uniformity and conſtancy of the temperature of the Globe; let us examine thoſe of the Human Race. There are ſome of the inhabitants of Switzerland, it is alleged, who have perceived a progreſſive accumulation of the ices on their mountains. I could oppoſe to this evidence, that of other modern Obſervers, who, in the view of ingratiating themſelves with the Princes of the North, pretend, with as little foundation, that the cold is diminiſhing there, becauſe theſe Princes have thought proper to cut down the foreſts of their States; but I ſhall adhere to the teſtimony of the Ancients, who could not poſſibly intend to flatter any one on a ſubject of this nature.

If the refrigeration of the Earth is perceptible in the life of one man, it muſt be much more ſo in the life of Mankind; now, all the temperatures deſcribed by the moſt ancient Hiſtorians, as that of Germany by Tacitus, of Gaul by Ceſar, of Greece

Greece by Plutarch, of Thrace by Xenophon, are preciſely the ſame at this day, as they were at the time when theſe ſeveral Hiſtorians wrote. The Book of Job the Arabian, which, there is reaſon to believe, is more ancient than the Writings of Moſes, and which contains views of Nature much more profound than is generally imagined, views, the moſt common whereof were unknown to us two centuries ago, makes frequent mention of the falling of the ſnows in that country, that is, toward the thirtieth degree of North Latitude. Mount Lebanon, from the remoteſt antiquity, bears the Arabian name of *Liban*, which ſignifies white, on account of the ſnows with which it's ſummit is covered all the year round. Homer relates that it ſnowed in Ithaca when Ulyſſes arrived there, which obliged him to borrow a cloak of the good Eumeus.

If, during a period of three thouſand years, and more, the cold had gone on increaſing from year to year, in all theſe Climates, their Winters muſt now have been as long and as ſevere, as in Greenland. But Lebanon, and the lofty provinces of Aſia, have preſerved the ſame temperature. The little Iſle of Ithaca is ſtill covered in Winter with the hoar froſt; and it produces, as in the days of Telemachus, the laurel and the olive.

STUDY FIFTH.

REPLY TO THE OBJECTIONS AGAINST PROVIDENCE, FOUNDED ON THE DISORDERS OF THE VEGETABLE KINGDOM.

THE Earth is, ſay the Objectors, a garden very injudiciouſly laid out. Men of wit, who never travelled, have amuſed themſelves with painting it, proceeding from the hand of Nature, as if the giants had been a fighting in it. They repreſent it's rivers flowing at random; it's moraſſes as vaſt collections of mud; the trees of it's foreſts turned upſide down; it's plains buried under rocks, or overſpread with briars and thorns; all it's high ways rendered unpaſſable; all it's culture the puny efforts of human genius. Such repreſentations, though pictureſque, have, I acknowledge, ſometimes afflicted me, becauſe they inſpired me with diſtruſt of the AUTHOR of Nature. To no purpoſe could it be ſuppoſed that, in other reſpects, He had loaded Man with benefits; one of

our firſt and moſt preſſing neceſſities had been overlooked, if He had neglected to care for our habitation.

The inundations of rivers, ſuch as thoſe of the Amazon, of the Oroonoko, and a great many others, are periodical. They manure the lands which they inundate. It is well known, beſides, that the banks of theſe rivers ſwarmed with populous nations, before any European had formed a ſettlement there. The inhabitants derived much benefit from theſe inundations, partly from the abundance of the fiſheries, partly from the fertility communicated to the lands. So far from conſidering them as convulſions of Nature, they received them as bleſſings from Heaven, juſt as the Egyptians prized the overflowings of the Nile. Was it, then, a mortifying ſpectacle to them, to ſee their deep foreſts interſected with long alleys of water, which they could without trouble traverſe, in all directions, in their canoes, and pick the fruits at their eaſe? Nay, certain tribes, ſuch as thoſe of the Oroonoko, determined by theſe accommodations, had acquired the ſingular habit of dwelling on the tops of trees, and of ſeeking under their foliage, like the birds, an habitation, and food, and a fortreſs. Whatever may be in this, moſt of them inhabited only the banks of the rivers, and preferred

preferred them to the vaſt deſerts with which they are ſurrounded, though not expoſed to inundations.

We ſee order only where we can ſee corn grow. The habit which we have acquired of confining the channels of our rivers within dikes and mounds, of gravelling, and paving our high roads, of applying the ſtraight line to the alleys in our gardens, and to our baſons of water, of ſquaring our parterres, nay, our very trees, accuſtoms us inſenſibly to conſider every thing which deviates from our rectangles, as abandoned to confuſion. But it is in places with which we have been tampering, that we frequently ſee real diſorder. We ſet fountains a playing on the tops of mountains; we plant poplars and limes upon rocks; we throw our vineyards into valleys, and raiſe our meadows to the declivities of hills.

Let theſe laborious exertions be relaxed ever ſo little, and all theſe petty levellings will preſently be confounded under the general levelling of Continents, and all this culture, the work of Man, diſappears before that of Nature. Our ſheets of water degenerate into marſhes; our hedge-row elms burſt into luxuriancy; every bower is choked, every avenue cloſes: the vegetables natural to each ſoil declare war againſt the ſtrangers; the

ſtarry thiſtle and vigorous verbaſcum, ſtift under their broad leaves the Engliſh ſhort graſſy ſod; thick crops of rye-graſs and trefoil gather round the trees of Paleſtine; the bramble ſcrambles along their ſtem, with it's prickly claws, as if mounting a breach; tufts of nettles take poſſeſſion of the urn of the Naïads, and foreſts of reeds, of the forges of Vulcan; greeniſh ſcales of minium corrode the faces of our Venuſes, without paying any reſpect to their beauty. The trees themſelves lay ſiege to the caſtle; the wild cherry, the elm, the maple, mount upon it's ridges, plunge their long pivots into it's lofty pediments, and, at length, obtain the victory over it's haughty cupolas. The ruins of a park no leſs merit the reflections of the Sage, than thoſe of an empire: they equally demonſtrate how inefficient the power of Man is, when ſtruggling againſt that of Nature.

I have not had the felicity, like the primitive Navigators, who diſcovered uninhabited iſlands, to contemplate the face of the ground as it came from the hand of the CREATOR; but I have ſeen portions of it which had undergone alterations ſufficiently ſmall to ſatisfy me, that nothing could then equal their virgin beauties. They had produced an influence on the firſt relations which were formed by them, and had diffuſed over theſe a freſhneſs, a colouring, a native grace inexpreſſible,

ſible, which will ever diſtinguiſh them to advantage, notwithſtanding their ſimplicity, from the learned deſcriptions which have been given of them in modern times.

To the influence of theſe firſt aſpects, I aſcribe the ſuperior talents of the earlieſt Writers who have painted Nature, and the ſublime enthuſiaſm which a Homer and an Orpheus have tranſfuſed into their poëſy. Among the Moderns, the Hiſtorian of *Anſon*'s expedition, *Cook*, *Banks*, *Solander*, and ſome others, have deſcribed ſeveral of theſe natural ſites, in the iſlands of Tinian, Maſſo, Juan Fernandez, and Taïti, which have delighted all perſons of real taſte, though theſe iſlands had been, in part, degraded by the Indians and Spaniards.

I have ſeen only countries frequented by Europeans, and deſolated by war, or by ſlavery: but I ſhall ever recollect with pleaſure two of theſe ſites, the one on this ſide the Tropic of Capricorn; the other beyond the ſixtieth degree of North Latitude. Notwithſtanding my inability, I am going to attempt a ſketch of theſe, in order to convey, as well I can, an idea of the manner in which Nature diſpoſes her plans in Climates ſo very oppoſite.

The firſt was a part, then uninhabited, of the Iſle of France, of fourteen leagues extent, which appeared

appeared to me the moſt beautiful portion of it, though the black free-booters, who take refuge there, had cut down, on the ſea-ſhore, the lataniers with which they fabricate their huts, and on the mountains, the palmettos, whoſe tips they uſe as food, and the liannes, of which they make fiſhing-nets. They likewiſe degrade the banks of the rivulets, by digging out the bulbous roots of the nymphæa, on which they live, and even thoſe of the Sea, of which they eat, without exception, every ſpecies of the ſhelly tribes, and which they leave here and there on the ſhore, in great piles burnt up. Notwithſtanding theſe diſorders, that part of the iſland had preſerved traces of it's ancient beauty. It is perpetually expoſed to the South-eaſt wind, which prevents the foreſts that cover it from extending quite down to the brink of the Sea; but a broad ſelvage of turf, of a beautiful ſea-green, which ſurrounds it, facilitates the communication all around, and harmonizes, on the one ſide, with the verdure of the woods, and, on the other, with the azure of the billows.

The view is thus divided into two aſpects, the one preſenting land, the other water. The land-proſpect preſents hills flying behind each other, in the form of an amphitheatre, and whoſe contours, covered with trees in pyramids, exhibit a majeſtic profile on the vault of Heaven. Over theſe foreſts riſes,

riſes, as it were, a ſecond foreſt of palmettos, which balance, above the ſolitary valleys, their long columns, crowned with parti-coloured plumes of palms, and ſurmounted with a ſpiral peak. The mountains of the interior preſent, at a diſtance, oval-ſhaped rocks, clothed with great trees, and pendent liannes, floating, like drapery, by every breath of the wind. Above theſe riſe lofty pinnacles, round which are continually collected the rainy clouds; and when theſe are illuminated by the rays of the Sun, you ſee the colours of the rainbow painted on their peaks, and the rain-water flowing over their duſky ſides in brilliant ſheets of cryſtal, or in long fillets of ſilver. No obſtacle prevents your perambulating the borders which embelliſh their ſides and their baſes, for the rivulets which deſcend from the mountains, preſent, along their banks, ſlips of ſand, or broad plates of rock, from which they have waſhed the earth clean away. Beſides, they clear away a free paſſage from their ſource, to the place of their diſcharge, by undermining the trees which would grow in their channel, and by fertilizing thoſe which do grow on their margin; and they expand over theſe, through their whole courſe, great arches of verdure which fly off in perſpective, and which are viſible from the ſhore of the Sea. The liannes interweave themſelves along the circumference of theſe

these arches, secure their arcades against the winds, and decorate them most beautifully, by opposing to their foliage other foliages, and to their verdure garlands of gloffy flowers, or pods of various colours. If a tree, wasted by age, happens to fall down, Nature, which universally hastens on the destruction of all useless beings, covers it's trunk with maiden-hair of the most beautiful green, and agarics undulated with yellow, saffron, and purple, which feed on it's spoils.

Toward the sea side, the turf which borders the island, is up and down sowed with thickets of latanier, whose palms, formed into a fan, and attached to pliant membranes, radiate in the air, like so many verdant suns. These lataniers advance even into the Sea, on the capes of the island, with the land fowls which inhabit them; while the small bays, swarming with multitudes of sea-fowl which swim in the water, and which are paved, if I may be allowed the expression, with madrépores of the colour of the peach-blossom; the black rocks covered with rose-coloured nerits, and shells of every kind, penetrate into the island, and reflect, like so many mirrors, all the objects of the Land and of the Heavens. You would imagine that you saw the birds flying in the water, and the fishes swimming among the trees, and you would be

be tempted to ſay, Here is the marriage of *Terra* and *Oceanus*, who thus blend and confound their domains.

