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From Magic to Modern Medicine

S. G. BLAXLAND STUBBS

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FROM MAGIC TO MODERN MEDICINE

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A Londoner by birth, Blaxland Stubbs got his education at St. Olave's Grammar School and at evening classes at the Birkbeck College and the Sir John Cass Technical Institute. Entering journalism in 1903 on a pharmaceutical weekly, he joined the Amalgamated Press in 1907, in Lord Northcliffe's day, becoming assistant, acting, and technical editor of a long list of educational and encyclopædic works, including lay medical books written mainly by medical men of all branches of the profession. Of late years he has been editor of technical encyclopædias of electricity, building, sanitary engineering, and photography. He was given the M.B.E. in 1942 and the O.B.E. in 1947 for his work for National Savings. He is permanently interested in history, local and general, and endeavours to keep in touch with the many aspects of medical progress.

FROM MAGIC TO MODERN MEDICINE

A BRIEF SKETCH OF MAN'S LONG FIGHT AGAINST DISEASE

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Part-Author of *Sixty Centuries of Health and Physick*
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PRELIMINARY

In these pages the reader is offered a brief sketch, in non-technical language, of the history of medicine from the magic treatments of prehistoric and primitive man to the high science of the 20th century. Necessarily, in covering in so small a space the story of some 7,000 years, we pick out the high lights, and omit much which is of great importance to the medical historian.

Furthermore, it is essential—if the story is to be intelligible and anything more than a catalogue of names and dates—to adhere closely to our subject, which is medicine. A separate book would be required to give a reasonable picture of the history of anatomy, surgery, and physiology.

The story of medicine—out of which the others stemmed—is itself so full of things of fundamental interest and importance, so closely bound up with Man's own progress and, at times, his existence that even in brief form it is an intellectual excitement and something of an education in the science of life itself. As a major branch of science its history shows the triumph of reason over superstition and loose thinking, flowering in the last hundred years or so into the blazing triumphs of research and discovery that distinguish the mid-20th century. By now medicine has evolved from what was largely empirical knowledge and practice—with important elements of real science—into a body of wholly scientific knowledge, albeit still with some disconcerting gaps.

The author wishes to acknowledge his debt to many

standard works on medical history, some of which are included in the list of books at the end. He also expresses his gratitude to the medical friend who most kindly read the MS. and to his old and valued friend and associate, Mr. Eric Bligh, who looked through the proof and made a number of very helpful suggestions. He trusts that the present little volume will at least stimulate interest in a subject which has even now suffered some neglect—not least, perhaps, by many members of the proud and historic profession they so finely practise.

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CHAPTER I

IN THE BEGINNING—MAGIC

PRIMITIVE MEDICINE. Man has always believed in Medicine, although Prehistoric and Primitive Man called it Magic. Always Man has been interested in what happens to his body and how it works, although he has often made a semi-religious mystery of it. He has always had need of medicine of some kind, for as far back as we know Man has suffered disease. We know that in the Carboniferous or Coal Age, which some authorities consider may be 180 million years ago, microbes and bacteria existed. The very earliest type of ape-like man, the Java Man, or, as the anthropologists know him, *Pithecanthropus erectus*, suffered a tumour on his thigh-bone. We possess the fossils of his bones, which show what the modern doctor calls an exostosis, or out-growth, like a tumour of the bone.

Even prehistoric animals suffered from rheumatoid arthritis in their bones, bone inflammation, and dental decay. A dinosaur, 40 feet long with jaws about 3 feet long, suffering from toothache offers obvious possibilities to the comic artist.

Then coming later, much later, when Modern Man made his first appearance in Europe, some 12,000–14,000 years ago, we have the earliest primitive form of treatment. It is very well known that men of the New Stone (or Neolithic) Age (6000–4000 B.C.), who made sharp flint knives and scrapers, knew how to use them to trephine the skulls of men and women who were thought to be

suffering from evil spirits in the brain. That is the only reasonable explanation of the fact that a number of prehistoric human skulls have been found with neat round holes cut in them, which are not sharp and ragged, but smooth and rounded, showing that the hole was cut in the skull during life and, partly at least, healed over.

The assumption is, of course, that the patient was relieved by cutting a hole through which the evil spirit escaped. The remedy, no doubt, was more dangerous than the disease; but the fact that skulls have been found showing round openings healed over, proves that at least some of them survived the operation. This was quite widely performed in Neolithic times.

Throughout prehistory and in Primitive Man we find evidence of disease. One Neolithic grave near Heidelberg produced a skeleton showing the oldest case of Pott's disease, i.e., tuberculosis of the spine. Arthritis, dental decay, other bone diseases, and bacterial diseases were all fairly certainly quite common.

Primitives of Modern Times. Early man must be assumed to have had a high level of intelligence. We know from his beautiful flint tools, his most artistic cave paintings, and his products in wood, bone, and ivory that he was highly skilled, and it is impossible to suppose that he did not apply this intelligence in some way to the diseases and accidents of life. We have, of course, little or no direct archæological evidence, but we have parallels in the primitive men of the modern world. If we apply these parallels with caution and critical detachment, we can build up some picture of medicine as practised by Prehistoric and Primitive Man.

That method is with little doubt summed up in the word "magic." We can study it in its modern parallel by taking examples from the methods practised by the

Stone Age Man of modern times, the Australian aborigine, the native of certain parts of New Guinea, and the bushman of South Africa.

In most native cultures we have the clear association of medicine and magic in the name "medicine man" or "witch doctor" given to the sorcerer who is feared by the whole tribe and yet trusted. The aborigine frequently ascribes disease to hostile magic, such as some form of witchcraft practised by an emeny, and it is the medicine man's job to destroy that magic and so cure the patient. It is, in fact, a form of faith healing, and like its civilized counterpart it frequently succeeds.

A specific example will illustrate. Australian aborigines think that all sickness, and even accidents, that are not due to breaking "taboo" (rules of conduct) are caused by hostile magic. The enemy points a "poisoned bone" at the individual from a distance, and this bone is invisibly sent into him by magic. The medicine man comes with his magic healing crystals (called the "Oruncha") and with magic markings on his body representing crystals. He gazes fixedly at the patient, thereby projecting the healing crystals into him, lies on his patient, massages him, and gradually sucks the "poisoned bone" out. So, whatever the disease, the patient is cured; but —and this is important—if the patient is convinced that he has suffered a fatal hostile magic or the medicine man refuses to treat him (probably because he fears failure), there is no faith on either side, and quite often the patient quietly lies down to die.

That is one aspect of primitive medicine as we know it, which in one form or another has pretty surely been practised for several hundred thousand years.

Another equally important aspect is treatment by simples, and herbs and other domestic remedies. Thus

the Australian aborigines—who, it should be remembered, had no contact with civilization before the 18th century—seem to have known the use of quite a variety of such simples, some of which investigation has shown to have genuine medical properties. The aborigines of Queensland, whose methods were closely studied, had no fewer than forty-two vegetable remedies which were clearly identified. They included, remarkably enough, six varieties of eucalyptus bark for fevers and dysentery, and Australian mint used for coughs and colds.

Even enlightened Europeans have been known to believe in and actually profit by remedies, the principal virtue of which was that they were said to be compounded of secret herbs preserved by native races such as the Red Indians.

So we may be quite satisfied that practical medicine as well as magic started in the very earliest times. Nor need we despise our ancient ancestors for their mixture of magic with rational medicine, for in all civilizations and in all ages medicine, magic, and superstitition have been interwoven. Indeed, we can hardly dare claim to be fully rational even in this 20th century. Quacks still flourish, faith-healing is still effective, and every panel doctor knows and despairs of his patients' irrational belief in the virtues of a "bottle of medicine."

CHAPTER 2

IN THE ANCIENT EAST—MEDICINE WITH MAGIC

Babylon, Assyria, and Egypt

In this chapter we consider the development and growth of medicine in the first real civilizations. Prehistoric Man, whom we talked of in the previous chapter, was in some respects a very accomplished man. But for the earliest ordered civilization there is not much doubt that we have to go to the Near East, to South-West Asia, somewhere between 5000 and 4000 B.C. Long after that, of course, primitive or barbaric man still flourished in what we now know as Europe; but in Asia, Mesopotamia, Babylon, and Assyria we have real cultures.

Sumeria and Babylonia. Somewhere about 5000 B.C., according to Sir Leonard Woolley, the ancient Sumerians settled down in Babylon. They built great temples and laid out great cities, they grew wheat, and they were superb craftsmen in gold and silver.

As with Primitive Man, their medicine was mixed up with magic and religion; but there is clear evidence that they had practical knowledge of drugs and herbs, including myrrh, balm of Gilead, laudanum, and many others. The physician was a recognized professional man, for we have the seal of a physician from Lagash before 3000 B.C. Tablets from Kish—reputed to be the oldest city in the world—provide medical information. At Kish the remains of well-laid and designed sanitary drains which certainly go back to 3000 B.C. have been found, and

in the famous city of Ur (often called "Ur of the Chaldees") Sir Leonard Woolley uncovered tiled lavatories in the houses, each of which was provided with drains and efficient soak-aways. In fact, as one author ity has stated, the right-thinking citizen of a modern city would probably feel more at home in ancient Babylon than he would in Medieval Europe. And we should remember that about this time the Bronze Age people of England were living in mud-covered huts.

It is obvious that if these Sumerians and Babylonians took so much trouble about sanitation and health they did it because they knew a good deal about medicine and disease. About 1950 B.C. Hammurabi, the great law-giver of Babylon, issued his famous Code (which still exists carved in stone, in the Louvre, Paris), in which he not only boasted that he gave health to his people but also gave details in various clauses of the duties and rates of payments for "physicians and healers of diseases." For our history this Code is of great value, because it derives from a much older Sumerian original and because it shows clearly the advanced state of medical practice. For instance it is laid down:

> If a physician operate on a man for a severe wound with a bronze lancet and save the man's life; or if he open an abscess in the eye of a man with a bronze lancet and save that man's eye he shall receive 10 shekels of silver.

(10 shekels would now be worth, very roughly, £5). Later:

> If it be a man's slave the owner shall give 2 shekels of silver to the physician.
>
> If a physician set a broken bone for a man or cure his diseased bowels, the patient shall give 5 shekels of silver

to the physician. If he be a free man he shall give 3 shekels.

Note the class distinctions. For man read nobleman or gentleman, for free man read plebeian. The slave is, of course, a man unable to pay, having no property. The doctor might be unfortunate. If in opening the abscess of the eye he killed the patient or destroyed the sight of his eye, it is decreed " his hands shall be cut off." But if it is only a slave " he shall replace the slave."

Assyrian Medicine. Clearly medicine was an established profession in ancient Babylon, but we do not know the name of any physician. The knowledge was maintained, developed, and handed down. Medical texts which are fairly certainly only a little later in origin than Hammurabi are found in the great Library of the Assyrian Empire-builder, warrior, and patron of learning, Ashurbanipal (known to the Greeks as the " Great Sardanapalus "). He was King of Assyria in 668–628 B.C., and as we have stated his library of clay tablets derives from the second millennium B.C. When Nineveh was discovered in the middle of the 19th century, one of the outstanding discoveries was this enormous collection of 10,000–12,000 tablets of baked clay inscribed in cuneiform, on which the King had caused to be recorded practically all the knowledge of his time. What interests us here is the section, now in the British Museum, of 660 tablets of medical interest which were translated by the late Dr. R. Campbell Thompson, a learned Assyriologist with great medical knowledge.

It will be not only amusing and interesting but also informative if we quote a few of the prescriptions and treatments taken from these very remarkable tablets. A large number of the tablets refer to the Babylonian theory that disease was due to invisible demons entering a man's

body. Magic and ritual, of course, entered into treatment, but they were very often mixed with sensibly chosen medicines.

Often a sensible remedy is compounded with an unpleasant ingredient to disgust the demon that caused the disease. So they mixed turpentine with a green frog, cherry and antimony with a dried and powdered old shoe. Like many peoples of the ancient and modern East, they suffered very widely from eye troubles, and the frog mentioned above is not altogether silly or merely nasty, because frog gall has apparently definite value in some eye conditions. Skin troubles, including scabies and itch, were common, and for these the tablets prescribed sulphur, a practical remedy. They also had prescriptions for dyeing grey hair black, for toothache, and for bad breath.

Rheumatism and digestive troubles were serious. Tablet after tablet of the later sections begins: "If a man's stomach burns" or "If a man eats bread and drinks beer and his stomach is constricted."

Aromatics are prescribed for heart-burn, together with a quite sensible period without food.

> If a man has heart-burn and his stomach holds fire . . . his chest rending him, that man is suffering from the heat of the day . . . hellebore, lupins, calendula, chrysanthemum, segetum, gum of Andropogon(?), manna, ricinus (castor oil), olium . . . together thou shalt pound in beer without a meal let him drink, and he shall recover.

The Assyrians used enemas before the Egyptians did. Their physicians ordered poultices (including linseed), bandages, plasters (including mustard plasters for an aching back), compresses, salves, liniments, and aperients.

Finally, let us quote a letter from a physician to King Esarhaddon, predecessor to Ashurbanipal, concerning a

boil or eruption. A significant point is that the King is cautioned to wash his hands thoroughly after he has put some ointment on his face. May we perhaps see in this a vague recognition of the possibility of transferring the infection from the boil on the chin elsewhere?

> As to the eruption concerning which the King has made enquiry . . . for the rest of the time he should take a complete rest. Let the King apply ointment to his chin. Let the King draw pure water with which to thoroughly wash the hands of the King, my lord. Do not worry. Soon the eruption will pass away.

Jewish Hygiene. Before we leave the Babylonians and Assyrians—who even in these few extracts show their right to the credit for a real share in the development of medicine and hygiene—it may be pointed out that there is a good deal of evidence of the influence of Babylon and Assyria on Jewish medicine to be found both in the Old Testament and the Talmud. In the latter compilation the Babylonian idea of the demon origin of disease and its treatment by incantation and ritual reappears. What the Jews may be specially credited with is their cult of ritual hygiene and cleanliness. Though the idea was essentially theological, it was in fact a sure means of preventing disease, and some authorities consider that this was the greatest Semitic contribution to medicine. In proof of this see the very remarkable detailed instructions laid down in Leviticus.

