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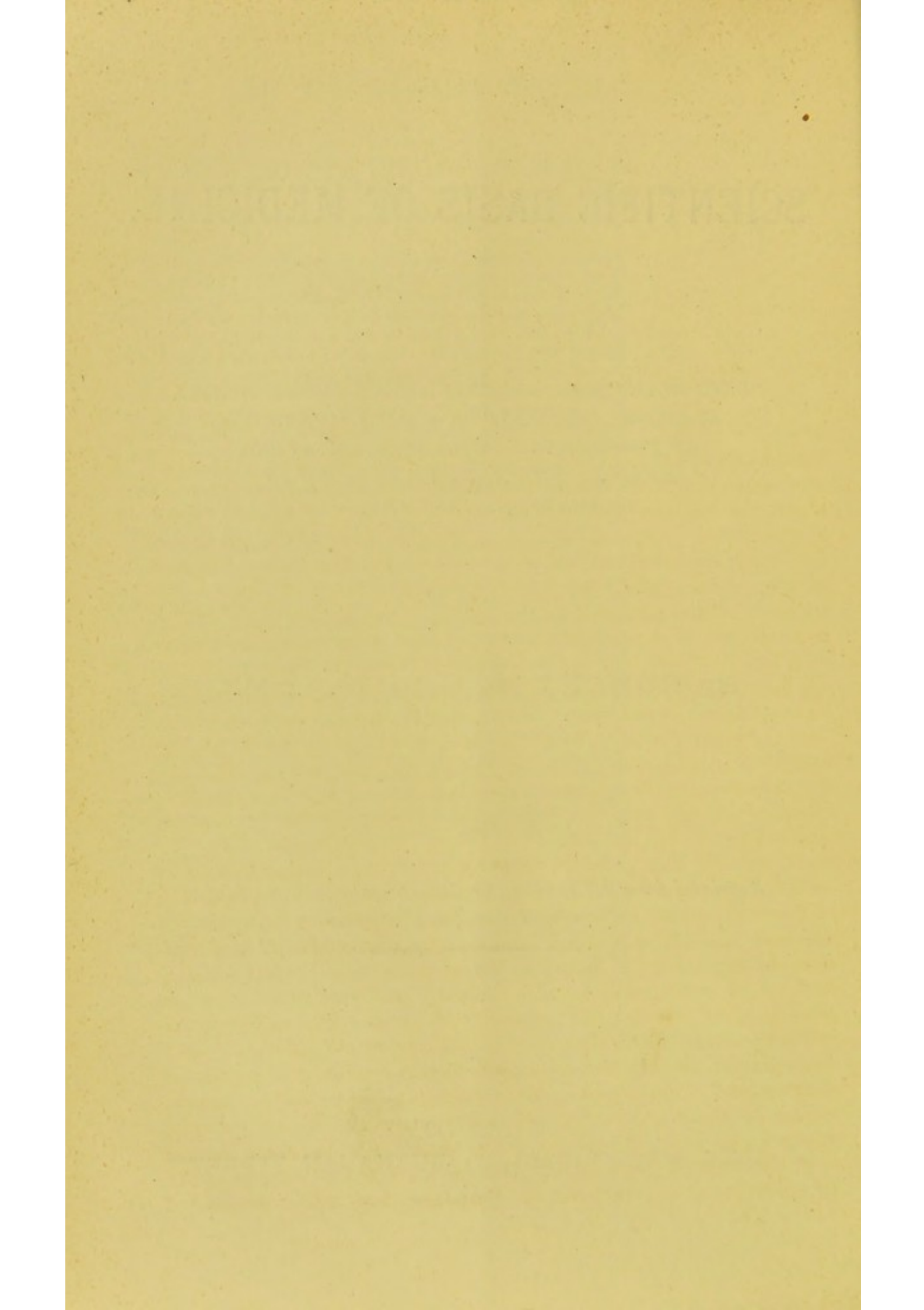
SCIENTIFIC BASIS OF MEDICINE.

*BEING INAUGURAL ADDRESS AS PRESIDENT OF THE
GLASGOW AND WEST OF SCOTLAND BRANCH
OF THE BRITISH MEDICAL ASSOCIATION,
READ AT THE ANNUAL MEETING IN
GLASGOW, 31st JANUARY, 1885.*

By ROBERT MUNRO, M.A., M.D.

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THE SCIENTIFIC BASIS OF MEDICINE.

GENTLEMEN,—When Christianity became amalgamated with the pagan ceremonies and superstitions of the Roman Empire, about the beginning of the 4th century, there gradually arose a system of religious despotism which ultimately absorbed into itself not only all spiritual power, but the entire control of the moral, intellectual, and political life of Europe. To such an extent was this ecclesiastical tyranny carried that the mere denial of a cosmical theory—which represented the earth as a fixed plain in the centre of the universe, having its physical laws and phenomena directly dependent on God, but liable to suspension or interference by various supernatural agencies—was considered a sufficiently dangerous heresy to merit the punishment of death. During the prevalence of this Stygian fog the most deadly plagues and epidemics, which then frequently swept over Europe, were considered to be special visitations from an offended Deity, which could only be removed by the prayers and general humiliation of the afflicted communities. Evil spirits and witches were believed to have the power of inflicting on poor humanity a variety of diseases, and for this crime alone many thousands of unfortunate beings, chiefly decrepit old women, were unmercifully hanged or committed to the flames. As mediator between heaven and earth, the church advocated the efficacy of miracles and holy relics in the treatment of diseases, and discouraged medical art as an interference with the profits of shrines and sanctuaries. As an instance of the abject superstition of these times, it is related that when Halley's comet appeared in 1456, the people were struck with so much terror that the church bells of all Europe were set to ring in order to scare it away, because its immense tail, which extended

over a third of the heavens, was supposed to “shake down diseases, pestilence, and war upon the earth.”