In the greateſt part even of uninhabited iſlands, lying between the Tropics, when the diſcovery of them was made, the banks of ſand which ſurround them were found to be filled with turtle, which came thither to lay their eggs, and with the ſcarlet flamingos, which, as they ſit on their neſts, reſemble burning torches. They had, beſides, a border of mangliers, covered with oyſters, which oppoſed their floating foliage to the violence of the waves, and of cocoa-trees loaded with fruit, which advancing into the very ſea, along the breakers, preſented, to the mariner's eye, the aſpect of a city with it's ramparts and it's avenues, and announced to them from afar the aſylum prepared for them by the God of the Seas. Theſe different kinds of beauty muſt have been common to the Iſle of France, with many other iſlands, and were, in all probability, deſtroyed by the craving neceſſities of the firſt mariners who landed upon them. Such is the very imperfect repreſentation of a country, the Climate of which, according to ancient Philoſophers, was uninhabitable, and the ſoil of which modern Philoſophers conſider as a ſcum of the Ocean, or of volcanos.

The

The ſecond rural ſcenery, which I ſurveyed with rapture, and of which I am going to attempt a deſcription, was in Ruſſian Finland, when I was employed, in 1764, on a viſitation of it's fortreſſes with the Generals of the corps of Engineers, in which I then ſerved. We were travelling between Sweden and Ruſſia, through a country ſo little frequented, that the firs had encroached on the great line of demarkation which ſeparates the boundaries of the two countries. It was impoſſible to get through in a carriage, and we were under the neceſſity of employing the country people to cut down the trees, that our equipages might follow us. We were able, however, to penetrate, in every direction, on foot, and frequently on horſeback, though we were obliged to inſpect the windings, the ſummits, and the ſmalleſt receſſes of a great number of rocks, in order to aſcertain their natural capability of defence, and though Finland is ſo covered with theſe, that ancient Geographers have given it the ſurname of *Lapidoſa* (ſtony.)

Not only are thoſe rocks ſcattered about in great blocks, over the ſurface of the earth, but the vallies, and entire hills, are there, in many places, formed of a ſingle maſs of ſolid rock. This rock is a ſoft granite which exfoliates, and whoſe ſcurf fertilizes the plants, at the ſame time that the enormous

enormous, maſs ſhelters them from the North-wind, and reflects on them the rays of the Sun, by their curves, and the particles of mica with which it is filled. The bottoms of theſe vallies were ſkirted with long borders of meadow, which every where facilitate the communication. At the places where they were pure rock, as in their original ſtate, they were covered with a plant, called, by the natives, *Kloukva*, which thrives on the rock. It comes out of the clefts, and ſeldom riſes higher than a foot and a half; but it ſpreads in all directions, and extends far and wide. It's leaves and verdure reſemble thoſe of the box, and it's boughs are loaded with a red berry, good to eat, reſembling the ſtrawberry.

The fir, the birch, and the ſervice-tree vegetated wonderfully well on the ſides of thoſe hills, though, in many places, they found ſcarcely earth ſufficient in which to inſert their roots. The ſummits of moſt of them were rounded in form of a ſcull-cap, and rendered quite gliſtering by the water which oozed acroſs the long crevices that furrowed them. Many of theſe ſcull-caps were perfectly bare, and ſo ſlippery, that it was difficult to walk over them. They were crowned, round and round, with a broad belt of moſs of an emerald green, out of which ſtarted here and there an

infinite

infinite multitude of mushrooms of every form, and of every colour. Some of them were shaped like large scarlet-coloured tweezer-cases, studded with dots of white; others were orange-coloured and formed like a parasol; others yellow as saffron, and of the oblong form of an egg. Some were of the purest white, and so well rounded, that you would have taken them for ivory draughts-men.

These mosses and mushrooms spread along the threads of water which flowed from the summits of the rocky hills, extended in long rays across the woods with which their sides were covered, and proceeded to skirt their extremities, till they were confounded with a multitude of strawberry and raspberry plants. Nature, to indemnify this country for the scarcity of apparent flowers to please the eye, of which it produces but few, has bestowed their perfumes on several plants, such as the *calamus aromaticus*, the birch which, in Spring, exhales a kind of odour of roses, and the fir, the apple of which is sweet-scented. She has, in like manner, diffused colours the most agreeable, and the most brilliant, of flowers, on the most common of vegetables, such as on the cones of the larch, which are of a beautiful violet, on the scarlet grains of the sorb-apple, on mosses and mushrooms, and even on turnip-radishes.

On

On the ſubject of this laſt vegetable, hear what the accurate *Corneille le Bruyn* ſays, in his Voyage to Archangel *: "During our reſidence among "them (the Samoiédes), they brought us ſeveral "ſorts of turnips, of various colours, and ex- "tremely beautiful. Some of them were violet- "coloured, like our plumbs; gray, white, yel- "lowiſh, all of them ſtreaked with red, like ver- "million, or the fineſt laca, and as grateful to the "eye as a pink. I painted ſome of them on paper "in water-colours, and ſent ſome to Holland, in "a box filled with dry ſand, to one of my friends, "who is fond of ſuch curioſities. I carried thoſe "which I had painted to Archangel, where no one "would believe they were copied after Nature, "till I produced the turnips themſelves: a proof "that no great attention is paid there, to the "rareſt and moſt curious productions of Nature."

I take theſe turnips to be of the radiſh ſort, the bulb of which grows above ground. At leaſt I preſume ſo, from the drawing itſelf of *Corneille le Bruyn*, and from having ſeen ſuch in Finland; they are in taſte ſuperior to that of our colewort, and have a flavour ſimilar to the artichoke bottom. I have produced theſe teſtimonies of a Painter, and that Painter a Dutchman, reſpecting the beauty of

* Vol. iii. page 21.

thefe coloured vegetables, to correct the prejudice with which fo many are hurried away, that in the Indies only the Sun gives a magnificent colouring to plants. But nothing, in my opinion, equals the beautiful green of the plants of the North, in Spring. I have frequently admired, in particular, that of the birch, of the turf, and of the moffes, fome of which are glazed with violet and purple. The folemn firs themfelves, then burft into feftoons of the moft delicate green; and when they come to throw, from the extremity of their branches, the yellow tufts of ftamina, they appear like vaft pyramids, loaded all over with little lamps.

We encountered no obftacle in traverfing their foreffs. Sometimes there lay in the way an aged birch, laid low by the hand of Time, and internally confumed by the worm; but in ftepping on the rind, it fupports you like a piece of thick leather. The wood of thefe birches decays very faft, and their bark, which no humidity is able to corrupt, is carried away, on the melting of the fnows, into the lakes, where it fwims about all in one piece. As to the firs, when they fall, humidity and the moffes confume them in a very little time. This country is interfected with great lakes, which every where prefent new means of communication, as they penetrate far into the land

land by their branching gulfs, and exhibit a new ſpecies of beauty, by reflecting, in their ſtill waters, the openings of the vallies, the moſſy hills, and the pendent firs bending from the promontories over their ſhores.

It would be no eaſy matter to deſcribe the hoſpitable reception which we found in the ſolitary manſions of theſe northern regions. Their maſters exerted themſelves in every poſſible way, to detain us among them for many days together. They ſent to the diſtance of ten, of fifteen leagues, invitations to their friends and relations, to come and aſſiſt them to entertain us. The days and the nights paſſed away in dancing and feſtivity. In the cities, the principal inhabitants regaled us by turns. Amidſt this hoſpitable conviviality, we made the tour of the cities of poor Finland, Wiburg, Villemanſtrand, Frederickſham, Niſlot, &c. The caſtle of this laſt town is ſituated on a rock at the diſcharge of Lake Kiemen, which ſurrounds it with two cataracts. From it's platforms you perceive the vaſt extent of that lake. We dined in one of it's four towers, in a ſmall apartment illuminated by windows like gun-ports. It is the very apartment in which the unfortunate *Ivan* was ſo long confined, who deſcended from the Throne of the Ruſſian Empire, at the age of two years and a half. But this is not the place to expatiate on the

influence which moral ideas may diffuſe over Landſcapes.

Plants, then, are not ſcattered about at random over the Earth; and though nothing has been hitherto ſaid reſpecting their general arrangement in different Climates, this ſimple ſketch is ſufficient to demonſtrate, that there is order in their combination. If we examine, in like manner, however ſuperficially, their expanſion, their attitude, their magnitude, and proportions, we ſhall find that there is as much harmony in the aggregation of their parts, as in that of their ſpecies. It is impoſſible, in any one reſpect, to conſider them as mere mechanical productions of heat and cold, of dryneſs and humidity. Our ſcientific Syſtems have brought us back preciſely to the opinions which precipitated barbarous Nations into idolatry, as if it were neceſſary that the perfection of our illumination ſhould be the recommencement and return of our darkneſs; conformably to the well-grounded cenſure of the Author of the Book of Wiſdom: *Aut ignem, aut ſpiritum, aut citatum aërem, aut gyrum ſtellarum, aut nimiam aquam, aut ſolem & lunam, rectores orbis terrarum Deos putaverunt* *: "They "could not out of the good things that are ſeen, "know him that is; neither, by conſidering the

* Wiſdom of Solomon, chap. xiii. ver. 2.

"works,

" works, did they acknowledge the Work-maſter:
" but deemed either fire, or wind, or ſwift air, or
" the circle of the ſtars, or the violent water, or
" the lights of Heaven, to be the Gods which
" govern the world."

All theſe phyſical cauſes, united, could not have determined the port of one ſingle moſs. In order to be convinced of this, let us begin with examining the circulation of plants. It has been laid down as an indubitable principle, that their ſaps aſcend through the wood, and re-deſcend through the rind. To the experiments which have been detailed in proof, I ſhall oppoſe only the inſtance of a great cheſnut-tree, in the garden of the Thuilleries, near the terrace of the Feuillants, which, for twenty years paſt, has had no bark round it's under part, and which, notwithſtanding, is in perfect vigor. Many elms on the Boulevards are in the ſame ſtate. On the other hand, we have ſeen old hollowed willows, which have not a bit of good wood left. Beſides, how is it poſſible to apply this principle of vegetation to a multitude of plants, ſome of which are compoſed entirely of tubes, and to others which have no rind, being encloſed only in dry pellicles?

Neither is there more truth in the ſuppoſition that they riſe in a perpendicular line, and that to

this direction they are determined by the action of columns of air. Some, it must be allowed, do follow this direction, as the fir, the stalk of corn, the reed. But a much greater number deviate from it, such as creeping plants of every species, vines, liannes, French-beans, &c.....Others ascend vertically, and having arrived at a certain height, in an air perfectly unobstructed, fork off in various tiers, and send out their branches horizontally, as the apple-tree; or incline them toward the earth, like firs; or hollow them in form of a cup, like the sassafras; or round them into a mushroom's head, like the pine; or straighten them into a pyramid, like the poplar; or roll them as wool on the distaff, like the cypress; or let them float at the discretion of the winds, like the birch.