Medicine in Most Ancient Egypt. When we were talking above of the Sumerians and the Kings of Babylon and the Assyrians, we were referring to a culture that began in 4000 B.C., nearly 6,000 years ago, and ended only a few hundred years before the birth of Christ. Egyptian culture was a very considerable advance upon that of Ancient Mesopotamia, but there were kingdoms in

Egypt before 4000 B.C., and the Stone Pyramid of Zeser was built only a few years after 3000 B.C.

The finest period of Egyptian art is nearly 4,000 years old, and though Ashurbanipal (whom we mentioned above) and other Assyrians defeated Egypt as late as the 7th century B.C., yet the achievements of Egypt shine far brighter in history than those of their ancient rivals and eventual conquerors.

Therefore, it is not surprising that Ancient Egypt did more for the true practice of medicine than the Babylonians and Assyrians, although even their progress was also grievously limited by superstition and magic. In that far away period when the stone Pyramid of Zeser was built we find a man who is reputed to be the first physician in history. His name was Imhotep. He was Zeser's architect for the amazing Pyramid, and he was also his physician. Later he became deified, as god of Medicine. His name means "he who cometh in peace."

He dates from somewhere about 2900 B.C. What he did as a physician we do not know, but the fact that so great a number of statuettes of him have been found (there are ten in the British Museum) and that he remained throughout antiquity famed as a physician as well as an architect indicates that he was better known among the Egyptians as a doctor than as a builder of Pyramids.

Other Pharaohs had their physicians, whose names have come down to us, but there is no need to list them here. What we are concerned with is to trace medical practice over a period exceeding 3,000 years. We will pick out a few highlights from the major periods, contrasting them with the limitations imposed by magic.

In the Old and Middle Kingdoms, which bring us down to 1580 B.C., there was a body of medical knowledge with scientific pretensions, although the idea of

driving out the demon of disease, which we have met with in Mesopotamia and Primitive Man, still persisted, and priest and physician are so closely associated that Egyptian medicine was never free from religion. When the New Kingdom began after 1580 B.C., followed by the Empires, which collapsed about 1090 B.C., magic and incantation appear again and scientific practice ceases. All the best of the Egyptian medical texts now in the museums are copied from really ancient texts.

So far as diseases are concerned, we can say that the Egyptians had them all, with the almost certain exceptions of rickets and syphilis. We have the great advantage of being able to examine pre-Dynastic bodies and the mummies,* and from them, as much as from the texts, we know that the Egyptians suffered much as we do in the 20th century from hardening of the arteries, tuberculosis, arthritis, and all forms of rheumatism.

Considering the Egyptian climate, some of these diseases are really rather surprising, although modern medicine does not agree that arthritic disease is necessarily associated with damp and lack of hygiene. The late Prof. Sir Elliot Smith declared that arthritis is *the* bone disease of the ancient Egyptians and Nubians. Another authority found common evidence of it in Egyptian human remains from pre-Dynastic times, 4000 B.C., to the 3rd century A.D. One can understand that slaves forced to the brutal labours of building the pyramids suffered strain and injuries which would conduce to

* In earliest pre-Dynastic times bodies were buried direct in the sand, and as a result were so remarkably well preserved that pathologists have been able to examine not only the tissues but the very contents of the intestines, so that the last meal taken before death, perhaps 5,000 years ago, can be investigated. From this habit of inhumation in the hot, dry sand it is fairly obvious that later Egyptians worked out processes of mummifying. Accordingly, from these two sources we have a remarkable body of medical evidence.

arthritic disease of the joints, and many hundreds of thousands of slaves were so employed over some 300 years. But this does not account for arthritis in the higher social levels or in later times.

Another major trouble was dental. The teeth of Egyptians of all periods have been carefully and elaborately examined, and we find in earlier times there was startling wear of the teeth, with consequent abscesses but no decay. In later periods, with more luxurious feeding, decay appears; and some 500 skeletons of aristocrats of the 3rd and 4th Dynasties, i.e. 2980 B.C. (when our first physician Imhotep flourished) to 2750 B.C., showed signs of dental decay (caries), tartar, and abscesses, as common as those in modern Europe. Throughout Egyptian history it seems to be the same. Dental disease among the wealthy, and relative immunity among the poorer. Perhaps more remarkable is that there is no evidence of any particular treatment of dental trouble, and tooth stopping was never practised. The toothbrush was unknown, and one authority remarks "that it is impossible to believe that Amenhotep III should have endured the agony that he must have gone through if the Court Physician had known how to pull out a tooth."

Much of this history is contemporaneous with ancient Assyrian medicine. Instead of the inscribed baked-clay tablet we have the papyrus, a form of paper made from reeds on which the writing was in hieratic characters (priest writing). The same amount of careful medical investigation has not been done on the Egyptian papyri as on the Assyrian texts, but we have quite enough to show that the five main collections of medical books of Egypt contain a substantial conspectus of Egyptian knowledge and practice.

As in Assyria, of course, magic is mixed with medicine,

but it is significant that in one at least, the Edwin Smith Papyrus from about 1600 B.C. (although its subject matter is undoubtedly older), magic hardly appears, because it deals with the physical needs of wounds and injuries and not with disease at all. The longest and most famous papyrus is the Ebers, dating from about 1500 B.C. but containing matter undoubtedly centuries older. It consists in the main of a large collection of prescriptions for specific ailments giving the names of the drugs, their quantities, and proper administration. There are 875 recipes altogether and forty-seven specific cases with their diagnoses. A leading authority on Egyptian Medicine, Mr. Warren R. Dawson, truly said that "this collection of cases marks a great advance in real, scientific observation and treatment."

These prescriptions and treatments are too numerous for quotation, but one example will give a good idea of the method. They all begin with symptoms, followed by diagnosis, treatment, and prescriptions.

> If you have to deal with a patient (attacked) by an obstruction . . . if he feels heaviness after eating, if his stomach is full of wind, if his heart troubles him while walking as it does in the case of a patient suffering from anal fissure—examine him lying on his back, and if you find his stomach warm and some obstruction in the intestine say "something is wrong with the liver." Then give him the secret remedy of herbs which the doctor must mix himself.
>
> Take the pulp of walnuts and dates, mix, soak in water, make the patient drink it four mornings consecutively, to relieve and empty the stomach.
>
> If after having done this you find the two hypochondria, that on the right warm, that on the left fresh (clear) say (about it), "The internal juices are fighting the evil which is destroying them!"
>
> If on examining him a second time you find all the

> stomach clear, say, "His liver is cured, it is cleansed, he has taken the remedy well."

Of the hundreds of drugs mentioned, some remained in the official Pharmacopœia until the 20th century. They used aloes, caraway, castor oil, dill, fennel, juniper, myrrh, turpentine, and hartshorn. The last named is still used in pharmacy for the same purpose as the Egyptians used it—it is now aqueous solution of ammonia. Castor oil, which they called the *degam* plant (now known as *ricinus*), was used in beer as a purgative, as an ointment for sores and boils, and for scalp troubles.

Like the Assyrians, their prescriptions quite commonly contained ingredients to disgust the demon causing the disease. It is not necessary to repeat them here, but it must be borne clearly in mind that the same principle of ritual, incantation, and disgust treatment against the demon or evil spirit causing the disease as we find in primitive times in the first chapter of this book, continues in Egyptian medicine and becomes all-important when magic and religion regain their hold after about 1580 B.C. A famous Egyptologist, Prof. T. E. Peet, summed it up :

> On medicine as on religion magic laid its devastating touch. Medical science was already old in the Middle Kingdom and yet it made no advance from that time onward. Magic had stopped its growth.

Let no reader smile when he is told that from the very earliest times prescriptions for infantile complaints included the swallowing of a skinned mouse. Even child bodies from a pre-Dynastic cemetery in the sands (*see* note, page 21) contain the remains of mice. There were still people alive in 1930 who remembered in their childhood having swallowed skinned mice as a remedy for whooping cough !

Nevertheless, the reputation of the Egyptian physician was deservedly high in the ancient world. Homer, in his Odyssey, says "in Egypt men are more skilled in medicine than any of human kind." Their hygiene also was of a very high standard. All the noblemen, gentlemen, and priests, at least, had their daily baths, their spotless clothes, and food inspection. We now turn from the Ancient East to the West.

CHAPTER 3

GREECE AND THE FATHER OF ALL MEDICINE

THE science and culture of Ancient Greece provide the foundation of much of the structure of the whole of Western civilization. That is a platitude—and a profound truth. But great as the Greeks were, and great the debt that we owe to them in medical science as in other sciences, yet they built on bases laid by the men who went before them, particularly, of course, those of the Ancient East whom we have discussed in the previous chapter. Ancient Greece flowered into its highest achievement in the 5th century B.C., and the gap of some 1,000 years that we have left between Greece and Egypt was in fact filled by the civilizations of the Minoans, of Troy, and Mycenæ which have completely perished. They left us no decipherable documents but ample material evidence in their ruins of standards of hygiene so high that they must clearly have practised a rational medicine, and the Greeks must have inherited much from them.

In Early Greece. In our earlier chapters we have medicine bedevilled by magic and at times stultified by priest-craft, but when we come to the Greeks practically all this disappears. There is, in the 5th century, no mystification and idea-killing magic and no prohibition by priest-ridden religion, for there was no priestly hierarchy. The Greeks took all knowledge for their province, they pursued it by means in essence scientific and practised a medical system so strongly based that modern medicine

has a debt to it that is not always sufficiently clearly recognized—and that is the opinion of the foremost modern historians of medicine.

In the 7th century B.C., when Ashurbanipal was collecting his library, what was probably the first Greek medical school was founded at Cnidus in Asia Minor. There the facts of disease, and not merely magical notions, were already being recorded and the symptoms classified and appropriate terms given. It is to the Cnidians that we owe the names, pleurisy, pneumonia, and others.

Before we come to the greatest name in medicine, Hippocrates, we should note one or two outstanding figures. In the 6th century B.C. Heraclitus of Ephesus (who may have been a physician) propounded a doctrine of air as the primary principle, the breath of life, and heat and moisture (with their opposites) as the body's fundamental qualities.

This doctrine was later developed by Empedocles of Agrigentum, who was a physician and physiologist, who called the "humours" or qualities of the body, heat and cold, moisture and dryness, a doctrine which dominated medieval medicine until it became completely sterile. Empedocles also taught the very modern doctrine that health depends upon the harmony of the elements within the body, that the blood is the life and the heart the centre of the body's system. To him also belongs the credit for an outstanding achievement in hygiene. He checked an epidemic of malaria in the city of Selinos by the very practical method of draining the marshes and fumigating the houses. Coins commemorating the city's deliverance were struck in his honour, and they can now be seen in the British Museum.

A hundred years earlier than Empedocles, we see the beginning of the first hospitals or clinics. These are the

temples of Asklepios, god of healing, or as the Romans called him, Æsculapius. Here were held semi-religious rites, festivals, and here were carried out treatments in baths, hostels, and other buildings. While their importance in medical science must not be over-emphasized, there is no question that they were a very important item in early Greek life, for over 300 temples are known to have been built to the god. Some of these which have been excavated include really beautiful structures accommodating large numbers of spectators. That at Epidaurus, which had one of the most lovely of Greek theatres, accommodated 20,000 spectators, and was also a highly successful and wealthy treatment centre. Others were almost equally popular.

The treatment was to a considerable extent what we should call faith-healing, which was probably the main reason for its success. In the *abaton*, or sleeping-place, the sick were given what was known as an incubation treatment. The patient slept in an open, airy chamber, and after performing the sacrifices and ritual washings the incubation began. Possibly the priest drugged the patient, to whom the god appeared in his dreams telling him what his illness was and how it should be treated.

All round the temple are tablets recording the cures, many of which are merely miraculous. In other cases the priest obviously operated on the drugged patient, as in the case of a man with an abdominal abscess. He dreamt that the god ordered his slaves to hold him so that his abdomen could be cut open.

> Æsculapius cut him open, rid him of the abscess and then stitched him up again . . . he departed cured and the floor of the abaton was covered with blood.

But the treatment went farther than dreams and miracles, for the patients were received for longer or shorter

periods and were prescribed simple diet, hot and cold baths, poulticing, massage, and exercise. Moreover, most of these temples flourished in places that were natural health resorts. Many of these spas, as we call them, were entirely secular and free from temple rites.

By the middle of the 5th century Greek medicine, which had struggled far from the myths of the East, was in danger of being submerged in miracle mongery and sophistry. Then appeared the figure which towered high in medical history.

Hippocrates the Great. Hippocrates was born at Cos, an island in the Ionian Sea, where he became an Asklepiad (a secular physician trained in the medical school) about 460 B.C. He was a teacher in the medical school of Cos, and beyond the facts that he travelled, possibly lived in Athens, and died at a great age, we know nothing of his life. But his fame in his own and all later times is almost beyond recounting. He was known as The Great. Plato placed him between two major artists, Polycleitus and Pheidias. He lived in the century that saw the achievements not only of Plato but also of Pericles, Socrates, and the great dramatists and the great artists who were the flowering of Hellenic life. For nearly 2,500 years he has been known as the Father of Medicine, and the ethic that he established forms the highest set of ideals of the medical profession. Let us quote then the great Oath of Service :

> I swear by Apollo Physician, by Asklepios, by Health [Hygeia], by Panacea, and by all the gods and goddesses, making them my witnesses, that I will carry out, according to my ability and judgement this oath and this indenture.
>
> To hold my teacher in this art equal to my own parents to make him partner in my livelihood; when he is in need of money to share mine with him; to consider his

family as my own brothers and to teach them this art, if they want to learn it, without fee or indenture; to impart precept, oral instruction and all other instructions to my own sons, the sons of my teacher, and to indentured pupils, but to nobody else.

I will use treatment to help the sick according to my ability and judgement, but never with a view to injury and wrong-doing.