When we consider that the healing art, in addition to the conjectural and problematical nature of its inherent elements, had to contend against a priestcraft which long sought to monopolise its practice as a privilege of Divine inspiration, we need not be astonished that it was longer than many of the collateral sciences in emerging from the shackles imposed upon all truth by institutions founded on such ignorance, prejudice, and superstition, as characterised the Middle Ages. The primary object of the Reformation was to remove the rites and ceremonies of pagan superstition from Christianity; but this struggle, though it gave the first great stimulus and comparative security to scientific investigations, did not extinguish religious intolerance towards discoveries that were supposed to be contrary to the verbal interpretation of the sacred writings. Hence we find that diseases continued to be prayed for as formerly, and as for actual treatment, more reliance was put in miracles, charms, &c., than in medical skill or sanitary measures. The witch mania was by no means abated, so the poor witches were tried, condemned, and burnt, not only for the infliction of diseases, but for their actual removal, which was said to be done by illegal remedies. One of the recorded pleadings by Sir George M'Kenzie, between the year 1661 and 1672, is for a woman named Mævia, who was accused of witchcraft. The indictment against this poor person is made up of the following three charges:—“(1.) That she did lay on a disease upon A B by using a charm. (2.) That she took it off by another. (3.) That it is deponed by two penitent witches that she and they did flee as doves to the meeting place of witches.”* Not longer ago than the year 1697, on the evidence of Christina Shaw, a girl of 11 years of age, who, it appears, was subject to hysterical convulsions, and was said “to put out of her mouth quantities of egg-shells, orange-peels, feathers of wild and bones of tame fowl, hair of various colours, hot coal cinders, straws, crooked pins, &c.,” no less than 7 persons were condemned and committed to the flames on the Green at Paisley for having been “the authors of these malefices from which the said Christina Shaw suffered.”†

Some notion of the opinions prevailing in Scotland, at a much earlier period, regarding diseases may be formed from

* *Pleadings of some Remarkable Cases before the Supreme Courts of Scotland.* By Sir George M'Kenzie, 1661-1672.

† Arnot, *Celebrated Criminal Trials*, p. 362.

the prominence given to the miraculous power of healing ascribed to St. Columba by his biographer, Adamnan. In the final chapter of his second book—a book entirely devoted to a record of the saint's miracles—Adamnan gives an account of his own knowledge and experience of the *plague*, which is of singular interest, both on account of the authenticity of its date (the close of the 7th century) and the literary ability of the author. The chapter is as follows—

“Concerning the Plague.—What we are about to relate concerning the plague, which in our own time twice visited the greater part of the world, deserves, I think, to be reckoned among not the least of the miracles of St. Columba. For, not to mention the other and greater countries of Europe, including Italy, the Roman States, and the Cisalpine provinces of Gaul, with the States of Spain also, which lie beyond the Pyrenees, these islands of the sea, Scotia (Ireland) and Britain, have twice been ravaged by a dreadful pestilence throughout their whole extent, except among the two tribes, the Picts and Scots of Britain, who are separated from each other by the Dorsal mountains of Britain. And although neither of these nations was free from those grievous crimes which generally provoke the anger of the Eternal Judge, yet both have been hitherto patiently borne with and mercifully spared. Now, to what other person can this favour granted them by God be attributed unless to St. Columba, whose monasteries lie within the territories of both these people, and have been regarded by both with the greatest respect up to the present time? But what I am now to say cannot, I think, be heard without a sigh—that there are many very stupid people in both countries who, in their ignorance that they owe their exemption from the plague to the prayers of the saint, ungratefully and wickedly abuse the patience and the goodness of God. But I often return my most grateful thanks to God for having, through the intercession of our holy patron, preserved me and those in our islands from the ravages of the pestilence; and that in Saxonia also, when I went to visit my friend King Aldfrid, when the plague was raging and laying waste many of his villages, yet both in its first attack, immediately after the war of Ecfrius, and in its second, two years subsequently, the Lord mercifully saved me from danger, though I was living and moving about in the very midst of the plague. The Divine mercy was also extended to my companions, not one of whom died of the plague, or was attacked with any other disease.”*

* *Historians of Scotland*, vol. vi, book ii, chap. xlvii, page 77.