All these attitudes may be seen under the same bearing of the wind. Nay, there are some which assume forms, that all the art of the gardener could hardly impress upon them. Such is the badamier of the Indies, which grows up into the form of a pyramid, and carries it divided into stories, like the king of the chess-board. There are plants uncommonly vigorous, which, far from pursuing the vertical line, recede from it the very moment that they get above ground. Such is the false potatoe of India, which loves to crawl along the sand of the shores, in hot countries, covering whole acres in it's

it's progreſs. Such, too, is the ratan of China, which frequently grows in ſimilar ſituations. Theſe plants do not crawl from weakneſs. The ſcions of the ratan are ſo ſtrong, that the Chineſe make cordage of them for their ſhipping; and when they are on the ground, they ſerve as a trap for the deer, who find it impoſſible, with all their force, to diſengage themſelves. They are nets ſpread out by the hand of Nature.

I ſhould never have done were I to run over, ever ſo haſtily, the different ports of vegetables; what I have ſaid is evidence ſufficient, that there is not a ſingle one whoſe direction is determined by the vertical column of the air. This error has gained currency, from it's being taken for granted that plants affected the greateſt volume of air; and this error in Phyſics has produced another in Geometry; for, on this ſuppoſition, they muſt all precipitate themſelves to the Horizon, becauſe there the column of air is much more conſiderable than in the Zenith. We muſt, in like manner, reject the conſequences which have been deduced from it, and laid down, as principles of Juriſprudence for the diviſion of lands in our boaſted mathematical treatiſes; ſuch is the following, *That no more wood, or corn, or graſs, can grow on the declivities of a mountain, than what would grow on the area of it's baſis.* There is not a wood-cutter,

nor hay-maker, in the world, who could not demonſtrate the contrary from his experience.

Plants, it has been ſaid, are mechanical bodies. Well then, try to conſtruct a body ſo ſlim, ſo tender, ſo fragile, as that of a leaf, which ſhall for whole years reſiſt the winds, the rains, the keeneſt froſt, the moſt ardent Sun. A ſpirit of life, independent of all Latitudes, governs plants, preſerves them, re-produces them. They repair the injuries which they may have ſuſtained, and ſkin over their wounds with a new rind. The pyramids of Egypt are crumbled into powder; but the graſſes which cloathed the ſoil, while the Pharaoh's filled the throne, ſubſiſt to this day. How many Greek and Roman ſepulchral monuments, the ſtones of which were rivetted with iron, have, one after another, diſappeared! Nothing remains around their ruins, except the cypreſſes which ſhaded them.

It is the Sun, ſay they, who gives exiſtence to vegetables, and who maintains that exiſtence. But that great agent of Nature, all-powerful as he is, muſt not be conſidered as the only and determining cauſe even of their expanſion. If his heat invites moſt of thoſe of our Climates to open their flowers, it obliges others to ſhut them. Such are, of this laſt deſcription, the great nightſhade of Peru, and the *arbor triſtis* (the ſad tree) of the Moluccas,

luceas, which flower only in the night-time. Nay, his remoteneſs from our Hemiſphere does not deſtroy in it the power of Nature. At that ſeaſon vegetate moſt of the moſſes which clothe the rocks with an emerald-coloured green; and then the trunks of trees cover themſelves, in humid ſituations, with plants imperceptible to the naked eye, called *Mnium* and *Lichen*, which give them the appearance, in frofty weather, of columns of green bronze. Theſe vegetations, in the very ſeverity of Winter, overturn all our reaſonings, reſpecting the univerſal effects of heat, as plants, of an organization ſo extremely delicate, ſeem to need, in order to their expanſion, a temperature the moſt gentle.

Again, the fall of the leaf itſelf, which we have been taught to conſider as an effect of the Sun's abſence, is not occaſioned by the cold. If the palm retains it's foliage, all the year round, in the South, the fir is equally an evergreen in the North. The birch, it is true, the larch, and ſeveral other ſpecies of trees, ſhed their leaves in northern Climates, on the approach of Winter; but a ſimilar depredation is likewiſe made on other trees, to the Southward. It is the reſinous ſubſtance, we are told, which preſerves the foliage of the fir in the North: but the larch, which is likewiſe a reſinous plant, is ſtripped of it's verdure in Winter; whereas the filaria, the ivy, the privet, and many other ſpecies, which

which are not reſinous, continue with us in full verdure, at all ſeaſons.

Without having recourſe to mechanical cauſes, the effects of which always contradict themſelves, whenever you attempt to generalize them, why not recognize, in theſe varieties of vegetation, the ſteady and uniform direction of a Providence? That Providence has aſſigned to the South, trees always green, and has clothed them with a broad foliage, to ſhelter the animal creation from the heat. In another reſpect, likewiſe, have the animals of hot climates been tenderly cared for, in being provided with clothing denuded of hair, conſequently, light and cool; and in having their habitations garniſhed with green ferns and liannes, ever freſh and ever comfortable. Neither has bountiful Nature neglected the animals of the North. She has ſpread as a roof over their heads, the ever green firs, whoſe lofty and tufted pyramids ward off the ſnow from their roots, and whoſe branches are ſo well furniſhed with long gray moſſes, that the trunk is rendered almoſt inviſible; for a bed, ſhe has accumulated a bank of moſs on the ground, in many places more than a foot in thickneſs; and the ſoft and dry leaves of many trees, which fall preciſely at the approach of the inclement ſeaſon: finally, their proviſion, too, is laid up in ſtore, namely, the fruits of thoſe very trees,

trees, which have then arrived at full maturity. To these she has added, here and there, the scarlet clusters of the sorb-apple, which, sparkling afar over the whiteness of the snows, invite the birds to an asylum; so that the partridge, the moor-cock, every species of snow-bird, the hare, the squirrel, frequently find, under the shelter of the same fir, a lodging, food, and the means of warmth.

But one of the greatest blessings of Providence to the animals of the North, is, the clothing of them with furred garments of long and thick hair, which regularly grow in Winter, and fall off in Summer. Naturalists, who consider the hair of animals as a species of vegetation, are at pains to account for this growth and decay, from the influence of heat. They pretend to support their system by the instance of the human hair and beard, which grow rapidly in Summer. But I would ask them, how it comes to pass that, in cold countries, horses which, in Summer, are sleek and smooth, assume, in Winter, a long and shaggy coat, like the fleece of a sheep? To this they reply, It is the internal heat of their body, increased by the external action of the cold, which produces this wonderful phenomenon.

This is all very well. But I am under the necessity of objecting, that cold does not produce this

this effect on the human beard and hair, for it retards their growth; that, beſides, in the caſe of animals on which Providence beſtows a clothing peculiarly warm, the hair is much longer and thicker on thoſe parts of their body that have the leaſt natural heat, ſuch as the tail, which is very buſhy in horſes, martens, foxes, and wolves; that this hair is ſhort and thin on the parts which have moſt natural heat, as the belly. Their backs, their ears, and frequently their very paws, are the parts moſt amply furniſhed with hair. But I ſatisfy myſelf with merely propoſing this laſt objection; the external and internal heat of an African lion ought, ſurely, to be, at leaſt, as ardent as that of a Siberian wolf; whence is it, then, that the firſt is ſmooth, as if newly ſhaven, whereas the other is ſhagged up to the eyes?

The cold, which we have been taught to conſider as one of the greateſt obſtacles of vegetation, is as neceſſary to certain plants as heat is to others. If thoſe of the South could not thrive in the North, thoſe of the North would not ſucceed better in the South. The Dutch have made many a vain attempt to make the fir grow at the Cape of Good Hope, in order to find a ſupply of ſhips-maſts, which ſell at a very high price in India. Many planters, in the Iſle of France, have made attempts, equally fruitleſs, to raiſe in that iſland the lavender,

lavender, the daisy, the violet, and other plants of our temperate climates. Alexander, who transplanted whole nations at his pleasure, could not, with all his efforts, make the ivy of Greece grow in the vicinity of Babylon *, though he was very ambitious of acting, in India, the character of Bacchus in complete style.

I am persuaded, however, that it might be possible to succeed in effecting these vegetable transmigrations, by employing ice, in the South, for the propagation of northern plants as we employ stoves, in the North, in the propagation of the plants of hot Climates. I do not believe there is a single spot on the Globe, in which we could not, with a little address and industry, procure ice, as easily as we can procure salt. In the whole course of my travels, I have never met with a temperature more sultry than that of the Island of Malta, though I have twice crossed the Line, and have passed a considerable part of my life in the Isle of France, where the Sun is vertical twice a year. The soil of Malta consists of little hills of white stone, which reflect the rays of the Sun with so much force, that the eye-sight is sensibly affected by it; and when the wind from Africa, known by the name of *Syroco*, which issues

* See Plutarch and Pliny.

from

from the ſands of Zara, on it's way to melt the ices of the North, comes to paſs over that Iſle, the air is as hot as the breath of an oven. I recollect, at that ſeaſon, a figure of Neptune in bronze, on the ſea-ſhore, the metal of which was heated to ſuch a degree, that you could ſcarcely apply your hand to it. They, however, imported into the iſland ſnow from Mount Etna, which is ſixty leagues diſtant; they kept it for months together, laid on ſtraw in vaults, and it was to be bought for a farthing a pound weight, even when farmed out. Since, then, it is poſſible to have ice in Malta, during the Dog-Days, I think it might be procured in every country of the Globe. Nature, beſides, as we have ſeen, multiplies icy mountains in the vicinity of hot countries. I may, perhaps, be here reproached with indicating the means of promoting the increaſe of luxury; but as the commonalty now live only on the luxury of the rich, my ſuggeſtion may tend to promote, at leaſt, the extenſion of the ſcience of Nature.

So far is cold from being the enemy of all plants, that it is in the North we find foreſts of the talleſt growth, and of the greateſt extent in the World. It is only at the foot of the eternal ſnows of Mount Lebanon, that the cedar, the king of vegetables, riſes in all his majeſty. The fir, which is, next to him, the greateſt tree of our foreſts, arrives

rives at a prodigious ſize only on icy mountains, and in the cold climates of Norway and Ruſſia. Pliny tells us, that the largeſt piece of timber which had ever been ſeen at Rome, up to his time, was a vaſt log of fir, a hundred and twenty feet long, and two feet ſquare at both ends, which Tiberius had conveyed from the cold mountains of Voltolino, in Piedmont, and which Nero employed in his amphitheatre. You may judge, ſays he, what muſt have been the length of the tree as it grew when a cutting of it had ſuch dimenſions. However, as I believe that Pliny means Roman feet, which are of the ſame dimenſion with thoſe of the Rhine, we muſt ſubtract from this meaſurement about a twelfth part nearly. He quotes, beſides, the fir maſt of the veſſel which brought from Egypt the obeliſk that Caligula ordered to be ſet up in the Vatican; this maſt was four fathoms in circumference. I know not where it might have grown. But I myſelf have ſeen firs in Ruſſia, compared to which thoſe of our temperate climates are mere twigs. Among others I remember to have ſeen, between Peterſburg and Moſcow, two logs which exceeded in ſize the largeſt of our maſts for ſhips of war, though theſe conſiſt of ſeveral pieces. They were cut from the ſame tree, and ſerved as mounting blocks at the gate of a peaſant's farm-yard. The boats which convey proviſions from Lake Ladoga to Peterſburg are not

not much ſmaller than thoſe which ply between Rouen and Paris. They are conſtructed of fir planks from two to three inches thick, ſometimes two feet broad, and whoſe length is that of the whole barge. The Ruſſian carpenters of the cantons where they are built, make only a ſingle plank out of one tree, timber being, in ſuch plenty there, that they do not take the trouble to ſaw it.