Neither will I administer a poison to anybody when asked to do so, nor will I suggest such a course. Similarly I will not give a woman a pessary to cause abortion. But I will keep pure and holy both my life and my art.

I will not use the knife, not even, verily, on sufferers from stone, but I will give place to such as are craftsmen therein.

Into whatsoever houses I will enter I will enter to heal the sick and I will abstain from all intentional wrong-doing and harm, especially from abusing the bodies of man or woman bond or free.

And whatsoever I shall see or hear in the course of my profession as well as outside my profession in my intercourse with men, if it be what should not be published abroad I will never divulge, holding such things to be holy secrets.

Now if I carry out this oath and break it not, may I gain for ever reputation among all men for my life and for my art; but if I transgress it and forswear myself, may the opposite befall me.

This translation is taken (by kind permission) from Mr. W. H. S. Jones' edition of *Hippocrates* in the Loeb Classical Library (Heinemann). [*See also* page 93.]

In writing of Hippocrates it is difficult to avoid over-enthusiasm. The quotations we have given earlier from Assyrian and Egyptian medical books and treatments, advanced as they were relatively, pale into utter insignificance when contrasted with the Hippocratic writings. The collection as we know it today consists of some sixty books of varying dates, mainly on medical and health subjects, six or seven of which are of the genuine Hippo-

cratic Canon, i.e. perhaps written by Hippocrates himself and certainly written by his School in his time. Others are compilations or copies of later date. The whole Collection as we have it is a set of copies made by the Scientific School at Alexandria in the 2nd century A.D. We will very briefly consider the six books of the Canon.

(1) *Prognostic.* A work of general pathology and medical histories of acute diseases, attributed to Hippocrates himself, and the keynote of his system.

(2) *Regimen in Acute Diseases.* This is supplementary to the Prognostic. It gives mild treatments with but few drugs and such measures as baths, sponging, fomentations, poultices, enemas, and suppositories, all with careful directions.

(3) *Epidemics.* This includes an astonishing series of clinical histories which illustrate the theory in Book I, Prognostic, and considered by Mr. W. H. S. Jones (and other authorities agree with him) to be "the most remarkable product of Greek science." Its importance to us lies in the fact that it presented the whole history of disease, its relation to the human organism, and its treatment. It is the first time that we see clear and even scientific recognition of the fact that without this basic knowledge treatment is arbitrary.

It was the essential simplicity of treatment, its lack of pretentious diagnostic boasting and careless promise of cure that distinguished and contrasted Hippocrates' work so completely, both from his predecessors and, unhappily, from many of his successors.

(4) *Aphorisms.* These were perhaps written by Hippocrates himself and were pregnant sentences beginning with the well known and almost hackneyed "life is short and the art [i.e., medicine] long; opportunity fleeting,

experiment dangerous and judgement difficult." They enshrine with the utmost economy of words the Master Physician's experience; and, as one historian, Dr. Douglas Guthrie, has said, "they deserve to be read and re-read by every practitioner of medicine and surgery." They show astute and most sound observation, and again, as we indicated in commenting on the Epidemics, emphasize and focus attention on the patient rather than on theories of disease, a vital principle which was almost forgotten until the great Sydenham, whom we shall discuss in Chapter 8, revived them in practical form in the 17th century.

(5) *Airs, Waters, and Places.* This was the first book on medical geography and climatology, and included notes on public hygiene in the study of water supply.

(6) *The Sacred Disease.* This is an entirely rational discussion on epilepsy and other brain seizures, probably written by a pupil. Its Hippocratic character is well set by its opening statement that "it is not any more divine or sacred than other diseases, but has a natural cause and its supposed divine origin is due to men's inexperience."

Large, learned tomes and lengthy histories and commentaries have been written on Hippocrates and his School. Yet it must suffice us to say that coming from the murky superstition of the centuries before him is like coming suddenly out of a dark tunnel into the healthy sunshine of true science.

CHAPTER 4

MEDICINE DECLINES WITH THE ROMANS

WE have indicated to what a high degree medical science was raised by Hippocrates, but it is not to be supposed that, supreme as he was, scientific medicine was universal in 5th-century Greece or even in Athens itself. Quacks and makers of nostrums, sectarian disputers, and charlatans continued to flourish. Hippocrates died some time after 370 B.C., and with the passing of him and his school, common sense and the scientific spirit weakened, and the centuries that followed were filled with sophistry, arid philosophic doctrines, and many things foolish and futile.

Aristotle. A few names stand out from the mob of charlatans and quacks who did lip-service to the master, but, in fact, were but little raised from the magicians who posed as physicians in Egypt and Assyria. Two names at once come to the mind, Aristotle and Galen.

Aristotle, who lived in the 4th century B.C., was himself the son of an Asklepiad who was a physician to Philip of Macedon. Aristotle became tutor to Alexander the Great. Though to us Aristotle may be a dry-as-dust and somewhat tedious schoolman, he was a man of fine intellect and originality. To him medicine owes its first real beginnings in botany, comparative anatomy, and physiology. It was somewhat unfortunate, as with his successor, Galen, that his ideas determined the direction of medical thought for nearly 2,000 years, thereby tending

to harden it into a body of dogmas which, like those of theology, must not be questioned. He held the doctrine of the four humours and four elements, based on the humours of Hippocrates, which were the keystone of medical knowledge for many centuries. His method of systematizing all knowledge (for "he was master of them that know") was illustrated in the efforts of the medievalists to force medicine into a cast-iron system which lost all regard for the patient himself as an individual and destroyed medicine as a science.

Græco-Roman Speculation and Quackery. Following Aristotle, who died in 322 B.C., there was a whole series of schools of speculative philosophers who are not, with one exception, worthy of our attention here. It was due primarily to their efforts to make medicine a rule-of-thumb treatment of classified sets of symptoms to be dealt with by specifics that soon made for the grossest extravagance in mixtures of drugs. Of them it was truly said that "never have medicines containing so much cured so little."

The exceptions, curiously enough, were the School of Dogmatists. They afterwards came to be called Rationalists, but they at least recognized that medicine must be based on physiology, and not on mechanical theories. One of them invented the opium method of treatment for toothache, and declared that fever was not itself a disease but a symptom.

In the 4th and following century Alexandria was the centre of Greek learning, and Galen, as well as other famous men of ancient science, like Ptolemy, Euclid, and Hero, were students there. Unhappily, its wonderful library was destroyed, some say in a fire during religious riots, and others by the accidents of war. The result is we have lost records of immense scientific value.

Certainly Hellenic medical culture in Alexandria was highly developed, and the schools that arose from it had the greatest influence on medical progress.

Throughout Roman literature, however, we see scorn of Greek science, and particularly of medicine. The Roman religious system forbade any scientific medicine, and therefore the only thing of the kind was Greek or Græco-Roman. In Imperial days there was an extraordinary variety of medical practitioners and hangers-on. Anybody could be a doctor (*medicus*); the only qualification was reputation. So one sees Martial and other Roman satirists speaking bitterly of physicians. Curiously enough the largest class were the eye specialists, and eye salves were the most popular form of patent medicine. There was even one oculist who held the appointment of "Oculist to the British Navy," this being an appointment to the Roman Fleet in British waters.

Claudius Galen, Last of the Ancients. We now come to the last great figure in ancient medicine, Claudius Galen, born in A.D. 131 at Pergamos in Asia Minor, where there was a library and a medical centre of high standing. At thirty-one he went to Rome, where Marcus Aurelius was emperor. Though his name means "peaceable," he led a life of noisy strife. He wrote some 500 treatises of considerable length on every subject. Before he was twenty-one he had written a text-book for midwives, another on eye diseases, and three on the lungs. He so systematized medicine, anatomy, and physiology that his word was "law," and no one gainsaid his authority for some 1,200 years. So despite his real achievements he became the dead hand in medicine; but this was due rather to medieval mentality than to his polemical thought and writings. When he went to Rome the Hippocratic calm was utterly forgotten and everything

was disputation and strident abuse of professional rivals, a form of strife in which Galen cheerfully took his part.

Nevertheless, he was a man of lasting merit, a clever experimenter in anatomy and physiology, and synthesizer of Græco-Roman medical science. He based his pathology on the Hippocratic humours and his own system of the temperaments. On paper it was all finely logical. The healer is to be well grounded in three things: logic, how to think; physics, the science of what is, i.e., nature; and ethics, the science of what to do. Unfortunately, as we have already noted, he became an unchallengeable authority, the dogma whose application to the unfortunate patient was a matter of dialectic. He did attach importance, like Hippocrates, to clinical observation and was ready to test theory by experiment, but he never gives us clinical histories such as we have from Hippocrates.

Galen's most important and perhaps his best work is *De Locis Affectis* ("On the Parts Affected by Disease"). In this he describes the symptoms and signs of disease in the organs of the body and then gives definitions which would read well in a modern work. Thus, "disease is an abnormal affection of the body giving rise to morbid changes in function." He also recognizes a pre-disposition to disease.

In modern pharmacy it is still customary to speak of "galenicals," and his materia medica undoubtedly had a lasting influence. But in this his practice and doctrines include both the sensible and the extravagant. He was only too ready "to forget his physiological methods in a search for specifics," as Prof. Sir Clifford Allbutt has pointed out. He added enormously to the number of drugs then in use, and was quite ready to satisfy the de-

mand that has come through to the present day for "something in a bottle."

Though they despised medicine, the Romans were masters of hygiene, as witness their great baths, their piped water supply, drainage, drainage systems, and even well-laid-out and highly organized military hospitals.

And now the splendour, culture, and remarkable scientific achievement of Greece and Rome, which at least in 5th-century Greece had achieved the highest level in art and thought, came down into the dust. The Barbarians broke in, and Europe passed into a thousand years of darkness. Had it not been for the sources of classical culture hidden in Byzantium until the fall of Constantinople in 1453, and the happy chance that Western medicine was to a very real extent preserved by the Arabs, little or nothing of what we have been describing would have lasted into modern times. As it is, we have to wait till the days of the Renaissance, "the revival of learning," for the resurgence of scientific medicine.

CHAPTER 5

A THOUSAND YEARS OF DARKNESS

It was not only the Barbarians, the Goths and the Visigoths, guilty as they were, who destroyed in two centuries much of the culture and the glory of Greece and Rome. There was a general decline; and with the fall of civilization as it had been known, ignorance and theological obscurantism triumphed completely. In medicine the decline had already begun, and after Galen we meet nothing for a thousand years but compilers and quacks, and what they compiled they spoiled. In the 4th century A.D. it was decreed that Paganism and Christianity could not exist side by side. Paganism in its best aspects, as well as in its worst, was suppressed and disappeared, and had it not been for certain heretics and heathen of the Near East, true medicine might have disappeared completely.

In Byzantium, where medicine of a kind survived for a few centuries (the records and the manuscripts of classical antiquity being most fortunately lost to sight until the Renaissance), we have the age-long mixture of common sense and futile magic. A physician of the Court of Byzantium who prepared a quite intelligent summary of Galenic pathology, also propounded absurd mixtures of drugs, charms, and amulets. An example amusing to us, for epilepsy, says :

> Take a nail of a wrecked ship, make it into a bracelet and set therein a bone of a stag's heart, taken from its body whilst alive and put it on the left arm; you will be astonished at the result.

It would be astonishing to find the bone in the stag's heart!

Then we see the primitive theory of disease as due to demons and worms, and healing, by what is essentially magic, revived. Thought and investigation were not free. Tertullian declared that science and the investigation of natural facts were completely unnecessary. Even the monks were illiterate.

One of the best accounts of what medical practice there was in the Dark Ages comes from Anglo-Saxon manuscripts of the 11th and 12th centuries. The British Museum has a finely illuminated one (a "Leechdom") dating from 1050 with hundreds of drawings of plants and animals based upon a Latin herbal. One of the pages shows a vivid drawing in colour of the inevitable worm. A recipe:

> A wort which is named saxifrage . . . is produced on Downs and in stony places. It leadeth to health where stones wax in the bladder.

Recipes include charms and a revival of the primitive theory of disease and pain "shot" into man and beast by elves. It was called "elf shot," which is clearly like the poison bone of the Australian aborigine in Chapter 1.

Some of the recipes are, again, like the ancient medicines, disgusting in order to nauseate and drive forth the elves, worms, and demons who produced the disease. Some are merely magical, like the "Lay of the Nine Healing Herbs." Herbs were gathered and chanted over separately, and then an incantation was made over the whole, and finally they were powdered and mixed up with other ingredients and administered to the unfortunate patient by the magician who sang the charms. Some are merely amusing as:

Against a woman's chatter take at night, fasting, a root of radish. That day the chatter cannot harm thee.

The School of Salerno. One light in all this darkness was the famous Medical School of Salerno. It was the first regular Medical School in Europe, and for some three centuries stood alone, achieving a fame which was, by critical standards, in excess of its due. It had the advantage of being a secular institution, for no clerical status was required of its students, but though it set a fairly high standard according to contemporary thought, it had little real scholarship or medical learning. The Emperor Frederick II, the "Wonder of the World," went so far as to ordain that "none shall henceforth practise physic unless he first be publicly examined by the masters of Salerno."

Its fame was spread by the semi-poetic work of the *Schola Salernitana*, which presented in verse form a body of very popular medicine. It spread over the whole of the western world, and was even printed as late as the 19th century. In fact, it was little more than a fairly sensible regimen of health.

When the Norman Roger Guiscard conquered Sicily and the mainland, including Salerno, near the end of the 11th century he brought with him a Saracen, named Constantine the African. He had a collection of Greek medical works in Arabic which he translated into Latin in the monastery of Cassino. The translations were poor, but they included three books of Hippocrates and others of Galen. They were treated as Arabian medicine, but they did, in fact, contribute to the eventual revival of Greek and classical medicine, which we shall discuss in our next chapter. Over the long centuries of intellectual darkness there is actually nothing better to record than the specimens given above.

CHAPTER 6

THE DARKNESS LIGHTENS—LEARNING AWAKES

WHEN the ancient civilizations collapsed and fell into the darkness and ruin indicated in our last chapter, some more or less reliable copies of Greek and Roman documents, and in a remarkable way some elements of the ancient culture, survived. Byzantium was apparently the home of little but unreal dialectic, plus superstitious magic and theological repression of thought. But when Constantinople was captured in 1453 a small flood of classical learning was released into a Europe by that time ready and eager to profit by it.