No symptom is here mentioned which would enable us to form any conjecture as to the nature of this plague, but in chap. iv there is a description of St. Columba's prophecy regarding a dense rainy cloud which he predicts "will discharge in the evening a pestilential rain which will raise large and putrid ulcers on the bodies of men and the udders of cows; so that men and cattle shall sicken and die, worn out with that poisonous complaint." The cure of this pestilence was effected by sprinkling man and beast with water in which some bread "blessed by the invocation of the name of God" had been previously dipped.

To this widespread belief in the supernatural origin and cure of diseases, I have to note one or two other causes which fostered the medical absurdities of the Middle Ages. A firm belief in the existence of the philosophers' stone, which, if discovered, would enable the happy finder to convert the baser metals into their equivalent in gold, and an *elixir vite*, which was supposed to prolong life almost *ad infinitum*, misled many of the philosophers of the period, and tinged all their speculations. The search for these valuable secrets of nature appears to have been the special province of alchemy. While prosecuting their investigations, the alchemists found, however, that funds for supplying the ordinary necessities of life were requisite; hence they combined with their pretended science the more lucrative profession of working miracles, and curing all sorts of maladies by touch, charms, talismans, &c. But to describe the motley crew of quacks, empirics, and charlatans, who practised the art of healing, and claimed a share in the noble work of relieving suffering humanity, would lead me away from the object of my address. Besides astrologers, necromancers, sorcerers, dealers in charms, amulets, and philters, touchers for the evil, compounders of sympathetic powders, mongers of secret remedies and all sorts of panaceas, we would have to wade through the exploded opinions of a variety of medical sects, such as chemical and mathematical physicians, animal magnetisers, homœopathists, allopathists, &c., some of whose theories have become merged into the medical speculations of our own time.

The commercial spirit of enterprise aroused in consequence of the discovery of America, and the revival of Greek learning in the West during the latter part of the 15th century, paved the way for the intellectual freedom of Europe. Though the introduction of the works of Hippocrates and Galen, as well as the Latin works of Celsus, had no immediate effect on the practice of medicine, it cannot be doubted that they

were instrumental in sowing seeds which have continued to germinate to the present time. The separation of chemistry from alchemy, and the study of human anatomy, which may be said to have been fairly established in the 16th century, speedily led to the important anatomical and physiological investigations which culminated in the discovery of the circulation of the blood by Harvey, and the lymphatic vessels by Aselli, early in the following century. Henceforth medicine was placed on a more rational foundation, and its subsequent history is but a record of a long series of discoveries in anatomy, chemistry, and physiology, and kindred sciences, which have greatly advanced the claim of medicine to be considered a scientific art.

It will be thus seen that the medical science of the present day is the offspring of a heterogeneous mass of ancient medical opinions, engrafted on the blind empiricism and superstition prevalent among the western nations of Europe during the dark ages. It is true that other sciences, such as chemistry, astronomy, geology, anthropology, &c., can boast of no better pedigree. But these all have this grand feature in common—viz., that a clean sweep has been made of all principles and dogmas which were found not to be in accordance with known truths. And this purging process still continues in force. At the present time astronomy has rejected every single clause of the Mosaic cosmogony, which was so long enforced by theological intolerance. Under the new and improved methods of investigation, and extended clinical observation now adopted in medical researches, a similar process is going on in the practice of medicine; and already many erroneous doctrines have been exploded. As for the supernatural element, it is no longer reckoned a factor either in the cause or treatment of disease.

Before giving expression in categorical language to the facts and principles which, in my opinion, constitute the scientific basis of medicine, I have to remind you that the science which investigates the laws and phenomena of disease may be a totally different thing from the art which professes to cure it. Thus, for example, the pathogenic causes of Bright's disease of the kidneys, and the morbid changes gradually induced in the uriniferous ducts, may be clearly ascertained, and yet nothing may be known of the means of stopping these changes, or restoring the altered renal structures to their normal condition. The same may be said *a fortiori* of the sciences by which the laws of health and the normal functions of the body are determined. Hence, one may be

intimately acquainted with the anatomical and microscopical structures of the body, and he may thoroughly understand the principles of human physiology, as well as the chemical and physiological action of drugs; or he may be conversant with the laws and natural history of a disease—its origin, effects, and probable termination, and yet have no knowledge of the art of curing it. A man full of such wisdom may be absolutely powerless in averting a fatal issue or relieving suffering. It does not, however, follow from this that these attainments are not essential as a preliminary step in acquiring a knowledge of the art of healing. On the contrary, as I shall afterwards more fully explain, I believe that no truly scientific system of medicine can exist that is not founded upon, and directly dependent on, the extent and correctness of the facts derived from such investigations. A difference of opinion on this very point gave rise at an early period in the history of medicine to two distinct medical schools or sects called *Rationalists* and *Empirics*. This division first assumed prominence among the professors of medical art in the famous school of Alexandria, which was established by the munificence of the Ptolemies, about 300 years before the Christian era. The adherents of the former (known also as Dogmatists) asserted that before diseases could be correctly treated it was essential to be acquainted with the nature and functions of the healthy body, the action of drugs upon it, and the morbid changes induced in the affected parts. Hence, they insisted on the necessity of making dissections of the human body, and prosecuting by every possible means the study of physiology, pathology, and therapeutics. Meanwhile, until such accurate knowledge could be attained, they disparaged the use of active remedies and blood-letting, and trusted more to the regulation of diet, hygiene, and the *vis medicatrix naturæ*. On the other hand, their opponents, the Empirics, ridiculed the acquisition of such minute knowledge as fanciful or impossible to be attained, and, even if possible, contended that it was of little use, and relied on experience as the sole guide in the treatment of disease. The disciples of these two rival schools, who enlisted apparently in about equal numbers all the physicians of that period, continued for a century or two to be the chief exponents of medical teaching, but, with the fall of the splendid museum at Alexandria, and the decline of Greek philosophy in general, their doctrines ultimately gave place to the sacred shrines and miracle cures of the subsequent dark ages. But the 14 centuries of Stygian darkness, which so long warped the intellectual aspirations of Europe, and prevented these early