Before I had travelled into northern countries, I took it for granted, in conformity to the laws of our Phyſics, that the earth muſt there be ſtripped of every thing like vegetation, by the rigor of the cold. I was very much aſtoniſhed to find there the largeſt trees I had ever ſeen in my life, and growing ſo near each other, that a ſquirrel could eaſily ſcamper over great part of Ruſſia, without touching the ground, by ſpringing from branch to branch. This vaſt foreſt of fir covers Finland, Ingria, Eſtonia, the whole ſpace comprehended between Peterſburg and Moſcow, and thence extends over a great part of Poland, where oaks begin to appear, as I know from actual obſervation, having travelled through theſe countries. But what I have ſeen is a very ſmall part only of theſe immenſe foreſts, for it is well known that they extend from Norway all the way to Kamſchatka, ſome ſandy deſerts excepted; and from Breſlau to the ſhores of the Frozen Ocean.

I ſhall

I ſhall conclude this article with refuting an error alluded to in the preceding Study; namely, that cold is diminiſhed in the North, in proportion as the foreſts are cut down. As this poſition has been advanced by ſome of our moſt celebrated Writers, and afterwards retailed, as the cuſtom is, by a multitude of others; it is of importance to overturn it, as being highly prejudicial to rural economy. I had long adopted it as inconteſtably certain, on the faith of Hiſtory; but I was at length cured of my miſtake, not, however, by books, but by ſimple peaſants.

One day in Summer, about two o'clock after noon, being about to croſs the foreſt of Ivry, I ſaw ſome ſhepherds with their flocks, who kept at a conſiderable diſtance from it, repoſing under the ſhade of ſome trees that were ſcattered up and down through the country. I aſked them why they did not go, with their flocks, to take ſhelter in the foreſt, from the heat of the Sun. They told me it was too hot there at that time of the day, and that they never drove their ſheep thither, except in the morning and evening. Being deſirous, however, of traverſing, in broad day, the woods in which *Henry* IV. had hunted, and of arriving betimes at Anet, to take a view of the country-palace of *Henry* II. and of the tomb of *Diana* of Poitiers, his miſtreſs, I engaged a lad belonging

to one of the ſhepherds to attend me as a guide, which was a very eaſy matter to him, for the great road leading to Anet croſſes the foreſt in a ſtraight line; and it is, on that ſide, ſo little frequented, that I found it covered in many places, with tufts of graſs and ſtrawberry plants. I felt all the way, as I walked along, a ſtifling heat, and much more ardent than was at that hour felt in the open country. I did not begin to reſpire freely, till I had got fairly clear of it, and had made my eſcape from the edge of the foreſt more than the diſtance of three muſket ſhot. In other reſpects, thoſe ſhepherds, that ſolitude, that ſilence of the woods, blended with the recollection of *Henry* IV. appeared to me much more affecting and ſublime, than the emblems of the chace in bronze, and the cyphers of *Henry* II. interwoven with the creſcents of Diana, which embelliſh, on all ſides, the domes of the Caſtle of Anet. This royal reſidence, loaded with ancient trophies of love, inſpired, at firſt, a mixed emotion of pleaſure and melancholy, which gradually ſubſided into profound ſorrow, on recollecting that this love was illicit; but this was followed, at laſt, by ſentiments of veneration and reſpect, which took complete poſſeſſion of my mind, on being informed that, by one of thoſe revolutions to which the monuments of men are ſo frequently ſubjected, the caſtle was then inhabited by the virtuous Duke of *Perthièvre*.

I have

I have, since reflected on what the shepherds told me, respecting the heat of the woods, and on what I myself had experienced; and I have, in fact, remarked that, in the Spring, all plants are more forward in the vicinity of woods, and that you find violets in flower on their borders much earlier than you gather them on the open plain, or on a naked hill. Forests, then, shelter the land from cold, in the North; but what is equally wonderful, they shelter it likewise from the heat in warm countries. These two opposite effects are produced entirely from the different forms and disposition of their leaves. In the North, those of the fir, the larch, the pine, the cedar, the juniper, are small, glossy, and varnished; their delicacy, their varnish, and the endless variety of their direction, reflect the heat around them a thousand different ways: they produce nearly the same effects as the hair of the animals of the North, whose furs are warm in proportion as the hair is fine and glossy. Besides, the leaves of some species, as of the fir and of the birch, are perpendicularly suspended from the branches by long moveable membranes, so that with every breath of the wind they reflect all around the rays of the Sun, like so many mirrors.

In the South, on the contrary, the palms, the tallipot, the cocoa, the banana, bear large leaves,

which, on the ſide next the ground, are rather rough than gloſſy, and which, ſpreading horizontally, form a deep ſhade below, where there is not the leaſt reflection of heat. I admit, at the ſame time, that the clearing away of foreſts diſpels the coldneſs occaſioned by humidity; but it increaſes the dry and ſharp colds of the North, as has been found on the lofty mountains of Norway, which were formerly cultivated, but are now uninhabitable, becauſe they are completely ſtripped of their woods.

This clearing of the ground likewiſe increaſes the heat in warm countries, as I have had occaſion to obſerve in the Iſle of France, on ſeveral parts of the coaſt, which are become ſo parched, ſince every ſpecies of tree has been ſwept away, that they are at this day abſolutely uncultivated. The very graſs which puſhes away during the rainy ſeaſon, is in a ſhort time quite burnt up by the Sun. What is ſtill worſe, there reſults from this parchedneſs of the coaſts, the drying up of a great many rivulets; for the trees, planted on the heights, attract thither the humidity of the air, and fix it there, as we ſhall ſee in the Study on Plants. Beſides, by deſtroying the trees which are on the high grounds, you rob the vallies of their natural manure, and the plains of the palliſades which ſhelter them from the high winds. Theſe winds deſolate,

to

to such a degree, the cultivation in many places, that nothing can be made to grow. I ascribe to this last piece of mismanagement the sterility of the heaths in Brittany. In vain has the attempt been made to restore their ancient fertility: it never can succeed, till you begin with recalling their shelter and their temperature, by re-sowing the forests. But there is a requisite prior even to this; you must render the peasantry happy. The prosperity of a country depends, before, and above all things, on that of it's inhabitants.

STUDY SIXTH.

REPLY TO OBJECTIONS AGAINST PROVIDENCE, FOUNDED ON THE DISORDERS OF THE ANIMAL KINGDOM.

WE ſhall continue to diſplay the fecundity of Northern Regions, in order to overturn the prejudice, which would aſcribe this principle of life, in plants and animals, only to the heat of the South. I could expatiate on the numerous and extenſive chaces of elks, rein-deer, water-fowls, heath-cock, hares, white bears, wolves, foxes, martens, ermines, beavers, &c. which the inhabitants of the northern diſtricts annually carry on, the very peltry of which, above what they employ for their own uſe, ſupplies them with a very conſiderable branch of commerce for the markets of all Europe. But I ſhall confine myſelf entirely to their fiſheries, becauſe theſe precious gifts of the Waters are preſented to all Nations, and are no where ſo abundant as in the North.

From the rivers and lakes of the North are extracted incredible multitudes of fiſhes. *John Schæffer*, the accurate Hiſtorian of Lapland, tells us *, that they catch annually at Torneo, no leſs than thirteen hundred boat-loads of ſalmon; that the pike there grow to ſuch a ſize, that ſome are found as long as a man, and that every year they ſalt as many as are ſufficient for the ſupport of four kingdoms of the North. But theſe fiſheries, however productive, fall far ſhort of thoſe of the Seas †. From the boſom of theſe is dragged the enormous whale, which is uſually about ſixty feet in length, twenty feet broad over the body and at the tail, eighteen feet high, and which yields up to a hundred and thirty barrels of oil. The fat is two feet thick, and in cutting it off, they are under the neceſſity of uſing great knives, ſix feet long.

From the Seas of the North, annually take their departure innumerable ſhoals of fiſhes, which enrich the fiſhers of all Europe; ſuch as cod, anchovies, ſturgeon, dory, mackerel, pilchers, herrings, ſea-dogs, belugas, ſea-calfs, porpoiſes, ſea-horſe, puffers, ſea-unicorns, ſaw-fiſh, &c.....The ſize of them all is conſiderably larger than in tem-

* Hiſtory of Lapland, by *John Schæffer*.

† Conſult *Frederic Martens* of Hamburg.

perate

perate Latitudes, and they are divided into much more numerous ſpecies. There are computed as high as twelve ſpecies of the whale tribe; and plaice are caught in thoſe ſeas of the enormous weight of four hundred pounds. But I ſhall farther confine myſelf to thoſe fiſhes which are beſt known to us, herrings, for example. It is an inconteſtable fact, that the Seas of the North every year ſend out a quantity more than ſufficient to feed all the inhabitants of Europe.

We are in poſſeſſion of Memoirs which prove, that the herring fiſhery was carried on ſo far back as the year 1163, in the Straits of Sunda, between the Iſlands of Schonon and Seeland. *Philip de Méſières*, Governor to *Charles* VI. relates, in the *Old Pilgrim's Dream*, that in the year 1389, during the months of September and October, the quantity of herrings in thoſe Straits was ſo prodigious, that, "For ſeveral leagues together you "might," ſays he, "have cut them with a ſword; "and it is credibly reported, that there are forty "thouſand boats which are employed in nothing "elſe, for two months, but in catching herrings; "each boat containing, at leaſt, ſix perſons, and "many not leſs than ten; and beſides theſe, there "are five hundred great and ſmall veſſels of bur"den, employed wholly in picking, ſalting, and "barrelling up the herrings." He makes the number

number of perſons engaged in this fiſhery amount to three hundred thouſand, Pruſſians and Germans.

In 1610, the Dutch, who carry on the herring-fiſhery ſtill farther to the North, where the fiſh is better, employed in it three thouſand boats, fifty thouſand fiſhermen, without reckoning nine thouſand other veſſels employed in barrelling, and conveying them to Holland, and a hundred and fifty thouſand perſons, partly at ſea, partly on ſhore, engaged in the carrying trade, in preparing and ſelling. At that period they derived a revenue from it, of two millions, ſix hundred and fifty thouſand pounds ſterling. I myſelf have witneſſed in Amſterdam, in 1762, the joy of the populace, expreſſed by diſplaying ſtreamers and flags over the ſhops where that fiſh was expoſed to ſale, on the firſt arrivals; and in every ſtreet this was the caſe. I have been informed in that city, that the Company eſtabliſhed for carrying on the herring-fiſhery was richer, and fed more mouths, than the Eaſt-India Company. The Danes, the Norwegians, the Swedes, the Hamburghers, the Engliſh, the Iriſh, and ſome traders of the ports of France, particularly of Dieppe, fitted out veſſels for this fiſhery, but in too ſmall a number for a fall of manna ſo plentiful, and ſo eaſily gathered.