Two other sources for the Renaissance existed, one strangely enough the heretical Nestorians, a sect which had broken away from the Orthodox church. A third, the earliest and most important, were the Arabs of the East and West up to the end of the 12th century.

Nestorian Learning. The Nestorian Church which arose from the excommunication of its bishop in Constantinople in 431 flourished for at least a thousand years. Small survivals of the sect were known even in the present century. They had bishoprics all over the Near East and even in the Far East. At their centre in Mesopotamia they preserved Greek learning, and established a sound school of medicine with hospitals. Driven out by the Orthodox Emperor, they taught Greek culture and medicine at a great Persian university in the 6th century, where there grew up a most famous school of Moham-

medan medicine. If the Nestorians had not carried Greek medicine to Persia, and so through the Arabs to Europe, it is doubtful whether Europe could have known anything worth while of Greek medicine before the fall of Constantinople. As Arabic historians have pointed out, "the passion of the whole Islamic world for culture from the 7th century onwards was astonishing." Bagdad had its great Hall of Science, Cordova its School of Physicians, and Toledo was a brilliant centre of Arab learning. So we have the partial revival of the 13th century.

Arabic Medicine. It would not profit us to discuss Arab medicine in any detail. Much of it is arid scholasticism. It contains enough of substance to show the names of those who shine out in medicine, such as Mesuë; Rhases (a Persian who wrote a medical encyclopædia in twenty-five books and distinguished accurately between measles and smallpox); Avicenna, Prince of Physicians as his countrymen called him, who wrote a Canon of Medicine which was in use as late as the 17th century in a French university; Albucasis, who wrote an individual book on surgery; and Averroes, last of the great physicians, who was Viceroy of Cordova in the 12th century.

The Arabs added little to practical medicine, except that in dietetics and pharmacy they did original work. Though their translations were corrupt and distorted by the intrusion of two opposing theologies, they did keep something of Hippocrates and Galen alive until learning re-awakened in the 15th century.

When we consider the West in this period it would be quite easy to give a catalogue of medieval physicians and writers who would present some interest and more amusement, for in general terms it is true to say that, apart from the rudiments of classical knowledge through Arabic

channels, there was an almost complete absence of scientific thought between the 1200s and 1500s. Two names in English and German thought stand out in all this fumbling in the darkness. Remember, that in the whole medieval period the idea of theory tested by experiment and the proving of statements hardly existed, and it was quite unusual for a medical writer to verify his facts. The only authority required was a garbled quotation from a certainly corrupt translation of Galen or Aristotle.

Roger Bacon and Albertus Magnus. This was the background under which a 13th-century monk, Roger Bacon, wrote down some principles of experimental science which have been accepted ever since. He was, in fact, a very early encyclopædist, and he completed a scheme for an encylopædia which was to base knowledge and education, not on the deadening scholastic logic, but on scientific study and experimental verification. His *Opus Majus* of about 1266 presents a picture of all the learning of his time, including medicine. Though we cannot quote precisely from the *Opus* in its medical aspect, it is clear that the results of Bacon's work and of his experimental principle upon medicine were profound, although general. This early English scientist, as he can claim to be, was working and writing at a time when scholars were still very much more concerned with calculating how many angels could dance upon the point of a needle than with observing the facts of nature.

The other encylopædist was Albertus Magnus, a contemporary of Roger Bacon's, who, like him, took all knowledge for his province—that is, all knowledge that then existed. He studied nature rather than books, produced the first nearly scientific botany since the Greeks, and claimed that he wrote only from his own experience. His medical works were widely read.

Alongside these forerunners of scientific thought we still have the mass of popular and almost futile medicine. In Chaucer's *Canterbury Tales* we have two "Docteurs of Physick." One was probably Gilbert the Englishman, who studied at Salerno and produced a huge compendium of medicine based largely upon corrupt Arab sources. The other is thought to be John of Gaddesden (1280–1361), a contemporary of Chaucer, who studied and taught medicine at Oxford. Though John was the better and more distinguished physician, both their compilations had features in no way superior to the weird Egyptian and Assyrian prescriptions discussed in Chapter 2. Gilbert had a fantastically silly prescription for gout which required that a very fat puppy should be skinned and stuffed with a number of wild fruits, "fat of vulture, goose, fox and bear"; the whole was boiled, and the grease that floated to the surface made into an ointment for the gouty person's feet, and "without doubt he would be healed."

CHAPTER 7

BEGINNINGS OF MODERN MEDICINE

SUDDENLY the light of the ancient world burst upon the West with the siege and capture of Constantinople in 1453 by the Turk Mohammed II. Byzantium disappears in ruin and slaughter, but the contents of the libraries of Constantinople still stocked with classical manuscripts of every kind are dispersed abroad. Medievalism in the thinking mind is already dying, and soon we see a real humanism being developed, and even being adopted by the Pope. Æneas Sylvius, Pope Pius II, actively encouraged the copying and distribution of the Greek and Roman manuscripts, particularly the former. For the first time the ancient classics can be read unspoiled by theological dogma and poor translation, and for a century the scholars of Europe are busy editing and translating, spreading the light of the ancient world, helped by the new marvel of printing. Medicine had its share in the revival, but it was not as substantial as that of general scholarship. In fact, right up to the beginning of the 17th century popular medicine was still largely under the dead hand of Galen, despite the fact that some works of Hippocrates were printed in 1473 and later also a few others of the classical works of medicine.

What we may say is that the leaven of the scholar's work introduced into the heavy bread of uncritical dogma, while it had little practical effect upon the people of their own generation, did change fundamentally the attitude of the student and the broader-minded physician towards

the facts of disease and cure. The medical "schoolman" was ousted at last by the man with scientific outlook groping after truth.

The Royal College of Physicians Is Founded. We now have an event of outstanding importance in the history of English medicine. One of the new humanists was Thomas Linacre (1460–1524), who learned medicine at Padua, studied Galen in the original, and became, early in the 16th century, physician to Henry VIII. In 1518 he obtained the charter from Henry VIII which constituted the College of Physicians (or, according to the Act, "the facultie of Phisicke"), thus founding the earliest purely medical institution in England, and indeed in Europe, which still exists today: a very notable achievement. (It became "Royal" sometime in the 17th century, a date not exactly known.)

Henry had always been interested in medicine. Directly he came to the throne in 1509 he issued the first English Act which regulated the practice of medicine. It forbade "unlicenst folk to practice," and reduced the evil of quacks and empirics, including the illiterate monks who were licensed by bishops. He passed five other Acts dealing with medicine and surgery during his reign, including that famous one of 1540 which incorporated the Barber-Surgeons Company. Henry himself had pretensions to practice, for a manuscript in the British Museum contains 114 pharmaceutical recipes, which are said to have been devised by the "kinges maiestie."

Henry's College was a body of approved physicians who had the sole privilege of admitting persons to practise as physicians within an area of 7 miles round London. Linacre was its first President until he died in 1524. We shall hear of the College again.

One of Linacre's successors as President of the

College was another scholar-physician who had graduated and lectured at Padua, whose name survives in a Cambridge College which he founded. He was John Caius, or Kaye (1510–73), and although we are not discussing anatomy in this book, it should be mentioned that he was acquainted with the great Vesalius, Father of Anatomy, and from that interest became himself the founder of the study of anatomy in England. He was Physician to Edward VI, to Mary, and to Elizabeth, and was the first in England to write a treatise on clinical medicine.

In the Charter of the Royal College the second name was that of John Chambers of Merton College, Oxford. He also was Physician to the King, and was probably the apothecary generally responsible for the "plastres and oyntements devised by the kinges hieghness," a phrase illustrating the fact that in Tudor times you spelt as you liked! It should be remarked that these recipes were generally practical and sensible, although they sometimes had too many ingredients.

In early Tudor times physicians were limited in number and only in the service of the nobles and the crown. Everyday medicine for the people was in the hands of the barbers and apothecaries, who existed as Companies in the principal towns. The London Company received in 1451 a grant of arms which speaks of them as "Masters of Barbery and Surgery." They were, of course, simple blood-letters, and in fact, generally rather ignorant persons. With their incorporation their status was raised and their practice presumably somewhat improved. From them developed the progressive art and craft of surgery. Treatment by the quack and empiric continued as it had throughout history.

Francis Bacon and Paracelsus (Bombastes). The 16th century in England and abroad was a time of adventure,

a stirring of the spirit. Medicine and other sciences and learning shared in the developments that arose like flowers out of the desert of arid medieval thought. Francis Bacon laid down, in the *Novum Organum*, his advanced method of inductive and experimental science. Elizabeth's Court physician and President of the Royal College, Dr. William Gilbert (1540–1603), founded the science of electricity with his work on magnetism *De Magnete*. He followed Bacon's method.

Alongside the new scientists were mystics and rebels. Standing out from them was the intriguing, almost monstrous, figure of the man generally called Paracelsus, whose full name was as long-winded as his treatises—Theophrastus Aureolus Bombastes Furioso von Hohenheim. Loud-mouthed and bombastic (the word comes from his name), he remains an enigma, for while he talked what seems to us a good deal of nonsense, and some authorities dismiss him with scorn, others regard him as a reformer who cleared away much of the futility of contemporary and medieval medicine. The son of a physician he was born in Sicily in 1493. He took the degree of Doctor of Medicine at twenty-two, and in the next eleven or twelve years planned and wrote comprehensive medical works and studies which showed outstanding originality and a good deal of observation.

Paracelsus never minced his words, and cheerfully made enemies among the orthodox. He called them "Professors of falsehood," saying that "it is not the office which a person holds but the work that he performs that makes a physician." He publicly burned the works of Galen and Avicenna, and, like Galen, scorned his contemporaries rather too loudly. He denounced the prescriptions with dozens of drugs (polypharmacy), saying "the longer the prescription the less the virtue."

Best among the great mass of his writings were the *Paramirum* (re-written 1531), a treatise on the causes and nature of disease, and the *Paragranum*, expounding the general principles of medicine. Sir William Osler called him " the Luther of Medicine," for when authority was paramount he stood out for independent study. Three quotations will show Paracelsus in his best light :

> The knowledge of Nature is the foundation of the science of medicine.
>
> If you wish to be a true physician you must be able to do your own thinking and not merely employ the thought of others.
>
> The patient must not be out of the physician's mind day and night. He must put his whole power of reasoning and his judgement deliberately in the service of his patient.

Yet on the other side he was a mystic, an astrologist, and an alchemist. Though it is by no means clear whether he deserves it, some authorities credit him with the discovery of zinc, various mercury compounds, calomel, and antimony salts, the use of which he certainly advocated. Perhaps the best note on which to end these brief remarks on a man about whom much has been written is that he had a high respect for Hippocrates and the Hippocratic ideal.

A Note on Plague and Infection

A deadly subject which has not been mentioned in earlier pages but one which devastated medieval society from the 6th century onwards, the threat of which was ever in men's minds, was the dreaded Plague. For twelve centuries right up to the 18th century plague killed its millions, and even to-day in some parts of the world it remains a killer. In the 14th century alone no less than half the population of the whole of Europe died of plague in the Black Death. In England half the population was destroyed, and in London

only one in ten survived. Its most awful aspect was Man's complete helplessness in the face of its hideously rapid progress. Century after century when epidemics broke out none could stay them, and when they sought safety in flight they did but spread the infection.

It is easy to say that this helplessness was due to ignorance, and though some physicians had fairly clear ideas of the mechanics of infection, they knew not the cause nor any effective method of checking it. Even as late as the 1890s a medical historian of repute considered the disease to be a soil poison, and it was not until 1894 that a Japanese scientist proved that it was due to a bacillus, and later still that the infection was spread by fleas that were parasites on rats. It is a somewhat disturbing as well as remarkable fact that we owe our modern immunity from such disastrous epidemics not merely to our methods of quarantine and port inspection of vessels coming from abroad, especially the East, but really to the incidental fact that in the 17th century the black rat, which was the host of the plague flea, was for some reason displaced by the brown, or sewer, rat, which does not breed inside houses. There is also the further fact that the change from wood and plaster house construction to brick removed the materials in which rats could build their nests.

Along with the discovery of the method of propagation, it was shown that the plague is dual, i.e. bubonic and pneumonic. Both forms were endemic, as we have noted, in Europe up to the 18th century, but in the East it still breaks out from time to time, the pneumonic being even more deadly than the bubonic. The pneumonic form, unhappily, is directly contagious. In Manchuria in 1910–11 over 60,000 died of it.

The *bacillus pestis*, which lives in the stomach of the rat flea, cannot multiply outside its host, and it was a most unfortunate guess in the 17th century that dogs were suspected of spreading the infection and were slaughtered, while the true villains, the rats, were neglected. The rat-catcher turned dog-killer. The Chinese made the same mistake in modern times. The name bubonic derives from the appearance of "buboes," or boils, in the lymphatic glands, particularly the arm-pits and the groin.

Some people did have sensible ideas on plague and infection generally. Defoe, in his great book, thought that the

disease was due to the multiplication of minute organisms. The man who first opened Man's eyes to the nature of infection was Girolamo Fracastoro, who, in his book *De Contagione* published in 1546, first clearly distinguished both causes and varieties of infection. In fact, his doctrine on the mechanics of infection was so sound that Dr. Charles Singer has said that "at the back of all modern views on infectious diseases lies the work of Fracastoro." He was a scientist, physician, and poet, and in an extraordinary poetic work, half-romantic and half-clinical, gave syphilis the name which has ever since been used. Three centuries before bacteriology was a science his doctrine of *seminaria*, the invisible seeds of contagion, stated clearly principles which are now established. No modern scientist can quarrel with his statement that "the force of the disease lies in those seeds since they have the power to reproduce their own kind, and they are the carriers of the contagion and the first origin of the disease." He also recognized the passage of infection by indirect means such as garments, or *fomites*, which is still the correct medical term for infected articles.