germs from bearing fruit, have now come to an end, and it is no small privilege to be able, in the full zenith of an enlightened era, to resume these discussions without encountering any persecution. In looking at medical science from two such widely separated chronological standpoints, it is singular to find how little the curative art has advanced beyond the point where the Alexandrian physicians left it. Rationalism and Empiricism are still the chief rival theories in medicine; and the description which Celsus gives of their respective doctrines, some 1800 years ago, is as applicable now as it was then. No doubt the numerous experimental researches conducted on the lower animals, and the strict attention now given to clinical observations, and the collective investigations of facts bearing on the natural history of disease, together with many other greatly extended and exact methods of diagnosis, have increased our knowledge of physiological and pathological processes, and opened up speculations regarding the nature of epidemic diseases which were entirely unknown to our Alexandrian *confrères*. But, notwithstanding all this, if we exclude the province of surgery, we have not got beyond the preparatory stage of collecting materials and data towards a science which yet remains to be constructed on truly scientific principles.

All organised living bodies are subject to the laws of matter, and so long as their structure and functions remain unimpaired they are said to live in a state of health. Health may be thus appropriately compared to the resultant of a compound parallelogram of forces, where the sides of the parallelogram are represented by the multifarious animal and physical influences which regulate the phenomenal activity of the individual during its life period. From this point of view the original character of the body is already determined at birth by the mysterious laws of heredity; and the molecular forces thus acquired are as real factors in its subsequent changes as those that come into play after birth. But this normal condition of the living organism is liable to be disturbed by a variety of causes, due to fluctuations in its environments, or some changes in the conditions of its existence, and when these deviations, either in structure or functions, exceed certain limits, the individual is said to be in a state of disease. The term disease is therefore a generic one, representing the aggregate of all those deviations from the normal type which tend to mar the enjoyments of life or bring the organism to a premature end.

At the head of animated creation, both as regards differen-

tiation of structure and specialisation of function, stands the human being. He is the terminal link of the long chain with which evolution has bound together all the countless and varied organisms on the globe, from the simplest cell or protoplasm upwards. The primary conditions of his existence are pure atmospheric air within certain limits of temperature, a regular supply of appropriate food, and a healthy activity of the entire metabolic phenomena of his body. The regulation of the details of many of these conditions is under his own control. This is notably true with regard to food, which entails on him a constant watchfulness and scramble for the means of daily existence. Though man, owing to his great mental development, has been enabled to modify the primitive struggle for existence imposed upon him by nature in several important respects—such as by increasing the productiveness of the earth and acquiring the means of transporting food from all parts of the world—yet these advantages are not always attained without corresponding drawbacks. Indeed, it not unfrequently happens that disease, sickness, and increased mortality advance *pari passu* with the so-called blessings of civilisation. It is the progressiveness of this civilisation, with its ever widening organisations, that gives scope to the profession of medicine.

A cursory glance at the mechanism of the human fabric, and the nature of its environments, will be sufficient to disclose the leading sources of disease. The atmosphere may contain a great variety of impurities, such as noxious gases, particles of inorganic matter, pollen and spores of plants, germs of disease, &c., which will either irritate the organ of breathing or prevent it from performing its excretory function, and so cause secondary disturbances in the tissues. Other changes in the surrounding media, due to variations in heat, light, electricity, atmospheric pressure, &c., may also cause various constitutional disturbances. Hence, to the variableness of the constitution of the atmosphere and its suspended impurities may be traced many of the diseases which afflict humanity. Again, this globe affords the opportunity of existence to thousands of other creatures besides man. These appear to be perpetually at war, not only with man but among themselves. In short, the entire organic world is a sort of Donnybrook fair, with constant struggles and free fights all round, each creature defending or attacking according to its own special methods and weapons. Over the larger animals man has now got the mastery, and, consequently, he has been dubbed lord of the creation; but in his