In

In 1782, at the mouth of the Gothela, a ſmall river which waſhes the walls of Gottenburg, one hundred and thirty-nine thouſand barrels were cured by ſalt, three thouſand ſeven hundred were ſmoked, and two thouſand eight hundred and forty-five caſks of oil were extracted from what could not be preſerved. The Gazette of France *, which contains an account of this fiſhery, remarks that, previous to 1752, theſe fiſhes had entirely diſappeared for 72 years together. I aſcribe their deſertion of this coaſt to ſome naval engagement, which had chaced them away by the noiſe of the artillery, as is the caſe with the turtle of the iſland of Aſcenſion, which forſake the road for weeks together, when veſſels paſſing that way diſcharge their great guns. It may, perhaps, be likewiſe accounted for, from a conflagration of the foreſts, which might have deſtroyed the vegetables that attracted them to the coaſt.

The good Biſhop of Berghen, *Pont-Oppidan*, the *Fenelon* of Norway, who introduced into his popular ſermons, complete tracts of Natural Hiſtory, as being excellent articles of Theology, relates †, that when the herrings coaſted along the ſhores of Norway, "The whales, which purſue

* Friday the 11th October, 1782.

† *Pont-Oppidan*'s Natural Hiſtory of Norway.

"them

" them in great numbers, and which dart their " water-ſpouts into the air, give to the Sea, at a " diſtance, the appearance of being covered over " with ſmoking chimnies. The herrings, in order " to elude the purſuit, throw themſelves cloſe in- " ſhore into every little bay and creek, where the " water, before tranquil, forms conſiderable ſwel- " lings and ſurges, wherever they croud to make " their eſcape. They branch off in ſuch quan- " tities, that you may take them out in baſkets- " full, and the country people can even catch " them by the hand." After all, however, that the united efforts of all theſe fiſhers can effect, hardly any impreſſion is made on their great general column, which coaſts along Germany, France, Spain, and ſtretches as far as the Straits of Gibraltar; devoured, the whole length of their paſſage, by an innumerable multitude of other fiſhes, and ſea-fowls, which follow them night and day, till the column is loſt on the ſhores of Africa, or returns, as other Authors tells us, to the Climates of the North.

For my own part, I no more believe that herrings return to the Seas from which they came, than that fruits re-aſcend the trees from which they have once dropped. Nature is ſo magnificent in the entertainments which ſhe provides for Man, that ſhe never ſerves up the ſame diſhes a ſecond time.

I preſume

I presume, conformably to an observation of Father *Lamberti*, a missionary in Mingrelia, that these fishes accomplish the circuit of Europe by going up the Mediterranean, and that the extreme boundary of their emigration is the extremity of the Black Sea; and this is the more probable, that the pilchers, which take their departure from the same places, follow the same track, as is proved by the copious fisheries of them carried on along the coasts of Provence and Italy. "Many herrings," says Father *Lamberti**, "are sometimes seen in "the Black Sea; and in the years when this hap- "pens, the inhabitants of the adjacent countries "draw a flattering prognostic of a plentiful stur- "geon-fishing season; and they deduce the oppo- "site conclusion from the non-appearance of her- "rings. There was seen in 1642 a quantity so "prodigious of them, that the Sea having thrown "them on the shallows which separate Trebisond "from the country of the Abcasses, the whole was "covered and surrounded with a bank of herrings, "which was, at least, three hand-breadths high. "The people of the country were under dreadful "apprehensions, that the air would be poisoned "by the corruption of these fishes; but they were "presently followed by enormous flocks of crows "and rooks, which eat up the herrings, and cured

* Account of Mingrelia, Thevenot's Collection.

"the

" the honeſt folks of their terror. The natives " talk of a ſimilar appearance before that period, " only the quantity was much inferior."

This immenſe glut of herrings is, undoubtedly, matter of aſtoniſhment; but how is that aſtoniſhment increaſed, when it is conſidered, that this column is not the half of what annually iſſue from the Seas of the North! It ſeparates at the northern extremity of Iceland, and while one diviſion proceeds to diffuſe plenty over the ſhores of Europe, the other puſhes forward to convey ſimilar benefits to the ſhores of America. *Anderſon* informs us, herrings are in ſuch abundance on the coaſts of Iceland, that a ſhallop can with difficulty force it's way through the ſhoal by dint of rowing. They are accompanied by an incredible multitude of pilchers and cod, which renders fiſh ſo plenty in the iſland, that the inhabitants have them dried, and reduced to meal with a grind-ſtone, to become food for their oxen and horſes.

Father *Rale*, a jeſuit, and an American miſſionary, ſpeaking of the Savages who inhabit between Acadia and New-England, tells us*, " That " they reſort, at a certain ſeaſon, to a river not far " diſtant, where, for the ſpace of a month, the

* Inſtructive Letters, vol. xxiii. page 199.

" fiſhes

" fiſhes force their way upward in ſuch quantities, " that, with hands ſufficient, fifty thouſand bar- " rels might be filled in a ſingle day. Theſe are " a ſpecies of very large herrings, moſt agreeable " to the taſte when freſh. They are preſſed upon " each other to the thickneſs of a foot, and are " taken out by pails-full, like water. The Sa- " vages dry them for eight or ten days, and live " on them during their whole ſeed-time."

This teſtimony is confirmed by a great many others, and particularly by a Gentleman of Engliſh extraction, but a native of America, who has favoured us with a Hiſtory of Virginia. " In " Spring," ſays he*, " herrings puſh upwards, " in ſuch quantities, along the rivulets and fords " of rivers, that it is almoſt impoſſible to paſs on " horſeback without trampling on thoſe fiſhes..... " Hence it comes to paſs, that at this ſeaſon of the " year, thoſe parts of the rivers where the water " is freſh, are rendered fetid by the fiſh which they " contain. Beſides herrings, may be ſeen an in- " finite number of ſhads, roach, ſturgeon, and a " few lampreys, which find their way from the Sea " up the rivers."

It would appear, that another column of thoſe fiſhes iſſues from the North Pole, to the eaſtward

* Hiſtory of Virginia, page 202.

of

of our Continent, and paſſes through the channel which ſeparates America from Aſia, for we are informed, by a miſſionary, that the inhabitants of the land of Yaſſo go to Japan, to ſell, among other dried fiſhes *, herrings alſo. The Spaniards, who have been attempting diſcoveries to the north of California, find all the nations of thoſe regions to be fiſh-eaters, and unacquainted with every kind of cultivation. Though they landed there only in the middle of Summer, before, perhaps, the fiſhing ſeaſon had commenced, they found pilchers in the greateſt abundance, the native country and emigrations of which are the ſame, for vaſt quantities of a ſmaller ſize, are taken at Archangel. I have eaten of them in Ruſſia, at the table of Mareſchal Count *Munich* who called them the anchovies of the North.

But as the Northern Seas, which ſeparate America from Aſia, are not much known to us, I ſhall purſue this fiſh no further. I muſt, however, obſerve, that more than half of thoſe herrings are filled with eggs, and if the propagation were to go on, to it's full extent, for three or four generations only, without interruption, the Ocean itſelf would be unable to contain them. It is obvious

* Eccleſiaſtical Hiſtory of Japan, by Father *F. Soliar*. Book xix. chap. xi.

to

to the firſt glance of the eye, that the herring produces, at leaſt, as many eggs as the carp. M. *Petit*, a celebrated practitioner in Surgery and Medicine, has found, by experiment, that the two parcels of eggs, of a carp eighteen inches long, weighed eight ounces two drachms, which make four thouſand, ſeven hundred and fifty-two grains; and that it required ſeventy-two of theſe eggs to make up the weight of one grain; which gives a product of three hundred forty-two thouſand, one hundred and forty-four eggs, contained in one roe weighing eight ounces and two drachms.

I have been ſomewhat diffuſe on the ſubject of this particular ſpecies of fiſh, not in the view of promoting our commerce, which, by it's offices, it's bounties, it's privileges, it's excluſions, renders every article ſcarce with which it intermeddles, but in compaſſion to the poorer part of the community, reduced, in many places, to ſubſiſt entirely on bread, while Providence is beſtowing on Europe, in the richeſt profuſion, the moſt delicate fiſh, perhaps, that ſwims in the Sea *. We are not to form our judgment from thoſe that are brought to Paris, after the ſeaſon is over, and which are caught

* More than one epicure has already made this obſervation: but here is another, on which few are diſpoſed to dwell, it is this, that in all caſes, and in all countries, *the moſt common things are the beſt.*

on our coaſts; but from thoſe which are caught far to the North, known, in Holland, by the name of *pickled herrings*, which are thick, large, fat, with the flavour of a nut, ſo delicate and juicy, that they melt away in the cooking, and are eaten raw from the pickle, as we do anchovies.

The South Pole is not leſs productive of fiſhes than the North. The Nations which are neareſt to it, ſuch as the inhabitants of the iſlands of Georgia, of New Zealand, of Maire's Strait, of the Terra-del-Fuego, of Magellan's Strait, live on fiſh, and practice huſbandry of no kind. That honeſt Navigator, Chevalier *Narbrught*, ſays, in his Journal of a Voyage to the South Seas, that Port-Deſire, which lies in 47°. 48′. South Latitude, is ſo filled with pinguins, ſea-calves, and ſea-lions, that any veſſel touching there, may find proviſions in abundance. All theſe animals, which are there uncommonly fat, live entirely on fiſh. When he was in Magellan's Strait, he caught, at a ſingle draught of the net, more than five hundred large fiſhes, reſembling the mullet, as long as a man's legs; ſmelts twenty inches long; a great quantity of fiſh like the anchovy: in a word, they found, of every ſort, ſuch an abundant profuſion, that they ate nothing elſe during their ſtay in thoſe parts. The beautiful mother-of-pearl ſhells, which enrich our cabinets, under the name of the Magellan-oyſter,

oyſter, are there of a prodigious ſize, and excellent to eat. The lempit, in like manner, grows there to a prodigious magnitude. There muſt be, continues he, on theſe ſhores, an infinite number of fiſhes to ſupport the ſea-calves, the pinguins, and the other fowls, which live ſolely on fiſh, and which are all equally fat, though their number is beyond computation. They one day killed four hundred ſea-lions, in the ſpace of half an hour. Of theſe ſome were eighteen feet long. Thoſe which are only fourteen ſwarm by thouſands. Their fleſh is as tender and as white as lamb, and excellent food when freſh, but ſtill better when it has been ſome time in ſalt. On which I muſt make this obſervation, that the fiſh of cold countries only take in ſalt eaſily, and retain, in that ſtate, part of their flavour. It ſeems as if Nature intended thus to communicate to all the Nations of the Globe the abundance of the fiſheries which iſſue from the frigid Zones.