The modern epidemic disease, influenza, described in detail in the 16th century, was called by the Italians "the influence" because they ascribed it to the influence of the stars. It became known as influenza in England in 1750 (*see* page 61). It, too, has been and will be, one fears, a killer, due to two, perhaps more, viruses.

CHAPTER 8

PRACTITIONERS OF MEDICAL SCIENCE IN THE 17TH CENTURY

We can consider that the foundations of real medicine have now been fairly soundly laid and we open a period of genuine medical science. This is the time when our leading scientific society, the Royal Society, was founded. It is the time when men like Robert Boyle, Robert Hook, Christopher Wren (a young anatomist, afterwards architect of St. Paul's), John Mayow, Thomas Willis, young Oxford physiologists, were meeting together, discussing and going over the whole ground of natural science. With them were others whose names are too many to mention here who were discussing and experimenting in almost all branches of physical science. It was the Baconian philosophy referred to in an earlier page that was now bearing fruit, and these men were practising the true method of science.

After their meetings were moved from Oxford to London their Society became so well established and important that Charles II gave it a Royal Charter (1662) as the Royal Society of London.

Harvey Discovers the Circulation of the Blood. This, then, was the atmosphere of medical science in the early 17th century, and its most outstanding figure, its greatest discoverer, was William Harvey (1578–1657). At the age of twenty-one he studied medicine at Padua, where Vesalius, the famous founder of modern anatomy and physiology, had been Professor of Anatomy. It was

in this tradition that Harvey studied and learned of an early discovery, by Fabricius, of the valves of the veins, which led undoubtedly to his own studies and his epoch-making discovery of the circulation of the blood. He returned to England in 1602, having become a Doctor of Medicine and was later appointed physician to St. Bartholomew's Hospital in London. In 1615 the College of Physicians appointed him lecturer on subjects connected with the body, and from the very beginning he announced new ideas on the movements of the blood and the working of the heart. For some years he lectured, doctored, and proved theory by experiment until he put before the world that new principle which disposed finally of all the older ideas on physiology. It was in 1628 when he published his *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus* (Anatomical Exercise of the Movement of the Heart and Blood in Animals). He was the first true, modern physiologist. He laid foundations which opened the whole field of research in nutrition, the chemistry of the blood, and its support of life. He had in fact made this discovery in 1616, but he waited to accumulate incontrovertible facts by continued experiment and thought.

It is perfectly true that ideas on the movement of the blood had been put forward from the time of Aristotle, and that Fabricius had shown there were valves in the veins preventing the blood flowing backwards (although he did not know that this was their function), but it was William Harvey who by careful and accurate dissection and experiment proved beyond doubt that the heart is a pump which forces the blood outwards through arteries and back through the capillaries and veins and that the small capacity of the heart itself proved that it is the same blood that goes and returns, i.e., circulation.

Harvey's life is full of interest—he was Royal Physician to Charles I and Francis Bacon, and was present at the Battle of Edgehill in 1642—but this work is not a biography. Naturally his book caused great controversy and some jealousy, but he had the great advantage of being one of the few men to see a revolutionary doctrine established in his own lifetime. He also explored the problem of generation, and in 1651 published *Exercitatio de Generatione Animalium* in which he at least disposed of the medieval theories of the Homunculus ("little man") which was still popularly believed. Harvey's revolutionary idea was that all living things derived from the fertilization of an egg. Had he had the advantage of the microscope made by Robert Hooke, one of the founder-members of the Royal Society we have already mentioned, he might have proved this theory as well.

The Microscope Is Invented. Without the microscope it would be a truism to say most, if not all, of modern medicine would have been impossible. It had in fact been invented in Holland towards the end of the 16th century, and Galileo had made one himself about 1609, but it was not until the middle of the 17th century that the invention became well established. The magnifying glass had, of course, been known for some time; and small objects like maggots, mites, and animalculi had been seen.

The first man who brought the microscope to the investigation of disease was a German professor of physiology, Athanasius Kircher (1702–80), who examined the blood of plague-stricken patients and saw therein "countless masses of small worms invisible to the naked eye." What he really saw were masses of red blood corpuscles, but his idea was sound, for he announced that infectious disease was conveyed by minute living organ-

isms. Malpighi used the microscope to prove Harvey's doctrine of blood circulation, for he saw in a frog's lung the network of tiny blood vessels which connected venous and arterial circulations.

A Dutch merchant of Delft, Anthony van Leeuwenhoek (1632–1723), was foremost among the early microscopists. He gave up his whole life to the instrument, made 200 microscopes and many valuable observations which were published by the Royal Society of London. He not only discovered red blood corpuscles but was also the first actually to see and to discover bacteria in disease. He was properly made a Fellow of the Royal Society.

In England the earliest and most brilliant microscopist was Robert Hooke (1635–1703), Curator of the Royal Society. A contemporary of Newton, he had a fertility of invention and ingenious devices that has hardly been excelled. He made several microscopes, one of which is now in the Science Museum, and at the age of thirty produced a great book called *Micrographia* with many beautiful plates of microscopic objects that were reprinted for 150 years after his death. Of medical interest was the fact that he quite early arrived at the true theory of respiration. Among his great friends, quarrelsome though he was, were men like Christopher Wren and that great English physician, Thomas Sydenham.

William Harvey and his scientifically minded contemporaries made modern scientific medicine practicable. If Harvey had not proved and worked out so thoroughly the circulation of the blood, scientific medicine would have had to wait until someone else did what he so thoroughly achieved. But it has to be admitted that, despite the experimenters and their real achievement, little was effected in the doctoring of the common man. Superstition still abounded; the credulous still accepted the

nostrums of the quacks and the ravings of the mountebanks; astrology, alchemy, witchcraft all flourished.

The London Pharmacopœia. While Harvey was delivering his lectures and working upon his great discovery, the London College of Physicians published the *London Pharmacopœia*, the first edition in 1618, the second in 1650. It has been described as a praiseworthy effort to put the materia medica in order, but it is frankly shocking that these early editions contained such queer remedies as fat, bile, claws, teeth, horns, excreta of animals of all kinds, hair, feathers, saliva of a fasting man, sponge, snakeskin, scorpions, woodlice, and even a bone from the skull of an executed criminal. Even the College itself seemed to accept the very remedies of primitive magic. The new age, like all periods of advancement, had to fight its way out of a fog of earlier futilities and superstition.

It was a characteristic of these rather vociferous times that there was a constant state of aggressive feeling between the physicians, the surgeons, the apothecaries, and the barbers. Examination of the contemporary writings of many members of the College of Physicians, honoured and dignified as they were, leaves one with an uncomfortable sense of the invincibility of the orthodox. What had been must be right, and new ideas were thought dangerous and destructive.

Sydenham, the English Hippocrates. But, as we have also seen, there were men of real learning and intelligence with scientific minds, and there were good physicians who thought more about the patient himself than what Galen might have said about his condition. Outstanding among them was Thomas Sydenham (1624–89). He was by far the greatest clinical physician of the century, and a man of straightforward common sense who

rightly deserved his title of "The English Hippocrates." He was a Puritan whose father fought for the Parliament, and he was himself a soldier. He had little patience with the science of his time, and when a young student came to him with a letter of introduction describing him as "a ripe scholar, a good botanist, a skilful anatomist" Sydenham brushed this aside with:

> This is all very fine, but it won't do—Anatomy—Botany. Nonsense. Sir, I know an old woman in Covent Garden who understands botany better, and as for anatomy, my butcher can dissect a joint full as well; no, young man, all this is stuff; you must go to the bedside, it is there alone you can learn disease.

As an opponent of the Royalists he never became a Fellow of the College of Physicians, and therefore probably never met Harvey; but despite difficulties and opposition, he accomplished an immense amount of thorough and effective work. His method consisted of careful observation in recording the facts of disease, and he had the greatest veneration for the Hippocratic method. He did not write much, but his books are excellent. In *Medical Observation*, in which he discussed fevers, he gives a precise and accurate description of measles. In *A Treatise on Gout*, of which complaint he had personal experience, he again gives a model account of the disease and its treatment. His descriptions of fevers, bronchopneumonia, pleuro-pneumonia, and others have served as models for the clinician and pathologist ever since. What he saw clearly, after centuries of largely empty theorising and scholastic treatises, was that the physician must be at the bedside and that the patient's recovery must be largely the affair of nature, aided by the physician's careful observation with treatment taken from his own experience. The "lustres of the art of medicine," he

said, "are not so clearly seen in elegant prescriptions as in curing disease."

He used only simple remedies, ignoring the fantastic prescriptions of the *Pharmacopœia* and polypharmacy. Because he made no great discovery he has not always been valued as highly as he deserved. Nevertheless, when his life and work are studied one understands that he was one of the greatest of English physicians and one who opened a new period of clinical medicine. He was one of the first to prescribe iron for anæmia; at first sceptical of its virtues he later popularized the use of cinchona or Peruvian bark (containing quinine) as a treatment for ague or malaria, which was a very serious and prevalent disease in England in this century. One of his favourite drugs was opium, in the form of a tincture known as "Sydenham's laudanum," which remained a popular remedy for very many years.

Another good physician, though not of the same order as Sydenham, was Dr. Nathaniel Hodges (1629–88), who wrote the best contemporary account of the Great Plague of London. He was one of the few who stayed in the City to fight the Plague. He treated his unhappy patients very sensibly, insisting upon rest, light diet, fresh air, and the promotion of perspiration.

Francis Glisson (1597–1577), who has been ranked with Sydenham as a great clinical physician, succeeded Harvey as the Royal College lecturer and became Professor of Physic at Cambridge. He gave the first really accurate account of infantile rickets.

There are many other names, English and Continental, that could be mentioned, but it is clear that the 17th century laid the foundations of what was the decisive period in modern medicine as we now know it.

CHAPTER 9

THE 18TH CENTURY—ENGLISH PUBLIC HEALTH BEGINS

THIS is a century of many great men in medicine as in science generally; a century of elegance and brutality, of cruelty and humanity—a time when reason, applied to the brilliant discoveries of an earlier age, to the classification of a great mass of accumulated facts, began to bring order out of what seemed to be chaos. It was the age of Isaac Newton, of Linnæus, and of Alexander Pope. It was also an age when industry began to develop on a more important scale than in earlier years, though of course not in any sense approaching the Industrial Revolution of the 19th century.

We shall consider in this chapter the beginnings of practical hygiene in England. It is inseparably associated with disease, and is always therefore a primary concern of medicine. The Romans and earlier ages knew of its importance, but that knowledge and practice was lost in the Dark Ages.

It is in the 18th century that we see the beginnings of the study of industrial disease, a subject which now has an enormous literature. An Italian, Bernadino Ramazzini (1633–1714), who was Professor of Medicine at Padua, wrote in the very first year of the century a *Treatise on the Diseases of Tradesmen*, and in 1746 Dr. Robert James (who was Physician to George III and invented James' Fever Powder, a popular remedy through two centuries) translated Ramazzini's book and thereby initiated Industrial

Medicine in England. Ramazzini studied every kind of trade and conditions in shops and workshops, noting the ill-effects that each trade had upon those who worked in it. He described lung diseases of miners and stone-workers, lead-poisoning of printers and potters, eye diseases of blacksmiths and gilders, and the effects of their trade upon vintners, tanners, tobacconists, fishermen, and even washerwomen.

Medicine was beginning seriously to concern itself with the prevention of disease, which is, of course, pure hygiene. And so we have the famous Dr. Richard Mead (1673–1754), an impressive figure in the medical world, consulted by the Government at that time for advice on the prevention of plague. Plague was still prevalent in Europe, and Mead, in his *Short Discourse concerning Pestilential Contagion* (1720), recommends quarantine and other measures. What he recommended was, in fact, the glimmering of a public health system. He suggested Health Officers, "understanding and diligent men" who should give notice to the magistrates of any uncommon death so that physicians should be sent to inspect the house immediately. If it is a pestilence families are to be removed, the sick and the sound separated.

> The healthy should be stripped of all their cloathes and washed and shaved before they go into their new lodgings. All the goods of the sick family should be burnt and the overseers of the poor should reduce overcrowding and, in regard to the houses, should take care by all Manner of Provisions and Encouragement to make them more *cleanly* and *sweet*. While houses are taken care of the streets should be washed and kept clean from filth, carrion and all manner of nusances.

Mead remarked that he was sorry to take notice, that necessary as orders of this kind were in populous cities, in London and Westminster he had no good report.

Ventilation—a New Idea. Another aspect of public health began to draw attention—the importance of effective ventilation. A pioneer in this subject—obvious to us but novel then—was a parson, the Rev. Stephen Hales (1677–1761). Though he was not a doctor, he was a very good physiologist and a scientist of high achievements. He studied the mechanics of the circulation and carried out brilliantly conceived experiments which added to knowledge. He demonstrated the pressure of the blood and measured it by inserting a glass tube into the artery of a horse. He also concerned himself with problems of water supply, the preservation of food, particularly at sea, and most of all with the ventilation of houses and ships. His *Description of Ventilators*, published in 1743, was the foundation of modern ventilation. At Newgate it at once reduced death-rate from gaol fever from eight to two per month. He described his apparatus as a "box-like Bellows for drawing out the Foul Air." The Navy a little later adopted a similar device.

Epidemic Disease Studied. Epidemic diseases are, as we have shown, intimately connected with hygiene. A very important figure in this section was John Huxham (1692–1768). A true follower of Sydenham and of Hippocrates, his most famous book was the *Essay on Fevers* (1739). In the second edition (1750) he first described the disease by the name we all now too unfortunately know, influenza. He had observed it in Europe. He was also very well known for his studies on colic, which he observed as an epidemic disorder in Devonshire with sometimes terrible results. He called it Devonshire colic, and ascribed it to the tartar in cider. A few years later the real cause was established by Sir George Baker (1722–1809), later President of the Royal College. His *Essay concerning the Cause of Endemial Colic*

of Devonshire is a masterpiece of scientific reasoning and exact proof. He proved beyond possible doubt at that time that the Devonshire colic was really lead poisoning from the pipes, etc. used for making and storing cider. His *Essay* was one of the earliest and most thorough investigations into an epidemic industrial disease.