struggles against the smaller ones he often falls a victim. These micro-organisms live on his body as parasites, or find their way in a variety of ways into his blood and tissues, where they create terrible havoc. A third source of disease is the food. This may contain organic germs of disease, or it may be deleterious, deficient in some nutritive qualities, or in excess as regards others, all of which eventualities are sure to be followed by consequences more or less injurious to the general life and wellbeing of the organism. Moreover, from the extreme delicacy and complexity of the chemico-vital processes and their interdependence on each other, the phenomenal forces of the body are liable to many derangements, all of which are intensified owing to their partial subjection to mental emotions and other obscure nervous causes. Nor must we forget to note that the body is subject to physical laws and their occasional violent results. Thus, we might classify diseases according to the immediate sources from which they are derived. Such a classification, though perhaps more philosophical than practical, suffices for my present purpose, inasmuch as it shows the extensive knowledge and wide range of subjects with which the physician must be familiar before he is in a position to apply any curative measures whatever. Not only must he know the structure and entire mechanism of the human body, the normal action of its organs, and the pathological changes induced in the state of disease, but he must seek for the primary causes of morbid conditions. Sometimes attention is directed to the external surroundings of the sufferer, and sometimes to errors of diet or obscure disturbances of mental origin. At other times he has to grapple with the effects of a colony of one or other of those parasitic germs which find in human blood and tissues the special conditions of their existence. In fact, it would be difficult to name a science from which the physician has not occasionally to cull information. Having ascertained the exact pathological condition of the patient, and the precise physical or organic circumstances which induced it, or, in other words, the cause of the disease, the next problem to be considered is the treatment. I specially mention *the cause*, as its determination often plays a very important part in the further proceedings. Thus, it makes a material difference in the treatment of mortification, say of the foot, whether it is due to frostbite, embolism, or atheromatous degeneration of the arterial vessels. Again, the treatment of chronic bronchitis, so common among colliers, Sheffield knife-grinders, &c., by expectorants, or indeed by

any other remedial agents, would be of little avail so long as the patient continued his employment. Hence, the first thing to be done is to remove the cause of the disease; and this is of much importance in cases where the cause is in constant operation, as among children living in close and confined rooms where the vitiated atmosphere poisons the system, as it were, in homœopathic doses. When the cause is a definite act, as fracture of an extremity by sudden violence, or temporary exposure to extreme cold, resulting in local mortification, we may have treatment alone to consider—the primary causes, *i. e.*, the violent strain and low temperature being already removed. In such cases it is most instructive to watch the marvellous powers of nature in restoring the contiguity of the broken bones, throwing off dead matter, and forming a new protective covering. Any outside interference must be exactly on the lines indicated by nature herself. The ends of the fractured bones may, however, be more evenly adjusted, and the morbid parts may be removed quicker by the knife of the surgeon than by the unaided efforts of nature. The healing action of a wound may also be quickened and assisted by various applications, and the absorption of pathogenic organisms, and other secondary effects on the system, may be entirely averted. But, besides such aid as can be given by surgical and mechanical appliances, there remains to be mentioned the power claimed by medical art in curing or modifying diseases by the administration of drugs, and so-called specific remedies. It would thus appear that all the objects contemplated by the medical art, in its widest application, may be summed up under the following three heads:—(1) Prevention of disease; (2) Removal of its primary causes; and (3) The administration of substances, supposed to act beneficially on the pathological conditions of the disease.

The unfortunate misconception of the nature and treatment of disease which followed the spread of Christianity in Western Europe, and so long retarded the development of rational medicine in mediæval times, led to a similar retrogression in sanitary matters. Notwithstanding the strict injunctions given in the Mosaic code of laws regarding personal cleanliness, healthy dwellings, and indeed everything bearing on the well-being of the Jewish nation; but especially the importance attached to isolation from the camp of all persons suffering from contagious disorders, it does not appear that the possible prevention of disease by similar measures was ever even entertained by either statesmen, ecclesiastical dignitaries, or the professors of medical art, until comparatively modern times.

And this neglect is more remarkable when we consider that these sanitary laws were part of the religious duties of the Jews, and that the entire teaching of the Pentateuch became incorporated with the doctrines of Christianity, many of which became infallible dogmas, and were enforced with the utmost rigour. That the Greeks, Romans, and other nations of antiquity, as they advanced towards civilisation, were much influenced by hygienic laws, is manifest from the structure of their houses, the number of public baths, the drainage schemes, vast aqueducts, and other sanitary arrangements which they possessed. But this knowledge, as well as that embodied in pagan medical literature, became a dead letter, and had no effect on the social organisations of Western Europe for many centuries.

When, therefore, one of those terrible epidemics of which we read in the Middle Ages arose, the misguided people had no idea of its causal connection with their prolonged and total disregard of the laws of sanitation. Instead of cleaning and ventilating their houses, which writers of the period describe as filthy beyond measure, and adopting the truly scientific principles of disinfection inculcated on the Israelites by their great Lawgiver—such as the cremation of all putrescible matters and articles of clothing which were likely to convey and disseminate contagious diseases, and the free use of water and fresh air—they fled, terror stricken, to shrines and sanctuaries, or otherwise performed such penances as were prescribed by an ignorant priestcraft. When, at length, statesmen became alive to the fact that the poor, living in unventilated and undrained hovels in the midst of accumulated organic debris, suffered severely from an epidemic, while the better classes were comparatively safe, many important measures were undertaken for the improvement of public health. With improved dwellings and social cleanliness, the local causes which fostered the plague, sweating sickness, and other diseases, are gone; and hence the community no longer dreads the return of these scourges. Under a proper system of drainage, ague has entirely disappeared from the country. Typhus fever, small-pox, scurvy, &c., though not completely eradicated, are greatly mitigated in severity. On the other hand, scarlet fever, measles, typhoid fever, and cholera still baffle us; but, considering the promising prospects of sanitary science opened up by the experimental researches of Pasteur and Koch, we need not despair that, eventually, they also will succumb to the ingenuity of man. The immense benefit conferred on mankind by the sanitary improvements of this century may be esti-