The weſtern coaſt of America, in that ſame Latitude, is not leſs amply ſupplied with fiſh. "Along "the whole ſea-coaſt," ſays the Peruvian *Garcillaſo de la Vega* *, "from Aréquipa to Tarapaca, a "track of more than two hundred leagues in "length, they employ no other manure to dung

* Hiſtory of the Incas, book v. chap. iii.

" the land, except the excrement of certain fowls, " called ſea-ſparrows, of which there are flocks ſo " numerous, as to exceed all belief. They inhabit " the deſert iſlands on the coaſt, and by the accu- " mulation of their ordure, they whiten them to " ſuch a degree, that, at ſome diſtance, they might " be taken for mountains covered with ſnow. The " Incas reſerved to themſelves the right of diſ- " poſing of thoſe iſlands, as a royal boon to ſuch " and ſuch a favourite province." Now this dung was entirely the produce of the fiſhes on which thoſe fowls conſtantly fed.

" In other countries, on the ſame coaſt," ſays he *, " ſuch as that of Atica, of Atitipa, of Villa- " cori, of Malla, and Chilca, they dung the land " with the heads of pilchers, which they ſow there " in great quantities. They put them in the " ground at ſmall intervals from each other, along " with two or three grains of maize. At a parti- " cular ſeaſon of the year, the Sea throws upon the " ſhore ſuch quantities of live pilchers, that they " have an abundant ſupply for food, and for ma- " nure, and this to ſuch a degree, that after theſe " demands were ſatisfied, they could eaſily load " whole ſhips with the overplus."

* Conſult the ſame Work.

It

It is obvious that the coaſt of Peru is nearly the boundary of the emigration of the pilchers which ſet out from the South Pole, as the coaſts of the Black Sea are the boundary of that of the herrings which iſſue from the North Pole. The continuation and direction of theſe two bands, the pilchers of the South, and the herrings of the North, are nearly of the ſame length, and their deſtinies are, at laſt, ſimilar. It would appear as if certain Nereïds were annually commiſſioned to conduct, from the Poles, thoſe innumerable ſwarms of fiſhes, to furniſh ſubſiſtence to the inhabitants of the temperate Zones; and that, having arrived at the termination of their courſe, in the hot Latitudes, where fruits are produced abundantly, they empty the gleanings of their nets upon the ſhore.

It will not be ſo eaſy a taſk, I confeſs, to refer to the beneficence of Nature the wars which animals wage with each other. Why ſhould beaſts of prey exiſt? Suppoſing me incapable of reſolving this difficulty, Nature muſt not be accuſed of cruelty becauſe I am deficient in mental ability. She has arranged what we do know, with ſuch conſummate wiſdom, that we are bound to give her credit for the ſame character of wiſdom, in caſes where we cannot find her out unto perfection. I will have the courage, however, to declare my opinion, and to offer a reply to this queſtion;

and so much the rather, as it affords me an opportunity of presenting some observations which I consider as at least new, if not worthy of attention.

First of all, Beasts of prey are necessary. What otherwise would become of the carcases of so many animals, which perish both on the land and in the water, and which they would, consequently, poison with infection. Several species of carnivorous animals, it must be allowed, devour their prey while yet living. But who can tell whether, in this, they do not transgress the law of their nature? Man knows very little of his own History. How is it possible he should know that of the beasts? Captain Cook observed, in a desert island of the Southern Ocean, that the sea-lions, the sea-calves, the white bears, the sots, the eagles, the vultures, lived in perfect concord, no one tribe giving the least disturbance to another. I have observed a similar good agreement among the fool and the frigat of the Island of Ascension. But, after all, we must not compliment them too highly on their moderation. It was merely an association of plunderers; they lived peaceably together, that they might devour, unmolested, their common prey, the fishes, which they all gulped down alive.

Let us revert to the great principle of Nature. She has made nothing in vain. She destines few animals

animals to die of old age; nay, I believe, that ſhe permits Man alone to complete his career of life, becauſe his old age alone can be uſeful to his fellow-creatures. To what purpoſe would ſerve, among the brute creation, grandſires deſtitute of reflection, to progeny brought into exiſtence in the maturity of their experience? On the other hand, what aſſiſtance could decrepit parents find among children, which abandon them, the inſtant they have learned to ſwim, fly, or walk? Old age would be to them a burthen from which they are delivered by the ferocious animals. Beſides, from their unobſtructed generations would ariſe a poſterity without end, which the Globe is not ſufficient to contain. The preſervation of individuals would involve the extinction of ſpecies.

Animals might always live, I ſhall be told, in a proportion adapted to the places which they inhabit; but in that caſe they muſt ceaſe to multiply; and from that moment farewel the loves, the neſts, the alliances, the foreſight, and all the harmonies which ſubſiſt among them. Every thing that is born is doomed to die. But Nature, in devoting them to death, takes from them that which could render the inſtant of it cruel. It is uſually in the night-time, and in the hour of ſleep, that they ſink under the fangs and the teeth of their deſtroyers. Twenty ſtrokes, ſent home in one inſtant to the

ſources of life, afford no leiſure to reflect that they are going to loſe it. That fatal moment is not embittered to them, by any of the feelings which render it ſo painful to moſt of the Human Race, regret for the paſt, and ſolicitude about futurity. Their unanxious ſpirits vaniſh into the ſhades of night, in the midſt of a life of innocence, and frequently during the indulgence of the fond illuſions of love.

Unknown compenſations may, perhaps, farther ſweeten this laſt tranſition. I ſhall obſerve at leaſt, as a circumſtance deſerving the moſt attentive conſideration, that the animal ſpecies, whoſe life is ſacrificed to the ſupport of that of others, ſuch as that of inſects, do not appear poſſeſſed of any ſenſibility. If the leg of a fly happens to be torn away, ſhe goes and comes as if ſhe had loſt nothing; the cutting off a limb ſo conſiderable is followed by no fainting, or convulſion, or ſcream, or ſymptom of pain whatever. Cruel children amuſe themſelves with thruſting ſtraws into their anus; they riſe into the air thus empaled; they walk about, and perform all their uſual motions, without ſeeming to mind it. Others take lady-birds, tear off a large limb, run a pin through the nerves and cartilages of the thigh, and attach them with a ſlip of paper to a ſtick. Theſe unfeeling inſects fly humming round and round the ſtick, unweariedly, and without

without any appearance of ſuffering pain. *Reaumur* one day cut off the fleſhy and muſcular horn of a large caterpillar, which continued to feed as if no mutilation had taken place. Is it poſſible to think, that beings ſo tranquil in the hands of children and philoſophers, endure any feeling of pain when they are gobbled down in the air by the birds?

Theſe obſervations might eaſily be extended much farther: particularly to that claſs of fiſhes, which have neither bone nor blood, and of theſe conſiſt the greateſt number of the inhabitants of the Seas, and they appear to be equally void of ſenſibility. I have ſeen, between the Tropics, a tunny, from the nape of whoſe neck one of the ſailors ſcooped out a large ſlice of the fleſh, with a ſtroke of the harpoon, which was forced backward to his head, who followed the ſhip for ſeveral weeks, and was outdone by no one of his companions, either in ſpeed or in friſkineſs. I have ſeen ſharks, after being ſtruck with muſket bullets, return to bite at the hook from which they had juſt before eſcaped, with their mangled throat.

We ſhall find, beſides, a greater analogy between fiſhes and inſects, if we conſider that neither have bones nor blood; that their fleſh is impregnated with a glutinous liquid, and which likewiſe appears to be the ſame in both, from it's emitting the

the ſame odour when burnt; that they do not reſpire by the mouth, but by the ſides, inſects by the trachea, fiſhes by the gills; that they have no auditory organ, but hear by means of the nervous impreſſion made on their bodies by the commotion of the fluid element in which they live; that they ſee all round the horizon from the diſpoſition of their eyes; that they equally run to the light; that they diſcover the ſame avidity, and are, for the moſt part, carnivorous; that, in both genera, the female is larger than the male; that theſe throw out their eggs, to an infinite number, without ſitting on them: that moſt fiſhes paſs, on their birth, through the ſtate of inſects, iſſuing from their eggs, in form of worms, and even ſome in that of frogs, ſuch as a ſpecies of fiſh in Surinam; that both are caſed in ſcales; that many fiſhes are provided with beards and horns, like inſects; that both the one and the other contain, in their categories, an incredible variety of forms, peculiar to themſelves; finally, that their conſtitutions, their metamorphoſes, their manners, their fecundity, being the ſame, there is a powerful temptation to aſcribe to theſe two numerous claſſes, the ſame inſenſibility.

As to animals which have blood, let *Mallebranche* ſay what he pleaſes, they are ſenſible. They expreſs a ſenſe of pain by the ſame ſigns which we do.

do. But Nature has fenced them with thick hides, with long hair, with a plumage, which protect them againſt external blows. Beſides, they are little, if at all, expoſed to cruel treatment, except from the hands of bad men.

Let us now proceed to conſider the generation of animals. We have ſeen that the greateſt and moſt numerous ſpecies of the Globe, in the animal and vegetable kingdoms, are produced in the North, independently of the heat of the Sun. Let us now enquire, whether the prolific power of fermentation be greater in the South. Certain Egyptians told Herodotus, that particular ſpecies of animals were formed of the fermented mires of the Ocean, and of the Nile. Whatever reſpect I have for the Ancients, I abſolutely reject their authority in Phyſics. Moſt of their Philoſophers have a ſufficiently ſtriking reſemblance to our own. They obſerved ſparingly, and reaſoned copiouſly. If ſome of them, in the view of ſpeaking peace to voluptuous Princes, have advanced that every thing proceeded from corruption, and returned to corruption again, others more honeſt and ſincere have refuted them, even in the earlieſt times.

It is not only certain, that corruption produces no one living body, but is fatal to all, eſpecially to thoſe which have blood, and chiefly to Man.

No

No air is unwholesome but where there is corruption. How could such a principle have generated, in animals, feet provided with toes, nails, and claws; skins clothed with so many sorts of hair and plumage; jaws palisaded with teeth cut out into a form adapted, some for cutting, and others for grinding; heads adorned with eyes, and eyes furnished with lids to defend them from the Sun? How could the principle of corruption have collected these scattered members; unite them by nerves and muscles; support them by bony substances, fitted with pivots and hinges; feed them with veins filled with a blood which circulates, whether the animal be in motion or at rest; cover them with skins so admirably provided with hairy furs, precisely adapted to the Climates which they inhabit; afterwards, make them move by the combined action of a heart and a brain, and give to all these machines, produced in the same place, and formed of the same slime, appetites and instincts so entirely different? How could it have inspired them with the sensation of themselves, and kindled in them the desire of reproducing themselves by any other method than that which originally gave them existence?