Hygiene in the Army and Navy. The government of the day paid some attention to the health of the prisoners of Newgate, and they were next stirred to some concern for the health of the Forces of the Crown. First, Sir John Pringle (1707–82) who was a brilliant physician and Professor of Moral Philosophy, was physician to the commander of the British Army on the Continent in 1742 (he was later appointed Physician-General to the Forces). At the Battle of Dettingen (1743) arrangements were made, on his suggestion, that military hospitals on both sides should be considered as sanctuaries, an arrangement which 120 years later developed into the Geneva Red Cross Convention. Always concerned with the good of the soldier, he can be credited with the founding of hygiene in the British Army. He recognized that typhus was spread by lice passing from sick to healthy through bedding or clothes; and that personal cleanliness was of first importance (note that it was not until 1910 that the actual cause of typhus and the part played by the louse was established). In his major work *Observations on the Diseases of the Army* (1752) he made such important suggestions for the hygiene of hospitals, barracks, gaols, and for the health of the troops that it was said of him "that few physicians have rendered more definite service to humanity."

He laid down very clear rules for the arrangements of hospitals and their ventilation and, striking a note that is not strange even today, speaks of "the difficulty of con-

vincing either the nurses or the sick themselves of the necessity of opening doors or windows at any time for air," and he specifically recommends the ventilator of his worthy friend the Rev. Dr. Hales. Curiously, anticipating by more than 100 years the work of Lister, he read before the Royal Society in 1750 a paper on "Experiments upon Septic and Antiseptic Substances," this being the first use of the word "antiseptic." He is not, of course, to be credited with its use in the modern sense.

Lastly, the Navy. Dr. James Lind (1716–94), Physician to the Royal Naval Hospital at Haslar, expounded the same principles of ventilation, cleanliness, and diet as Pringle. He is ever to be remembered as the man who abolished scurvy in the Navy. Almost in one year (1796), when as a result of his work the Admiralty ordered the issue of lemon juice to all ranks, scurvy disappeared. Scurvy is due to the absence of vitamins in the food, Navy food being largely salted beef, hard biscuits, and similar preserved foods. Huxham and others had more or less vaguely spoken of lemon or orange juice, but the sole credit for its use belongs to Lind. It was, in fact, a paralysing disease. In 1747 a Fleet returning after a voyage of only three months and a week had 1,200 men incapacitated by scurvy, and in Anson's voyage round the world in 1740 three-quarters of the crew died from it. In his wards at Haslar, Lind often had 300 or 400 cases, "poor wights lying helpless with swollen, discoloured limbs and bleeding mouths," and though he knew nothing of vitamins, his practice was correct. He died a year before the Admiralty order mentioned above, and scurvy disappeared so completely as a maritime disease that few but medical historians now remember his name.

Hygiene is to us, perhaps, a rather obvious subject, but in the 18th century it was novel and vitally important.

CHAPTER 10

THE 18TH-CENTURY'S CONTRIBUTIONS TO MEDICINE

THE century is generally regarded as the Golden Age, a description which is justifiable from the literary point of view. From the point of view of the common man, as we now call him, it was probably not much better gilded than earlier decades. Still, medicine was not only spreading its bounds but was also working outwards and downwards. There were, doubtless, many doctors in town and country, wise and gentle souls, who, following the example of the great Sydenham, did their best by the bedside, whether humble or wealthy. They are not known to history, but like that noble person of our own day, the General Practitioner, they contributed their skill and their hardly acquired knowledge to the welfare of the general public.

A Great Teacher—Boerhaave. When we turn to the literature of medicine in the century we are stimulated by the quality of some of it and taken aback with the sheer mass of it all. Any large medical library can produce pamphlets, booklets, and books by the thousand. Much of it is of antiquarian interest, and more of little importance today. Here, then, as in our next chapters, we can pick out only a few names of outstanding merit to indicate the progress that medicine is making. Greatest among them was Hermann Boerhaave (1668–1738), a wise and gentle Dutchman, Professor of Practical Medicine at Leyden. He was, it has been said, one of the greatest

teachers that medicine has ever had. His fame spread so widely that students even came from America to his classes, and by his teaching at the bedside and at the post-mortem he did more than anyone to fashion the course of 18th-century medicine. He had an enormous private practice, and was a man of boundless energy, always, like his master Hippocrates, considering his patient as the beginning and the end of his work, preferring observation to argument.

One of his pupils, Alexander Monro (1733–1817), brought fame and distinction to the Edinburgh School of Medicine. Another, also an Edinburgh man, William Cullen (1710–90), whom some writers rank only second in importance to Boerhaave as a teacher, was the founder of the Glasgow School of Medicine. He was certainly an extraordinarily versatile man, and was the first Professor of Medicine to lecture in his native tongue instead of in Latin. In his early years he was a partner of William Hunter. Like Boerhaave he cannot be credited with any discoveries of importance, but his *Classification of Diseases* was something of a pioneer work.

Morgagni "Creates" Modern Pathology. As we have already noted, a number of great men made a considerable number of contributions to science in general in the century, and the same applies in its own way to medicine. One of the greatest needs had been a proper study of pathology correlating the diseases of the living man with the signs and consequences in the dead body. There had been a large volume of collection of post-mortem facts, but a clear and scientific interpretation hardly existed. The science of modern pathology was, to a large extent, created by one man, an Italian physician, Giovanni Morgagni (1682–1771). It was a major piece of work, and it permitted medicine, later on, at any rate,

to advance from clinical observations to something like a scientific investigation of the cause of a disease, its course, and its consequences. In 1761 he published in Venice *De Sedibus et Causis Morborum per Anatomen Indagatis*, which translated exactly means "The Seats and Causes of Diseases Tracked Down by Anatomy." He means, of course, the examination of the dead body.

All previous works on pathology became at once out of date, and as Dr. Esmond Long said in his *History of Pathology* the feature of his book was "its extraordinary completeness of correlation between clinical detail and post-mortem revelation." Morgagni's reading was enormous, and his work diverted the course of medicine into new channels. Unfortunately, as is so often the case, he was a prophet with little honour in his own generation, and he had to wait until long after his death for recognition of the great value of his work by such disciples as Laennec and, even later, Bright.

The Hunters. Two other figures whom we cannot discuss in detail, since their triumphs were in the realm of surgery, but who must be mentioned at least, were the Hunters, William and John—William, the great surgeon and anatomist, and John, who has been described as "the greatest pathologist the world had then seen." Of the two brothers, John had the greater influence which affected the whole medical world. William was a splendid anatomist, and his museum of anatomical specimens completely re-formed anatomical instruction in Great Britain. That museum still exists as the Hunterian Collection.

Though we cannot go into details of the work of these two great men in this book concerned with medicine, it should be stated that John was a man of such genius that he revitalized the whole of medicine as well as surgery. He made all medical men of his own and the

succeeding generation realize both the basic importance of preventive medicine as against curative and that prevention of disease depended upon a clear understanding of the physiology and structure of the human frame and its capacity for self-repair, as well as on an appreciation of the laws of nature. The memory of the two brothers is commemorated by the Hunterian Oration, delivered annually by distinguished leaders of the profession, and the Hunterian Chair of Anatomy at the Royal College of Surgeons.

Percussion and the Stethoscope. Two new developments of the greatest importance to medicine, though they are commonplaces today even to the patient, were the discoveries of percussion and the stethoscope. The first was by a physician of Vienna, Leopold Auenbrugger (1722–1809), and the other by the Frenchman René Laennec (1781–1826). Auenbrugger was a simple physician who, in his *Inventum Novum*, presented the world, to use his own words, with

> a new sign which I have discovered for detecting diseases of the chest. This consists of the percussion of the human thorax, whereby according to the character of the particular sounds thence elicited, an opinion is formed of the internal state of that cavity.

What this means is that if the thorax of a healthy person is struck with the points of the fingers brought together, one sound is elicited; if there is some abnormal condition, another sound will be heard. To the trained doctor with experience, much valuable knowledge of the patient's actual condition is thus to be gained. Auenbrugger expected to encounter the opposition of the medical world, but it was not until the last year of his life that his book was revived by Napoleon's physician and the importance of his discovery recognized.

Laennec's discovery was, as will be easily understood, even more important, obvious as it may seem to the modern reader. He had a patient who seemed to have heart disease, but owing to her stoutness he could get little information by percussion. Recalling an acoustic phenomenon, that if you put a stick of wood against the ear a scratch of a pin at the other end is easily heard, he rolled a piece of paper into a tube, placed one end over the heart region and his ear to the other. "I was both surprised and gratified at being able to hear the beating of the heart with much greater clearness than I had ever done before by direct application of my ear." Thus was born one of the simplest but most valuable instruments of diagnosis. The method is called auscultation, and the instrument is, of course, the stethoscope. Laennec's simple wooden tube was in use by some doctors till the 20th century, but the modern instrument has rubber tubes and two earpieces. It is most informative, as Laennec at once realized, for diagnosis of all complaints of the thorax, heart, and abdomen. Sir William Osler said of Laennec's book *De L'Auscultation Médiate*, "It is in the category of the eight or ten greatest contributions to the science of medicine."

Jenner and Smallpox. The one genuinely epoch-making discovery of this century that every reader knows about is that of Edward Jenner (1749–1823), a pupil of John Hunter, who by work and experiment over many years overcame what was then a greatly dreaded disease, smallpox. The idea of prevention existed, but Jenner proved the principle and developed the method. His first basic experiment was made in 1798.

Smallpox had long been a formidable scourge, and few people escaped it. The idea of inoculation in a fairly simple form existed much earlier in Asia and Africa, the

"principles" of the disease being inoculated into the skin or blown into the nostrils. This was, in fact, more in the nature of a preventive than a treatment. In 1717 the famous Lady Mary Wortley Montague wrote from Constantinople describing the method by which Turkish women made the smallpox "entirely harmless by the invention of engrafting." The method is peculiarly interesting. Parties of people deliberately took smallpox. An old woman, whose business it was to perform the operation, opened a vein with a large needle, and from a nutshell "full of the matter of the best sort of smallpox" put a small portion into a vein. The wound left little scars, the patients had a fever for two or three days, and in eight days they were completely well again. Their faces were never marked, and thousands every year underwent the operation and so escaped the disease itself.

Lady Mary had her own infant son so "inoculated" by a Scots physician who was then in Constantinople. He, Dr. Charles Maitland (1668–1748), published a pamphlet on the subject in England in 1722. This, and Lady Mary's propaganda on her return home, introduced the practice into England. The children of the Prince and Princess of Wales were also "inoculated," subject, however, to a preliminary—and successful—experiment upon six condemned prisoners from Newgate. A particularly interesting point was that on one of them the "inoculation" had no effect, and he was found to have had smallpox before. This rather casual and unscientific procedure did little harm—an inoculated patient could unfortunately pass on the actual disease by infection—and undoubtedly did a large amount of good.

Then Jenner came along, and despite much opposition from those who always found danger and blasphemy in something new, he put the whole thing on a scientific

basis, and as a direct consequence banished the disease from this country, except for infection brought from abroad. He noted one day that a dairymaid said of smallpox, "I cannot take that disease for I have had cowpox." It was a commonly held belief that farm and dairy workers did not take smallpox if they took cowpox first. That remark led Jenner to the principle of prophylaxis, the prevention of disease by conferring immunity. The vital experiment of 1796 was to take matter from the hand of a dairymaid who had been infected by cows and insert it, by two quite superficial incisions, into the arm of a healthy boy of eight. A little later, matter from pustules of a smallpox patient was inserted into the boy's veins, and to Jenner's triumph no disease followed. The difference was that the boy had been *vaccinated* (vaccine obtained from cows) and not *inoculated*. In Jenner's method vaccination did not pass on the disease, and was not dangerous. Two years later he published his famous book which established his triumph: *An Enquiry into the Causes and Effects of the Variolae Vaccinae, a Disease Discovered in some of the Western Counties of England, particularly Gloucestershire, and Known by the Name of the Cow Pox.*

Controversy has, right up to the present day, raged on the question of vaccination. There have been unfortunate incidents, but by and large there can be no question that, considered scientifically, vaccination has completely removed the threat of one of the most dangerous diseases from our midst.

In Germany in the middle part of the 19th century epidemics produced deaths of 5,000 to 8,000 per annum, rising in the 1860s and 1870s to no fewer than sixteen separate years when deaths exceeded 10,000 per annum. A German Vaccination Law was passed in 1875, and

deaths immediately dropped to 1,000 and by the 1880s were negligible.*

Jenner, in fact, established the principle of what the modern physician calls "immunization"; and in the hands of Sir Almroth Wright of the famous vaccine-therapy school at St. Mary's Hospital, London, and his many followers, it was extended to cover with almost complete success a whole range of diseases. In smallpox and rabies living modified virus is used, and in typhoid, plague, pneumonia and cholera, dead bacteria are used.

Physicians of Standing. Three or four other names, out of hundreds, remain to be included here. There was Samuel Hahnemann (1755–1853), the founder of homœopathy; there was John Abernethy (1761–1831), a fashionable physician and something of a character; there was William Heberden (1710–1801), Physician to George III and Dr. Samuel Johnson; and there was William Withering, botanist and physician of Birmingham.

Hahnemann, a physician of Liepzig, experimented on his friends and himself in very small doses of drugs which, when given to healthy persons, produced symptoms similar to the actual illness. His principle was not merely that of excessively small doses, but "that like cures like" or as he announced *similia similibus curantur*. He classified practically all the drugs then available, and showed, for instance, that cinchona (or quinine) was the right drug to use for ague, that ipecacuanha was correct for asthma, that aconite would reduce a feverish condition. Naturally his system aroused much opposition, but it is practised by qualified physicians to this day,

* In England several Vaccination Acts making vaccination compulsory were passed between 1853 and 1887, all being repealed by the National Health Service Act of 1946. Satisfactory general statistics for smallpox deaths in England in the 19th century do not exist, but about 1875 the death rate was 1½ per cent only of the total mortality.

and one famous Royal Physician (Sir John Weir), Physician-in-Ordinary to the King and Queen Mary in the present century, is a homœopathist. The system certainly had its merits in checking dangerously excessive use of drugs in the 18th and 19th centuries.