mated from the fact that the average death-rate in Britain at the present time is only about half of what it was in the middle of the 16th century. But, notwithstanding the improved social and domestic habits of the people, who are undoubtedly better housed, clothed, and fed than formerly, and the many legislative enactments now in force, by means of which distress and poverty are instantly relieved, I hold that preventive medicine has not yet received the attention from the State which it merits. Much has been done, but still more remains to be done before the Augean stables are cleared out.

Among the many achievements of preventive medicine there is none, since the day when Edward Jenner gave experimental proof of the protective power of vaccination against small-pox, that has attracted more attention than the biological investigations now enthusiastically pursued in every efficient laboratory in the civilised world, which appear to support, if not demonstrate, a causal connection between micro-organisms and epidemic diseases. The general outcome of these investigations, so far as their medical aspect is concerned, is the discovery of a method of separating the pathogenic organisms from the blood and tissues of a diseased animal and, by means of a series of artificial cultivations, converting them into a modified vaccine, which, when inoculated upon healthy animals, produces certain harmless symptoms, somewhat analogous to the original disease, but (and this is the important part to humanity) still retaining the power of rendering individuals so treated unsusceptible to the natural disease. It is curious to note the complete parallelism there is between these two great discoveries; and this is more remarkable when we bring to recollection Jenner's belief in the identity of the virus of small-pox and cow-pox—in other words, he believed that it is the same organic substance that produces cow-pox in the cow and small-pox in man. Experiments have now proved that if a cow is vaccinated with a portion of the matured pustules of small-pox the result will be cow-pox. Hence we conclude that the pathogenic organisms are merely deprived of their virulent properties during their transitory habitation in the blood and tissues of this animal. The difference, therefore, between Jenner and the modern experimenters is simply this, that, instead of the bovine influence which the former took advantage of to mitigate the virulence of the disease, and so permit of the altered virus being used as a prophylactic against the natural disease, the latter substitute a new method—viz., that of isolated cultivation, which is found to produce a similar result.

Passing from these remarks on the simple prevention of diseases to the consideration of the actual instruments of treatment, you will observe that I have noted a transition stage, in which the physician's interference is supposed to be necessary only to the extent of discovering and removing their primary causes, and thereby restoring the equilibrium of the conditions of health. It is on the principle involved in this assumption that all recommendations as to change of food, drink, and clothing, are made; that exercise in the open air is prescribed to persons suffering from dyspepsia due to sedentary habits; that the poor, sickly children of our crowded dens and alleys regain their natural vigour and health when removed to a Convalescent Home; and that gouty, rheumatic, and scrofulous people are so much benefited by clear mountain air. But it is needless to multiply illustrations. Let me rather look ahead to the boundless field for genuine medical skill and practical good to humanity which is here forced on our consideration! To the immense labour of acquiring a tolerable acquaintance with the marvellous complexity of the structure and functions of the human body must be added an exact knowledge of the external environments of the patient, his mode of living and habits of life, and such other preliminary inquiries as have already engaged our attention when discussing the problems of preventive medicine. What a grasp of the secret workings of nature—what a variety of methods of investigation, delicate experiments, and manipulative research—what powers of observation and inductive philosophy—and above all, what wide experience and mature judgment are requisite to unravel the tangled skein of disease, and enable the physician to form a correct opinion of the multitudinous ailments he is called on to investigate!

But why, it may be asked, do I restrict the physician to the mere rectification of the physical causes of disease? When the morbid lesion and its exciting causes are discovered and the conditions of normal health readjusted, is there nothing else that can be done either to hasten the cure or relieve the sufferings of the patient? Is medical interference like a vacuum abhorrent to nature? And is she alone henceforth sufficient to establish convalescence? These questions naturally suggest a few remarks on the respective claims of the power of nature and the appliances of art in the cure of disease.

That nature possesses within her own resources, as manifested in the combined action of the metabolic forces of the human body, an inherent power of removing pathological products and

reconstructing new tissues, after the disturbing elements have been removed, there can be no doubt at all in the mind of any observant person who has watched the natural termination of disease and accidents among men and the lower animals, in circumstances where no human aid was given or available. Her successful resistance against epidemic diseases by ultimately eliminating the organic poison and its morbid products from the system, is now recognised by all competent physicians. Sydenham believed in this *vis medicatrix naturæ*, and commends the great sagacity of Hippocrates in discovering that "*Nature by herself determines diseases, and is of herself sufficient in all things against all of them.*" (P. 17, vol. i, Syd. Soc.)