Corruption, so far from conferring life on them, must have deprived them of it, for it generates tubercles, inflames the eyes, dissolves the blood, and produces

produces an infinite number of diſeaſes in moſt animals which reſpire it's emanations *. The fermentation of any ſubſtance whatever could have formed

* Of all corruptions, that of the human fleſh is moſt noxious. Of this a very ſingular inſtance is related by *Garcillaſo de la Vega*, in his Hiſtory of the Civil Wars of the Spaniards, in the Indies. Vol. i. Part ii. Chap. xlii. He obſerves, firſt, that the Indians, of the Iſlands of Barlovento, poiſon their arrows, by plunging the points of them into dead bodies; and then adds, "I ſhall relate what I myſelf ſaw happen in "the caſe of one of the quarters of the dead body of Carvajal, "which was expoſed on the great road to Collaſuyu, to the "ſouth of Cuſco. We ſet out a walking one Sunday, ten or "twelve ſchool-fellows of us, all mongrels, that is, the pro-"geny of Spaniſh men by Indian women, the oldeſt not above "twelve years of age. Having obſerved, as we went along in "the open country, one of the quarters of Carvajal's body, we "took a fancy to go and look at it, and having come up, we "found it was one of his thighs, the fat of which had dropped "to the ground. The fleſh was greeniſh, and entirely corrupted. "While we were examining this mournful ſpectacle, a forward "boy chanced to ſay, I could wager no one here dares to touch "it; another replied, he would. At laſt the ſtouteſt of all, "whoſe name was Bartholomew Monedero, imagining he was "going to perform an act of courage, plunged the thumb "of his right hand into this putrid limb, which it eaſily pene-"trated. This bold action aſtoniſhed every one, to ſuch a de-"gree, that we all run away from him, for fear of infection, "calling out, 'O abominable! Carvajal will make you pay "dear for this raſhneſs. He went, however, inſtantly to the "brook, which was cloſe by the ſpot, waſhed his hand ſeveral "times, rubbing it over with clay, and ſo returned home. Next "day he returned to ſchool, where he ſhewed us his thumb,

"which

formed no one animal, nor even the egg from which it iſſued. We find in the dunghills of our great towns, where ſo many ſubſtances ferment, organic

"which was ſwollen prodigiouſly; but towards evening the "whole hand had become inflamed up to the wriſt; and next "day, which was Tueſday, the arm had ſwelled up to the elbow, "ſo that he was reduced to the neceſſity of diſcloſing the caſe "to his father. Profeſſional men were immediately called in, "who had the arm tightly bandaged, above the ſwelling, and "applied every remedy which art and experience could ſuggeſt "as a counter-poiſon. After all, notwithſtanding, it nearly "coſt the patient his life; and he recovered not without ſuffering "intolerable pain, after having been for four months ſo en- "feebled, as to be incapable of holding the pen."

From this anecdote it may be concluded, how dangerous the putrid emanations from our church-yards muſt be to the inhabitants of cities. Pariſh Churches in which ſo many corpſes are interred, become impregnated with an air ſo corrupted, eſpecially in Spring, when the ground begins to grow warm, that I conſider this as one of the chief ſources of the ſmall-pox, and of the putrid fevers which are prevalent at that ſeaſon. An unſavoury ſmell then iſſues from it which makes the ſtomach riſe. I have felt this to an inſufferable degree in ſome of the principal Churches of Paris. This ſmell is extremely different from that produced by a croud of living people, for we are affected with no ſuch ſenſation in the Churches of Convents, where few only are interred.

It would be a curious ſubject of enquiry to Anatomiſts, Why the putrefaction of dead bodies ſhould deſtroy the animal economy of moſt beings, while it makes no derangement in that of carnivorous animals. Many ſpecies of inſects and fiſhes live on carrion. I remark that the greateſt part of theſe have no blood, which

organic particles of every ſpecies; entire bodies of animals, blood, plants, ſalts, oils, excrements, ſpirits, minerals, ſubſtances more heterogeneous, and more combined by Man in a ſtate of ſociety, than ever the waves of the Ocean accumulated and confounded on it's ſhores: there was never found there, however, a ſingle organized body.

It muſt not be affirmed, that the heat neceſſary to their expanſion is there wanting, for it exiſts in every poſſible degree, from ice up to fire. Salts cryſtallize in them, and ſulphurs are formed. There was picked up in Paris itſelf, ſome years ago, ſulphur formed by Nature, in ancient dung-hills of the time of *Charles* IX. We ſee, every day, that fermentation may be excited in dung to ſuch a degree, as to catch fire. Nay, it's moderate heat is ſo favourable to the expanſion of germs, that it is employed for the hatching of chickens. But the combinations of all theſe ſubſtances never produced any thing living, or organized. What do I ſay? The firſt operations of Nature, which we wiſh to explain, are covered in ſo many myſteries, that an egg with an aperture ever ſo ſmall loſes it's

which is the firſt fluid that corruption lays hold of, and that the apertures through which they breathe are not the ſame with thoſe by which they take in their food. But theſe reaſons, it muſt be allowed, are inapplicable to vultures, ravens, and other birds of prey.

prolific

prolific power. The ſlighteſt contact with the exterior air, is ſufficient to extinguiſh in it the radical principles of life. It is neither matter, then, nor degrees of heat, which are wanting to Man, to imitate Nature in the pretended creation of beings; and this power, ever young and active, has by no means waſted itſelf, as it is always exerting itſelf in their re-production; a diſplay of omnipotence equally wonderful with that of conferring exiſtence at the firſt.

The wiſdom with which ſhe has ſettled their proportions, is not leſs worthy of admiration. On a careful examination of animals, we ſhall find no one deficient in it's members, regard being had to it's manners, and the ſituation in which it is deſtined to live. The large and long bill of the toucan, and his tongue formed like a feather, were neceſſary to a bird who hunts for inſects, ſcattered about over the humid ſands of the American ſhores. It was needful that he ſhould be provided, at once, with a long mattock wherewith to dig, with a large ſpoon to collect his food, and a tongue fringed with delicate nerves, to enjoy the reliſh of it. Long legs and a long neck were neceſſary to the heron, to the crane, to the flamingo, and other birds, which have to walk in marſhy places, and to ſeek their prey under the water. Every animal has feet, and a throat, or a bill, formed in a moſt wonderful

wonderful manner, to ſuit the ſoil which they have to tread, and the food by which they are to be ſupported. From the different configurations of theſe, Naturaliſts derive the characters which diſtinguiſh beaſts of prey from ſuch as live on vegetable ſubſtances.

Theſe organs have never been wanting to the neceſſities of animals, and are themſelves indelible as their inſtincts. I have ſeen, up in the country, ducks brought up at a diſtance from water, for ſeveral generations, which, nevertheleſs, retained on their feet the broad membranes of their ſpecies, and which, on the approach of rain, clapped their wings, ſcreamed aloud, called upon the clouds, and ſeemed to complain to Heaven of the injuſtice of Man, who had baniſhed them from their element. No animal wants any one neceſſary member, or is encumbered with one that is ſuperfluous. Some philoſophers have conſidered the ſpurs appended to the heels of the hog as uſeleſs, becauſe they do not bear upon the ground; but this animal, deſtined to live in ſwampy places, where he delights to wallow, and to make, with his ſnout, deep trenches in the mire, would frequently ſink under the impulſe of gluttony, had not Nature placed above his heels two prominent excreſcences, which aſſiſt him in getting out again. The ox, who frequents the marſhy banks of rivers,

is provided with nearly ſimilar weapons. The hippopotamus, who lives in the water, and upon the banks of the Nile, is furniſhed with a cloven foot, and, above the paſtern, with two ſmall horny ſubſtances, which bend backward as he walks, ſo that he leaves on the ſand an impreſſion, which ſeems to have been made by the preſſure of four paws. The deſcription of this amphibious animal may be ſeen toward the end of *Dampier*'s Voyages.

How was it poſſible for enlightened men to miſunderſtand the uſe of theſe acceſſory members, the form of which is imitated by ſome of our country clowns, in ſtilts; which, from this very reſemblance, they call *hogs-feet*, and which they employ in wading through marſhy ground? Theſe ſame clowns have, in like manner, imitated that of the pointed and divergent ſpurs of the goat's-foot, which aſſiſt them in ſcrambling over the rocks, in their pikes ſhod with two iron points, contrived to prevent the backward motion of loaded carriages, on the declivity of mountains.

Nature, who varies her means with the obſtacles to be ſurmounted, has beſtowed the appendix excreſcences on the heels of the hog, for the ſame reaſon that ſhe has clothed the rhinoceros with a hide rolled up in ſeveral folds, in the midſt of the torrid Zone. This clumſy animal has the appearance

ance of being invested with a threefold mantle: but, being destined to live in the miry morasses of India, where he grubs up with his horny snout the long roots of the bamboo, he would have been in danger of sinking, from his enormous weight, had he not been endowed with the strange faculty of extending, by blowing himself up, the multiplied folds of his skin, and of rendering himself lighter, by occupying a larger space.

What to us appears, at first sight, a deficiency in animals, is, you may rest perfectly assured, a most wonderful compensation of Providence; and it would be, in many cases, an exception from her general laws, if she had any other than the utility and happiness of the beings which she has formed. Hence she has given to the elephant a proboscis, which serves him, like a hand, as he scrambles over the roughest mountains, where he delights to live, in picking up the grass of the field, and the foliage of the trees, which the thickness and inflexibility of his neck would not permit him otherwise to reach.

She has infinitely varied, among the animal creation, the means of defence, as well as those of subsistence. It is impossible to suppose that those which move slowly, or which scream violently, are in a state of habitual suffering: for how could a race of

creatures always sickly perpetuate itself, nay, become one of the most universally diffused of the whole Globe? The sluggard, or sloth, is found in Africa, in Asia, and in America. His tardiness is no more a paralytic affection, than that of the turtle and of the snail. The cries which he utters, when you go near him, are not the cries of pain. But among animals, some being destined to roam about over the face of the Earth, others to remain fixed on a particular post, their means of defence are varied with their manners. Some elude their enemies by flight; others repel them by hissings, by hideous figures, by poisonous smells, or lamentable cries. There are some which deceive the eye, such as the snail, which assumes the colour of the walls, or of the bark of trees, to which he flees for refuge; others, by a magic altogether inconceivable, transform themselves, at pleasure, into the colour of surrounding objects, as the cameleon.

O, how sterile is the imagination of Man, compared to the intelligence of Nature! He has produced no one thing, in any line whatever, of which he has not borrowed the model from her Works. Genius itself, about which such a noise is made, this creative genius, which our wits fondly imagine they brought into the world with them, and have brought to perfection in learned circles, or by the assistance of books, is neither less nor more

more than the art of obſerving. Man cannot forſake the path of Nature, even when he is determined to go wrong. We are wiſe only with her wiſdom: and we play the fool only in proportion as we attempt to derange her plans.