It cannot be stated that Abernethy contributed much to the science of medicine, but he was very famous in his day, and was a pupil of John Hunter, much of whose practice he inherited. Himself an excellent teacher and an eminent surgeon, his fame comes mostly from his eccentricity. Many stories are told of him and his brusque method of treating patients. Usually there was common sense in them, as when he told an over-fed alderman to "live on 6*d.* a day and earn it."

A physician whose standing was great in his day was William Heberden (1710–1801), a contemporary of William Cullen of equal fame, mentioned on page 65; he was physician to George III and to Dr. Johnson, who called him "the last of the Romans." His book *Commentaries on the History and Cure of Disease* (published by his desire after his death at the age of ninety-one) contained original and detailed observations on a number of diseases, including remarkably clear and factual descriptions of heart disorders and the pulse, chicken-pox, measles and epidemic colds, and many another. He held there were more wrong facts than false theories in medicine.

Mention of heart troubles brings to the mind the provincial doctor who was also a botanist, William Withering (1741–99). He is known for a book, now a very rare work, *An Account of the Foxglove* (1785). He knew that country folk in Shropshire used foxglove tea for dropsy, and he showed that dropsy might be due to heart disease. The alkaloid, or principle, of the foxglove is digitalis, and he thus introduced to medicine a drug which

has been used in heart conditions by every doctor ever since. It would be impossible to count the number of lives that have been saved by its use.

The 18th century showed a really astonishing expansion and systemization of knowledge and a rapid growth of a rationalistic, critical, and inquiring spirit. It led straight into the even greater developments and wider and deeper medical research of the 19th century.

CHAPTER II

THE GROWTH OF THE ENGLISH HOSPITAL

THE word "hospital" is a very old one, and we have already seen it mentioned in connection with the Roman armies. Before the Reformation, however, the "hospital" was an ecclesiastical and not a medical institution. The monks looked after people, but they did not set out to cure them. With the dissolution of the monasteries, when some 750 or more of these "hospitals" disappeared, including about 200 for lepers, they were replaced to some extent by the almshouses of the 16th and 17th centuries.

There are only two hospitals in England which can properly claim to be medieval in origin and to have had an almost unbroken history to modern times: St. Bartholomew's, which, as everyone knows, was founded in 1123 by Rahere, a monk, and was re-founded by Henry VIII himself in 1544, thus surviving the Dissolution; and St. Thomas's, also in London, which was suppressed and re-founded under Edward VI. The only public institutions in London at the beginning of the 18th century for the treatment of the sick poor were these two hospitals. Otherwise and elsewhere there was either the parish relief or private charity. Lunatics were locked up in the Hospital of St. Mary of Bethlehem, or Bedlam.

The 18th century distinguished itself among other things by the uprising of a spirit of philanthropy, and early in the century the third of the great London Hospitals was established. It was the Westminster Infirmary, near Tothill Fields, which later became St.

George's Hospital and was transferred to Hyde Park Corner. A year later, in 1721, a wealthy bookseller, Thomas Guy, founded the fourth. He also endowed it so that it was independent then of public subscription, giving it the enormous sum of £220,000, the equivalent in 1951 of more than £3,000,000! Guy's Hospital was opened to the public on January 16, 1725 "for the relief by physic or surgery of sick persons." The London Hospital, in the country adjacent to the Whitechapel Road, was built in 1740, and the Middlesex in 1745.

The era of the great City hospitals had begun, and with them one of the greatest forces in modern medicine was developing. The debt that medicine and medical education owe to the great hospitals cannot be computed.

The New Humanity. This has often been called the period of the New Humanity, as exemplified by the Wesleys, John Howard and his prison work, William Wilberforce, and others. We see a number of maternity homes, lying-in hospitals, infirmaries, and general dispensaries opened in various parts of the country. The spirit was excellent, but it is to be feared that early hospital organization and treatment were sadly lacking in quality. We have mentioned in an earlier chapter that Sir John Pringle reduced the death-rate in hospitals by insisting upon ventilation. There was little idea of cleanliness, carelessness of infection, and the most primitive of nurses. Both then and later hospitals tended to be characterized by "hospital fever," of which many died. This was typhus, and we have already noted its cause. Sanitation was, of course, crude, there was no bathing accommodation, and medical and surgical cases lay side by side, not always even in separate beds. The surgeon often ordered nosegays "to prevent the patient being infected by the stench of his own wounds."

That was the gloomy side of the picture. Despite these drawbacks, which were reduced gradually and steadily, both medicine and the patient owed much to this manifestation of the new humanity.

The century was, on the whole, an extremely unhealthy one. Between 1720 and 1740 the English death-rate was as high as thirty-five per thousand, and the hospitals had their share in its reduction in the next century to halt that figure. These high death-rates arose from influenza, smallpox, typhus, and maternal and infant mortality. Gin drinking also had its large and melancholy share. Before the maternity institutions referred to above were established, childbirth was a very great risk for both mother and child. Deaths reached as high as twenty per thousand births (compared with the 20th-century rate of five per thousand). In the middle of the 18th century 50 per cent of all children died under the age of five.

It was the gradual realization of these vital problems that led to the organization both of public relief and the hospitals and the other medical institutions of which we have spoken. This spirit of compassion, combined with many increases in medical knowledge, also produced the developments in sanitary reform discussed in Chapter 9.

Another development, which was something of a revolution, was the expansion of medical teaching which the new hospital system provided. Before the hospitals were organized students and medical men had to go to the great University and Continental centres. Now arrangements were made with the hospitals' staffs for apprentices to take courses of hospital work under the supervision of the staff. So the medical staff became the medical faculty, and the apprentices became clerks and and dressers in the wards. This was the beginning of "walking the wards."

CHAPTER 12

A GOLDEN AGE OF MEDICINE—19TH CENTURY

THERE are many difficulties in writing a history of medicine. The smaller the scope, the more the difficulties increase. In the century we are now entering upon a thousand or more names could be mentioned, but a catalogue of names is not a history. The selection must, therefore, be to some extent arbitrary, since it is in part conditioned by the writer's outlook. The departments of medicine that showed real advances are so many and the discoveries so important, that it will be essential to consider the developments themselves, giving credit to the discoverers without biographical details. In this century, especially its second half, we see an enormous amount of successful work and discovery in every field, rising to an even greater crescendo in the 20th.

Sir George Newman, himself a leader of the profession and one-time Chief Medical Officer to the Ministry of Health, stated :

> At the beginning of the 19th century . . . we pass into a Golden Age of medicine. Probably it is true to say that no period of human history shows anything comparable to the advances of medicine since 1798. Yet all that had gone before had been a preparation for it and led up to it. This modern period was an age of enquiry.

The 18th century was, as we have seen, rationalistic and fruitfully inquisitive, but the 19th century showed a

continuing passion for fundamental research. Out of this mass of remarkably fruitful work we shall have to consider a few departments with their most outstanding purely medical achievements.

Bacteriology and Antisepsis. Perhaps the medical achievements that strike the public imagination most forcibly are the founding and development of the whole science of bacteriology, and the remarkable antiseptic and aseptic methods of dealing with disease due to bacteria.

From the work of Louis Pasteur (1822–95) stemmed our modern methods of dealing with infection. He studied ferments, and proved by a brilliant series of experiments that fermentation is not caused by a chemical agent, that the doctrine of spontaneous generation was fallacious, and that fermentation is due to the presence of bacteria.

He solved the mystery of anthrax, showing that it was due to a bacillus; and succeeded, by inoculating cattle with a weakened culture, in abolishing a scourge that goes as far back as the ancient Egyptians (murrain). Another remarkable achievement was, of course, his discovery and proof of the cause of hydrophobia or rabies. He did not isolate the organism responsible, but, following experiments upon animals, he boldly tested his serum upon a human being suffering from dog-bite, and completely succeeded. The enthusiasm that followed this success in 1885 led to the inauguration and opening in 1888 of the famous Pasteur Institute in Paris. The Pasteur treatment reduced the death-rate from rabies to a negligible point, and it remains negligible to this day. The Institute became, and is still, a world centre for the study of preventive medicine.

Pasteur's study of infectious disease convinced him

that the body cured itself provided it was given protection. He began the work in antiseptic methods which, applied later and developed by Lister, revolutionized the whole practice of surgery. It is a fitting tribute to his memory that his discoveries in bacteriology did in fact extend the frontiers of human life, for the principle on which he worked was that science should "labour to enlarge the frontiers of life."

Pasteur's discoveries came to Joseph Lister (1827–1912; Lord Lister in 1897, the first medical peer) as a sheer inspiration. From Pasteur's work on fermentation, Lister deduced that infection in wounds must be a similar process. In order to destroy these organisms, the exact nature of which he did not then know, he used crude carbolic acid in various forms, his first trials being in 1866. He did not claim to have invented antiseptics. What he did achieve was the discovery of the principle of preventing wound infection and often curing it. His genius led him to use his antiseptic both on the wound and its dressings and on instruments, fingers, and everything that might touch the wound, so in fact inventing the true principle of asepsis, or prevention of infection.

He even used his carbolic acid as a spray to kill germs in the surrounding air, though he abandoned this later. In 1867, after nine months of his antiseptic methods, Lister reported that not a single case of pyæmia, hospital gangrene, or erysipelas had occurred, though his two large wards were previously among the unhealthiest in the Glasgow Royal Infirmary.

Primarily this work was for the advancement of surgery, but obviously it produced a medical revolution, since efficient asepsis prevented disease and checked or prevented its spread. So when the British Pasteur Institute was opened in 1879 it did much more than treat

hydrophobia but went on to study the treatment and prevention of all infective diseases. Its real scope was made clear by the title adopted in 1903—the Lister Institute of Preventive Medicine. So one more new fundamental branch of medicine was established.

Naturally, Pasteur gathered round him many disciples, of whom two were Robert Koch (1843–1910) and Elie Metchnikoff (1845–1916). Professor Robert Koch ranks with Pasteur as a founder of the science of bacteriology. He isolated the anthrax bacillus, he discovered the bacillus of tuberculosis and of cholera, and was one of the greatest bacteriologists of all time. He laid down the principles on which the nature of a bacterium and its identification must be established. It must

(i) be invariably present in disease;
(ii) be capable of culture outside the body; and
(iii) if injected into a healthy animal reproduce the disease.

Koch was given the Nobel Prize in 1905.

Metchnikoff, who also won the Nobel Prize (1908), gave up his career in Russia to work under Pasteur, and he is known for his work on intestinal infection and the use of lactic acid ferments in the diet. He established the theory, which to a considerable extent still holds the field, of phagocytosis; that is, that the white corpuscles of the blood (phagocytes) are able in the healthy state to surround and ingest bacteria, one of the methods by which the body tends to cure itself.

There were many more bacteriologists, but it is only possible to note that in the later part of the century the causal organisms of the following diseases were discovered: leprosy, gonorrhœa, typhoid, suppuration, diphtheria, tetanus, plague, pneumonia, Malta fever, and, to complete the list, the spirochæta of syphilis in 1905.

An amazing list, when we consider the slow progress of the previous centuries.

Out of this work and these discoveries further research by other bacteriologists produced anti-toxins and vaccines, some of the most important of which we shall meet in the 20th century. But it was the intensive research of the 19th century that made the triumphs of the 20th century possible.

Conquest of Typhoid Fever. Several of the great triumphs of the new century were due to the work of Almroth Wright (1861–1947) and his school. Wright's great triumph was the prevention of typhoid fever by immunization—anti-typhoid inoculation. In the South African War of 1899–1902 there were over 57,000 cases of typhoid, with more than 9,000 deaths (over a quarter of the Army strength being casualties). On the same basis the First World War would have meant 125,000 typhoid deaths; actually there were a little over 1,000. This was due to Wright's work and persistence.

He started in 1895 by inoculating two volunteers, but as he could not effectively experiment upon animals he had to invent new methods whereby it was possible to count the "antibodies" produced in the blood of volunteers after inoculation with the anti-typhoid vaccine. Thereby he could prove that the resistance of the body to infection was greatly increased; he also found that the effectiveness of the immunization might be limited to two years. He proved his case, but he had not convinced the world in general or the Army in particular, and it was not until the First World War broke out (when he was Professor of Pathology, Army Medical Services, at Netley) that he persuaded Lord Kitchener that no man should go to France without being inoculated.

Soon the whole Army was inoculated, and from his

great hospital, St. Mary's, about 10 million doses of vaccine were issued to the Services and Allied Forces. For that service Wright was very properly knighted. Only a man of his stubborn character could have overcome the prejudice against injecting dead bacteria into the human body. From this triumph developed a whole school of preventive, or prophylactic, treatment.

Doctors' Names for Diseases They Discovered. Alongside these fundamental and spectacular advances there was a large amount of original work on a smaller scale, though important, by clinicians, the bedside physicians. The earliest of these in the century was Richard Bright (1789–1858), of Guy's Hospital, who studied closely the diseases of the kidney so that a particular form of inflammation, called technically nephritis, is known to this day as Bright's disease. A brilliant physician, he first described the disease in 1827, pointing out that it was one of the causes of dropsy. Two wards at Guy's Hospital were set aside for his kidney cases for intensive investigation. The actual kidney of the first patient on whom he demonstrated his accurate observations was on exhibition in London at the South Bank during the Festival of Britain in 1951.

Another distinguished physician and contemporary of Bright, also of Guy's Hospital, who also gave his name to a disease, was Thomas Addison (1793–1860). A leading teacher at Guy's, his achievements included studies of pneumonia and consumption which were of considerable importance in the medicine of his day. The text-book on medicine which he wrote with Bright included an excellent account of inflammation of the "appendix vermiformis" very many years before appendicitis became commonly known. The disease he gave his name to was that fatal form of anæmia which is due to

disease of the little glands of the kidney known as the suprarenal capsules. They are two of the many vital glands of the body whose essence is essential to life. His classic work on the disease dates from 1855.