The same opinion is amply confirmed by an intelligent survey of the fluctuating means and instruments of medical art as practised at different times and in various countries. As long as treatment was confined to the effects of amulets, charms, spells, or other imaginary influences, and included no more potent drugs than the inert substances of many celebrated quack nostrums, and the infinitesimal globules of Hahnemann, it must be admitted that the numberless cures recorded under such conditions were entirely due to the natural and unaided efforts of nature. Such treatment merely justifies the well known definition of physic, that "*it is the art of amusing the patient while nature cures the disease.*" It would have been better for the reputation of the healing art, and perhaps for humanity at large, had its injunctions in many instances been of a less heroic character than the treatment we find described in the medical records of the past. Thus, for example, when the terribly fatal disease, known as the English sweating sickness, first broke out in London, in the year 1485, it was treated by such active measures as were then in vogue. But drastic pills, electuaries, and the famous feather beds by which the patients were made to sweat for 24 hours, had no effect in lessening its mortality. In fact, medical science completely broke down, and was considered so utterly useless that, according to Hecker, its professors are nowhere alluded to throughout this epidemic. "No resource," says this writer (*Epidemics of the Middle Ages*, p. 186) "was therefore left to the terrified people of England but their own good sense, and this led them to the adoption of a plan of treatment than which no physician in the world could have given them a better—viz., not to resort to any violent medicines, but to apply moderate heat, to abstain from food, taking only a small quantity of mild drink, and quietly to wait for four-and-twenty

hours the crisis of this formidable malady." On the Continent the consequences of medical interference with the natural course of this disease were still more deplorable, and many sufferers were said to have been actually "stewed to death" by the feather bed treatment. When the success of the English expectant method became known, many pamphlets were published recommending it to the afflicted communities, and even the Council at Berne went so far as to issue an "exhortation to patience and unshaken courage, in which the use of feather beds and all medicines, except cinnamon water, was earnestly deprecated during the disease." Hecker, referring to a pamphlet by Caspar Kegeler, of Leipzig, on the treatment of this disease, says—"It is a melancholy monument of the credulity which, from Herophilus to the present day, has pervaded the whole medical art. It is a regular pharmacopœia for the sweating sickness, thrown together at a venture, without any insight into the nature of the disease. A mine of wonderful pills and electuaries composed of numberless ingredients where-with this 'mysterious worthy' undertakes to raise a commotion in the bodies of his patients. If he had but seen even a single case of the disease he would at least have known how impossible it would be to administer, within the space of four-and-twenty hours, the hundredth part of his pills and draughts. With what approbation this little pharmacopœia was received by physicians of equal penetration and understanding as himself, is shown by the eight editions which it passed through, and the melancholy reflection is therefore forced upon us that possibly thousands of sick persons were maltreated and sacrificed from the employment of Kegeler's medicines." (*Ibid*, p. 272.) Farther on, the same author, while commending the English method of treatment, adds, "We have, therefore, nothing further to add to this judicious and truly scientific practice but our unqualified approbation; *for it is the part of the physician, in diseases which have a spontaneous power of curing themselves, to leave this power free scope to act, and merely by fostering care to remove all obstacles to its exercise.* Should it be the destiny of mankind to be again visited by the disease of the sixteenth century (and it is by no means impossible that at some time or other similar events may recur), we would recommend our posterity to bear in mind this eternal truth, and to treasure up the golden words of the Wittenberg pamphlet—viz., to guard the healing art from strange and unnatural farragos, *for it is only when it is subordinate to nature that it bears the stamp of reason—the mistress of all earthly things.*" (*Ibid*, p. 289.)

A similar criticism is applicable to the practice of phlebotomy, and other debilitating measures, almost invariably adopted in the treatment of fever, rheumatism, pneumonia, and all kinds of acute inflammations, from the time of Hippocrates down to the middle of the present century. Sydenham thus describes the symptoms in a fever patient that guided him in the use of the lancet:—"Whenever I have to deal with a patient whose blood is in itself of a weak character (as it is for the most part with children), or else deficient in animal spirits (as it is with men in the decline of life, and youths that have long been invalids), I keep my fingers from the lancet.

Whenever, on the other hand, the state of the blood is of a different description (such as I find it amongst youths of an athletic habit and a sanguine temperament), venesection is my leading remedy. Except in certain cases it cannot with safety be omitted. Neglect it, and you run the risk of frenzies, pleurisies, and such like inflammations, which originate in the preternatural ebullition of the blood. More than this—from the excess of the blood the circulation is impeded; you smother it." (*Syd. Genuine Works*, p. 46, vol. i.)

Regarding rheumatism, he says, "As soon as I am sent for, I draw blood from the arm of the side affected to ten ounces, and then prescribe the following julep;—

R. Water of water-lilies,
Purslain-water,
Lettuce-water, āā ℥iv.
Syrup of lemons, ℥ss.
Syrup of violets, ℥j.

Mix, and make into a julep; to be taken *ad libitum*.

"The following day I order the same amount of blood to be drawn, and a day or two after, according to the strength of the patient, I bleed again. Three or four days after this I bleed for the fourth time, and this fourth bleeding is generally the last," &c. (*Ibid*, p. 256.)