The graver of *Callot*, ſo prolific of monſters, never patched up ſo many frightful demons, as the ill-aſſorted members of different animals, the beak of the owl, the jaws of the crocodile, the body of the horſe, the wings of the bat, the fangs and the paws which he has united to the human figure, to render his coſtrafts more hideous. Our female friends, too, who, ſweetly capricious, amuſe themſelves with embroidering fancy-flowers on the various articles of their dreſs, are reduced to the neceſſity of borrowing their patterns from the garden. Examine, on their gowns and handkerchiefs, the ſportive productions of their imagination: there you have the flower of the pink, on the foliage of the myrtle; roſes on the ſtalk of the reed; pomegranates in the place of ears of corn. Nature alone produces none but rational harmonies; and aſſorts, in both animals and plants only parts adapted to the places, to the air, to the elements, to the uſes, for which ſhe has deſtined them. Never was a race of monſters beheld iſſuing from the ſublimity of her conceptions.

I have frequently heard living monſters announced for exhibition at our fairs; but I never had the fortune to ſee a ſingle one, whatever trouble I could take to that effect. One day a placard was diſplayed, at the fair of Saint Ovide, "a cow with three eyes, and a ſheep with ſix "feet." I had a curioſity to ſee theſe animals, and to examine into the uſe which they made of organs and members, to my apprehenſion, entirely ſuperfluous. How, ſaid I to myſelf, Nature plant ſix legs under the body of a ſheep, when four were amply ſufficient to ſupport it? At the ſame time, I began to recollect, that the fly, who is much lighter than the ſheep, had ſix; and this reflection, I acknowledge, ſtaggered me. But having one day obſerved a fly which had alighted on the paper before me, I found ſhe frequently employed herſelf in alternately bruſhing her head and wings with the two fore and the two hinder feet. I then evidently perceived, that ſhe had occaſion for ſix feet, in order to have the ſupport of four, while the other two were applied to the bruſhing ſervice, eſpecially on a perpendicular plane. Having caught, and examined her by the microſcope, I diſcovered that the two middle feet had no bruſh, but that the other four had. I farther obſerved, that her body was covered over with particles of duſt, which adhere to it, in the atmoſphere through which

which ſhe flies; and that her bruſhes were double, furniſhed with fine hairs, between which ſhe emitted, and drew back, at pleaſure, two claws, ſimilar to thoſe of a cat, but incomparably ſharper. Theſe claws enable the fly to lay hold of the moſt poliſhed ſurfaces, ſuch as the glaſs of mirrors, along which you ſee them march upward and downward, without ſliding.

I was very curious to ſee in what manner Nature had attached two new legs to the body of a ſheep, and how ſhe had formed, in order to put them in motion, new nerves, new veins, and new muſcles, with their inſertions. The third eye of the cow perplexed me ſtill more. I had nothing for it, then, but, like other ſimpletons, to part with my money for the gratification of my curioſity. The people were coming out in crowds, from the repoſitory of thoſe wonders, delighted and aſtoniſhed with their pennyworth. At laſt, I too had the ſatisfaction of contemplating the marvellous ſight. The two ſuperfluous legs of the ſheep were nothing but two ſhrivelled pieces of ſkin, cut out like thongs, and hanging down from the breaſt, but without touching the ground, and incapable of being of any uſe whatever to the poor animal. The pretended third eye of the cow, was a kind of oval wound in the middle of the forehead, without orbit, without apple, without a lid, and without any

membrane which preſented one ſingle organized part of an eye. I withdrew, without examining whether theſe accidents were natural or artificial, for, in truth, it was not worth the trouble.

The monſters which are preſerved in cryſtal globes filled with ſpirit of wine, ſuch as pigs with the proboſcis of an elephant; children double bodied, or with two heads, which are exhibited in cabinets, with a philoſophic myſterioufneſs, prove much leſs a laboured production of Nature than the interruption of it. No one of thoſe beings could poſſibly have attained a complete expanſion: and ſo far from demonſtrating, that the intelligence which produced them had fallen into a blunder, they atteſt, on the contrary, the immutability of Supreme Wiſdom, which has rejected them from it's plan, by refuſing them life.

There is a benignity, in the conduct of Nature toward Man, which challenges the higheſt admiration: it is this, that in defying him, on the one hand, to infringe the regularity of her laws, to gratify caprice; on the other, ſhe frequently permits him to derange the courſe of ſome of them, to relieve his neceſſities. For inſtance, ſhe connives at the production of the mule from the copulation of the aſs and the mare, becauſe that animal is ſo ſerviceable in mountainous countries,

tries, but positively forbids the re-production to proceed, in order to preserve the primitive species, which are of more general utility.

It is easy to discern, in most of her works, these maternal condescensions, and, may I call them so? regal provisions. They manifest themselves particularly in the productions of the garden. We find them in those of our flowers which have a profusion of *corollæ*, as in the double rose, which is not reproduced by seeds, and which, for this reason, certain Botanists have dared to brand with the name of monster, though it be the finest of flowers, in the estimation of all persons of taste and sensibility. Naturalists pretend, that it deviated from the laws of Nature, because it scorned to conform to their Systems: as if the first of laws, which governs the World, had not for it's object the happiness of Man! But if roses, and other flowers, which have a superabundance of *corollæ*, are monsters, fruits which have a superabundance of pulpy flesh, and sugary pastes, of no use toward the expansion of their seeds, such as apples, pears, melons, and fruits which have no seeds at all, as the pine-apple, the banana, the bread-fruit, all these must likewise be monsters. The roots which become so plump in our kitchen-gardens, and which are converted into large balls, into succulent glands, into bulbs farinaceous, and of no effect toward

toward the expanſion of their ſtems, muſt, forſooth, be all monſters.

Nature feeds the human race, in part, only with this vegetable ſuperabundance, and beſtows it only as the reward of Induſtry. However fertile the ſoil may be, the vegetables of the ſame ſpecies with thoſe which are produced in the garden, degenerate in the uncultivated plain, grow wild, and ſpend themſelves in foliage and branches. Is it not, therefore, an inſtance of wonderful complaiſance on the part of Nature, that ſhe ſhould transform, under the hand of Man, into pleaſant and wholeſome aliment, the ſame juices which would be converted, in the foreſt, into lofty ſtems, and tough roots? Were this condeſcenſion withheld, in vain would man ſay to the ſap of trees, you ſhall flow into the fruit, and you ſhall go no further. To no purpoſe would he, in the moſt fertile region, prune, crop, nip; the almond-tree would refuſe to cover it's nut with a fleſhy melting pulp, like that of the peach.

Nature, from time to time, makes Man a preſent of varieties both uſeful and agreeable, which ſhe extracts from the ſame genus. All our fruit-trees come originally from the foreſt, and no one there re-perpetuates itſelf in it's ſpecies. The pear called Saint-Germain was found in the foreſt of

of that name, with it's well-known flavour. Nature culled it, like the other fruits of our orchards, from the table of the animal, to ſerve it up on that of Man; and that it might be impoſſible for us to doubt reſpecting her bounty and it's origin, it is her ſovereign will that the ſeeds ſhould re-produce crabs only. Ah! if ſhe were to ſuſpend her particular laws of beneficence in the gardens of our miſcreants, in order to eſtabliſh in them her pretended general laws, what would be their aſtoniſhment to find nothing re-produced in their kitchen-gardens and orchards, but ſome miſerable wild carrots, pitiful dog-roſes, harſh pears, and unſavoury fruits of every ſort, ſuch as ſhe produces, on the mountains, for the coarſe palate of the wild boar! They would, in truth, find ſtems of trees lofty and vigorous. Their orchards would be doubled in ſize, and the crops reduced to one half.

The ſame metamorphoſis would take place in the animals of their farm-yards. The hen, which lays eggs much too large in proportion to her ſize, and that for nine months uninterruptedly, contrary to all the laws of incubation among the feathered race, would then fall back into the general order, and would produce, at fartheſt, twenty eggs in the courſe of a year. The hog would, in like manner, loſe his ſuperfluous fat. The cow, which yields,

yields, in the rich paſtures of Normandy, up to twenty-four quarts of milk a day, would give no more than a bare ſufficiency to ſuckle her calf.

To this it is replied, that this profuſion of eggs, of fat, and of cream, from our domeſtic animals, is the effect of their copious feeding. But neither does the mare give as much milk as the cow, nor does the duck lay as many eggs as the hen, nor does the aſs clothe himſelf with fat like the hog, though theſe animals all feed as plentifully the one as the other. Beſides, the mare, the ſhe-goat, the ewe, the ſhe-aſs, have only two teats, whereas the cow has four.

The cow, in this reſpect, deviates, in a very remarkable manner, from the general laws of Nature; who has adjuſted, in every animal ſpecies, the number of teats in the mother to that of the young; ſhe, however, is furniſhed with four paps, though ſhe produces but one calf, and very rarely two; becauſe the two ſupernumeraries were deſtined to be nurſes to the Human Race. The ſow, it is granted, has only twelve teats, though ſhe is intended to bring up, ſometimes, a litter of fifteen or more. Here the proportion ſeems defective. But if the firſt has more teats than are requiſite to the number of her family, and the ſecond too few for her's, it is becauſe the one is ordained to preſent

ſent Man with the ſurplus of her milk, and the other with that of her brood. In all countries, pork is the poor man's meat, unleſs religion, as in Turkey, or political conſiderations, as in the iſlands of the South Sea, deprive him of the benefit of this gift of Nature. I ſhall obſerve, with Pliny, that of all fleſh it is by far the moſt ſavoury. There may be diſtinguiſhed in it, ſays he, up to fifty different reliſhes. It is employed in the kitchens of the rich to give flavour to every ſpecies of aliment. In every country, I repeat it, that which is beſt is always moſt common.

Is it not paſſing ſtrange that, when ſo many plants and animals exhibit proportions ſo beautiful, adaptations ſo wonderful to our neceſſities, and proofs ſo evident of a Divine Benevolence, we ſhould ſet about collecting ſhapeleſs abortions, pigs with a long proboſcis, as if our yards teemed with young elephants, and ceremoniouſly arrange them in our cabinets, deſigned to exhibit a diſplay of Nature? Thoſe who preſerve them as invaluable curioſities, and deduce from them conſequences and doubts reſpecting the intelligence of their AUTHOR, do they not diſcover as much want of taſte, and act as unfairly, as one who ſhould go into the workſhop of a Founder, and pick up the figures which had been accidentally mutilated, the bubblings over of the melting-pot, and the mere metallic

metallic moulds which might lie ſcattered about, and triumphantly diſplay them as a proof of the Artiſt's blundering ignorance?

The Ancients burnt monſters, the Moderns preſerve them in ſpirit of wine. They reſemble thoſe ungracious children, who watch their mother, in the hope of ſurprizing her in a fault, that they may arrogate to themſelves a right to do what they pleaſe. Oh! if the Earth were indeed abandoned to diſorder, and that after an infinity of combinations, there ſhould at laſt appear, amidſt the monſters which covered it, a ſingle body well proportioned, and adapted to the neceſſities of Man, what a ſource of ſatisfaction would it be to creatures at once ſenſible and unhappy, to catch but a glimmering of an INTELLIGENCE, ſomewhere, who took an intereſt in their deſtiny?

END OF THE FIRST VOLUME.