Another great name associated with Guy's was Thomas Hodgkin (1798–1866), the third of these colleagues of the first rank. The disease with which his name is associated is also a serious one—pseudo-leukæmia or lymphadenoma. He recorded cases in 1832 in which enlargement of the spleen and the lymphatic glands was a feature, but even 120 years later the newest drugs have not provided certain cure for this mysterious disease.

A clinical teacher who ranks high in 19th-century medicine was Robert Graves, an Irish physician (1796–1853), who is known today as the first who clearly described Graves' disease, the form of goitre known as exophthalmic. It was said that it was due to his efforts that typhus was practically extirpated in Ireland, where epidemics frequently occurred. Another of his life-saving reforms was the banishment of starving, purging, and bleeding in the treatment of fevers, prescribing plenty of good food. The epitaph he suggested for himself was: "He fed fevers."

These are but a few of the many, many physicians who raised medicine in the 19th century to the high level that the public has become accustomed to in the 20th century.

CHAPTER 13

THE 20TH CENTURY—TRIUMPHS OF RESEARCH AND TREATMENT

THIS 20th century is an age of specialization in medicine as in everything else, and to a certain extent the specialist rules the field. But it might be more truthfully described as the age of the general medical practitioner, the G.P., as he is popularly and affectionately referred to. Such is the breadth and depth of modern medical knowledge, and so wide the training of the general practitioner, that the average patient quite confidently expects his doctor to be able to answer any question about his illness or lack of full health. In earlier centuries, even the 19th, the patient was quite prepared for his physician to try simple methods, like blood-letting and purging, hoping for improvement if not a full cure; but in these modern days medical knowledge is so full that it is expected that only in really serious cases will the specialist be called in. That is in itself a high tribute to the advance of medicine.

In this our final chapter, the method of treatment must be different from that of previous periods. Not only has general medicine, as we have said, reached what seems to be the highest level of its long history, but we have such an immense bulk of specialist discoveries of fundamental importance that apart from a very few names of outstanding leaders, nothing like a complete list is possible in this little book. Furthermore, the really amazing story of the medical miracles of the last fifty years, the

story of hormones, vitamins, insulin, the sulphonamides, the study of viruses, penicillin, and the other healing moulds is still so new, that it could not be treated on an historical level. As one medical historian (Dr. Douglas Guthrie) has said, we have to wait until "their integration into the general concept of medical science is complete."

We will take first three sections of these astonishing developments as examples of these apparently miraculous achievements—the moulds, chemo-therapy, and vitamins. They are not, in fact, miracles, because they depend entirely upon the full application of the scientific method.

Penicillin and Other Moulds. Everyone has heard of the dramatic discovery of penicillin. This discovery ranks with the achievements of Pasteur and Lister, and is in direct line with them. Dr. (later Sir) Alexander Fleming, Professor of Bacteriology at the famous St. Mary's Hospital Medical School, knew of a report in 1925 from the Pasteur Institute in Brussels of a mould that stopped the growth of disease bacteria. But no significance was attached to it, and it was Fleming who in 1927 observed that a mould on a culture plate had clearly prevented the growth of the bacteria of which he was making a culture. He spent the next four years investigating and proving the deductions that he drew from this accidental fact. This mould, whose scientific name is *penicillium notatum*, was the first of the great family of what are now known as antibiotics. From it 650 species had been isolated by 1946, but only three produced true penicillin. This is a true example of small accidents producing great results.

Fleming listed the bacteria which were attacked by penicillin and proved its potency and, even more important, its harmlessness to the body tissues.

Having failed, however, in his attempt to isolate the

active principle of the mould, the aid of the biochemist became necessary; and in the meantime the chemists took the stage with the triumphant production of the sulphonamides, the famous M. & B. and its congeners which we shall mention later. So it was not until just before the Second World War that Oxford scientists (Dr. Howard Florey, Dr. Chain, and others), using a culture from Fleming's original mould—that historic culture plate is still in existence—succeeded in preparing an extract of penicillin which, however impure, did completely stop the growth of certain bacteria of infection in a solution of one part in half a million.

By 1941 the "miracle drug," as it was called, was established as curative agent, and it was obvious that large quantities would be required. American help was called in, and by 1944 reasonable supplies of a purer, concentrated penicillin were available, and further research had shown how wide its application could be. From "D Day" every wounded man had the benefit of penicillin, and it is on the authority of Sir Arthur Porritt of St. Mary's Hospital that it can be said: "The advent of penicillin brought about a revolution in military surgery of world-wide import." After the War, civilians benefited by the new drug, and mammoth plants exist to produce it.

Following these dramatic successes, research has produced, from penicillin as a prototype, a whole host of antibiotics, including names that are becoming increasingly familiar, as streptomycin, aureomycin, chloromycetin, and terramycin. Millions owe their lives to penicillin and its derivatives, and this great epic of medical history is well recognized in the Nobel Prize to Sir Alexander Fleming, Professor Howard Florey, Dr. Chain, and those associated with them.

The Vitamins. When we were talking in an earlier chapter of the abolition of scurvy at sea by administering lemon and lime juice the first note was then struck in the history of vitamins. This is a subject which through the intensive researches of biologists and chemists in the 20th century has covered an enormous field of preventive and curative medicine.

It really began with the famous discovery in 1890 that the oriental disease beri-beri common in the East Indies could be prevented if the whole rice grain and not the polished grain was eaten; that is to say, there was an unknown substance in the whole grain which prevented the disease. Then it became to be realized, particularly by Sir F. Gowland Hopkins (1861–1947), that there was a factor in the diet without which animals and men could not thrive. That accessory factor was later named *vitamin*. Soon it was found that there was a whole family of these vitamins from vegetable and other natural sources, and they were classified A, B, C, D, etc.

Now we have clear recognition that vitamin deficiency can and does produce disease conditions, and since vitamins have been isolated in the pure state they have proved of immense value in treatment. More vitamins were separated out; Vitamins A and B, for instance, now have ten or more sub-divisions.

In the 1930s one of the vitamins was artificially produced. By the mid-century most of them could be made synthetically, their very complicated chemical formulæ having been established. In Great Britain alone there are three Institutes devoted entirely to the science of nutrition, where much work has been done on vitamins, the alphabet of which runs from A to L and P with many sub-divisions. About thirty separate vitamins are known. As recently as 1949 vitamin B 12 achieved success in the

treatment of that dangerous disease pernicious anæmia, and competed successfully with the older treatment by liver extract. While it may be true that there has been some commercial exploitation of the vitamins in the form of exaggerated claims for foods with added vitamins, there can be no doubt that vitamin therapy is one of the really positive of the many successes of 20th-century medicine. Vitamin deficiency certainly causes skin troubles, rickets, scurvy, pellagra, and other diseases.

The Sulphonamides—Chemo-Therapy. It is probably not a gross exaggeration to say that almost every family in this country has known the life-saving virtues of M. & B. Before it was available, pneumonia, for instance, was one of the more deadly diseases. In 1938 a Norfolk farm labourer, hopelessly ill with pneumonia, was dramatically cured by two doctors who administered M. & B. 693 to him; since then pneumonia has gone much lower in the list of killing diseases.

This was perhaps the most widely known example of what is called chemo-therapy—treatment by chemicals. The title M. & B. means a drug produced in the laboratories of a firm of manufacturing pharmacists, May and Baker, Ltd., and the number means the last of a series of 693 experiments. Its name was sulphapyridine, and it was the beginning of quite a long list of new drugs of high importance produced by co-operation between scientific research and commercial enterprise. They are grouped as the sulphonamides (known by our American friends as the sulfa drugs) and include sulphapyridine, sulphathiazole, sulphaguanidine, sulphanilamide, and others which it would be of no great help to list here. Their virtues include not only the rapid, safe cure of microbic diseases, such as pneumonia, but also the saving of life on a large scale in the last war, by direct application to wounds.

The list of diseases for which the sulphonamides are used is large and expanding. It includes the following important cases: pneumonia, peritonitis, bacilluria, gonorrhœa, burns, wounds, and such serious infections as cellulitis, erysipelas, meningitis, septicæmia (blood poisoning), tonsillitis, puerperal fever, scarlet fever, etc.; also infections causing boils, carbuncles, etc. The list is worth quoting because it is impressive, although it is not from the medical point of view nearly complete. Often a sulphonamide is used with penicillin, as the bacteria tend to resist the effects of one drug (e.g. in pneumonia), and the sulphonamide helps the work of penicillin by preventing the multiplication of the bacteria, while the penicillin kills them.

The first sulpha drug, synthesized in Germany by Bayer in 1935, was called Prontosil, and considerable claims were made for it. This same German firm co-operated with the great pathologist, Paul Ehrlich (1854–1915), who startled the medical world by preparing in 1910 the arsenical drug called Salvarsan (modified as novarsenobenzol). This, for the first time, produced a fairly certain and safe cure for syphilis, which previously had been treated with mercury to the point of poisoning. The other name for the drug was "606," indicating that it represented this number of experiments with arsenical compounds before success was registered. From the same house came two synthetic anti-malarial drugs, atebrine and plasmoquine, with which almost all soldiers in the Far Eastern campaign in Malaya and Burma from 1942 onwards were familiar in the absence of quinine. The German product was later improved upon in May & Baker's mepacrine.

Clearly, therefore, chemo-therapy (founded by Ehrlich) has played an astonishing part in modern medicine,

a part which could not have been dreamed of by the compounders and prescribers of simple and complicated galenicals in the previous and earlier centuries.

To these manufacturing researchers even the triumph of Sir Frederick Banting (1891–1941) was in part due. His discovery of insulin, which was certainly one of the greatest triumphs in medical research in the early part of the century, would have been of much less value if a firm of Canadian manufacturing chemists had not been able to produce insulin in a stable form. Many thousands of diabetics all over the world owe their continued, more or less normal, existence first to Banting and his colleagues Drs. C. H. Best and J. J. McLeod, and then to the chemists in Canada and Great Britain who made this substance. Within a few years of its introduction, mortality from diabetes was reduced by about 50 per cent. It is obtained from the pancreas of the sheep and other animals.

Notes on Viruses, Hormones, and Radiation

While it is quite impossible to cover even a major part of the enormous and exciting field of 20th-century discoveries, and many of them as remarked at the beginning of this chapter are not yet suited for historical treatment, there are, in fact, several matters that have already become history.

First the viruses. Up to about 1930 they were postulated rather than known. It was known that there were agents of infection which were not bacteria, partly because they could not be seen in the microscope and partly because they passed through the finest filters which stopped all known bacteria. It was shown that blood or serum taken from people suffering from certain diseases could pass a filter and yet cause the particular disease in an animal. These diseases, for which no bacteria were known and viruses suspected, included foot-and-mouth disease, poliomyelitis, rabies, and, as was known later, influenza.

The invention of the electron microscope with electro-

magnetic lenses instead of glass lenses permitted magnification up to 100,000 or 150,000 times as against 2,000 with the ordinary microscope. This actually enabled photographs of viruses, the smallest known examples of living matter, to be taken. They appear mainly as tiny rods of special structure.

We have mentioned influenza in its earlier appearance in Europe, and it is one of the most tantalizing problems of medicine. This plague, which killed more people in 1918–19 than were killed in the First World War itself, is still an incompletely solved mystery. At one time Pfeiffer's bacillus was thought to be guilty, and it was not until 1933 that active work on the virus of human influenza began. Research was hampered by a number of awkward facts, one of which was that it was not until that year that an animal was found (the common ferret) that could be inoculated with human influenza and could itself infect a human being. By 1940 it was shown that there were at least two viruses, influenza "A" and influenza "B," and that the mode of attack and the virus responsible varied so that no vaccine was likely to be successful. A World Influenza Centre for the study of epidemics on a world-wide basis was set up in 1950.

Although we are not concerned in any detail with physiology in this little book, it seems desirable to mention the substantial successes. The hormones, which on a philosophical basis could be regarded as related to the Greek doctrine of the temperaments, are the secretions in minute quantities of what are known as the endocrine glands. They are situated in the pancreas, the adrenal gland above the kidneys, the thyroid, the sexual glands, and other parts. Minute as their quantities are, these secretions or essences are so powerful that without them the body breaks down, *e.g.*, Addison's disease mentioned in page 82, insulin in diabetes on page 90. The interest from our immediate point of view is that many of these essences can be extracted and prepared with astonishing results. A semi-idiot child suffering from thyroid deficiency can be made practically normal by administration of a preparation of the thyroid glands. Almost every hormone is now available either in tablets or as a solution for injection.

One of these preparations which attracted world-wide attention in 1948 is cortisone, with its associate ACTH. Extracted in minute quantities from ox-bile and administered to

hopelessly crippled arthritis cases, it has in many instances changed the cripple into an active person in a few days. Unfortunately, although efforts to prepare it in synthetic form promised success in 1951, this hormone drug in natural form is extremely expensive and may even be dangerous. It is not a cure. If the drug is stopped arthritis returns.

An instrument of immense diagnostic and treatment value is the X-ray. Every schoolboy knows that it was discovered by Professor Roentgen in 1895, and that it is a form of radiation. It actually falls in the spectrum between the invisible ultra-violet rays of the sun and the rays emitted by radium. As X-rays pass through soft bodies like flesh and nerves but are stopped by denser bodies like bones, and as they affect a photographic plate, it is possible by controlling the rays either to photograph the denser tissues or to see them on a fluorescent screen. The use in diagnosis is too obvious to expand upon.

In treatment good results have been obtained in many forms of skin diseases and quite often with malignant disease.

In the previous chapter we called the 19th century on good authority a Golden Age of Medicine. What we have been able to say in brief compass about the first half of the 20th century is surely sufficient to show that we are living in epoch-making times, when medical history is being made on the largest scale, times in which medical activity and the passion for truth by research have been unequalled since the Golden Age of Greece.

A hundred years ago, despite the advances that had been then registered, only too often the patient seriously ill could have little confidence that if nature did not cure him his doctor would be able to. In this century every facility and capacity of medical science is at his disposal if his case is beyond the scope of the family doctor. And he, the G.P., is far more highly and widely qualified than the most brilliant physician of the mid-19th century.

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