If this celebrated engine of medical art has been such a benefit to mankind during the long period of 2,000 years, why has it now been so completely discarded? If it has not been a benefit, but, on the contrary, the means in many cases (as acknowledged by Sydenham himself), of weakening and retarding the powers of nature against disease, what shall we say of the accumulated experience and clinical observation (the supposed infallible instruments of medical skill), which never, during all these long years, detected its dangerous effects! Some assert that diseases have changed their character, and that we no longer encounter the sthenic symptoms which

formerly justified bleeding. If so, it is curious that those diseases should have remained so long unchanged, and that the change, when once initiated, should be so rapid as to be accomplished within the short compass of a man's life-time. It is still more curious, and perhaps somewhat more significant, to find that bleeding held its ground so long, and only so long, as the old humoral pathology was an accepted theory. As to the shifting methods of treatment, and frequent fashions in drugs adopted in these later times, it does not appear that the bills of mortality have been sensibly affected under the prevalence of any particular system of moderate therapeutics.

We have thus positive evidence of the existence, in the natural forces and organic processes of the body, of a power of healing disease, independent of all medical skill and its appliances. I have often wondered, on mere philosophical grounds, why the existence of this power should ever have been called in question. Its action is not more mysterious than the marvellous and unquestioned teleological principles on which the body was originally constructed. What guided the molecular forces during foetal development? The functions of every cell, or group of cells, of every localised bundle of tissues, and of every organ of the body, were all intended and specially adapted for the general good of the living organism. Their continued action and subsequent changes are also directed towards the same end, and continue till all the life energies of the individual are exhausted. It would, therefore, be very strange that the natural forces which guided the functions of so many different organs for a special purpose—viz., the preservation of the normal health of the organism, should cease to act in the same direction when disturbed by any foreign element. The *vis medicatrix naturæ* is, therefore, not a new principle nor a peculiar property of the human being. It extends to all living organisms. The late Sir J. Forbes, M.D., D.C.L., F.R.S., sums up his estimate of its value in the following words:—“The one great result obtained from the study of those various authorities is this—that the power of nature to cure diseases is infinitely greater than is generally believed by the great body of medical practitioners, and by the public generally. So great, indeed, is this power, and so universally operative, that it is a simple statement of the facts to say—that of all diseases that are curable and cured, the vast majority are cured by nature independently of art; and of the number of diseases that, according to our present mode of viewing things, may be fairly said to be curable by art—the far larger proportion may be justly set down as cured by nature and art conjointly.

The number of diseases cured entirely by art (of course I omit in all these statements *surgical art*), and in spite of nature, in other words, the number of cases that recover, and would have died had art not interfered, is extremely small." (*Nature and Art in the Treatment of Disease*, p. 170.)

And now we come to consider medical science in its highest aspect—viz., that of *assisting the efforts of nature* in curing diseases by the administration of whatever means or agents medical skill can suggest. This is supposed to be the special province of the skilled and accomplished physician; all others, however important to the public health in general, being considered mere accessories to the high calling of writing prescriptions in doggerel Latin. I have underlined the words, *assisting the efforts of nature*, in order to emphasise the fact that, in all morbid states, the healing powers of nature are enlisted, whether they are, or are not, able to effect a cure; and, hence, the physician can always count on their co-operation. And here I would further note that, whatever the agents, instruments, or appliances of medical art may be, they are but a preliminary adjustment of circumstances by means of which nature operates, so that when a cure is effected, or a definite result produced, the process by which this is accomplished is as much the work of nature as if the physician had merely removed the obstructing causes. There is no medical art independent of nature. The part of the physician is to bring certain animal or chemical substances into contact with the diseased tissues or the fluids of the body, the rest, *i. e.*, the *modus operandi* of the cure, is as much a mystery as any of the ordinary physiological phenomena of organic life. In the present state of knowledge of these organic processes it may be difficult to give an intelligible explanation of what really takes place in the process of removing abnormal conditions, but we cannot be far astray if we say that it is due to some chemical alteration in the fluids of the body, or some change in the functional activity of one or other of its numerous organs. The causes that produce such changes are numerous, and of varied character. Besides the effect of food, and so-called remedies, on the body, we have to consider the influence upon it of certain mental states, originating either in the brain itself or suggested to the mind by external phenomena. Thus, the salivary glands are stimulated by the scratching of a pencil on a slate, or the prospect of a savoury dish, causing, in common parlance, the teeth to water. On the other hand, fear dries them up, makes the hair stand on end, and sometimes renders the animal completely powerless. The bowels, kidneys, and

other excretory organs, are also affected by a variety of causes, such, for example, as the immediate prospect of a critical examination, the fear of losing a train, &c. A disgusting sight, as is well known, sometimes causes jaundice. Love, hope, anger, disappointment, thwarted ambition, and all other moving springs of human action, find their representation in the body by well marked physical symptoms. The influence of a strong presentiment is often the chief agent in bringing about the dreaded result; and hence, it is well said that the imagination kills and cures. Its effects are well illustrated by hypochondriasm, hysteria, and many other diseases. That music powerfully affects the moral and intellectual faculties is too patent to require illustration; and as a curative agent, in removing distressing despondency and melancholy associations, has been frequently taken advantage of, both in ancient and modern times. The ancients attached much importance to the influence of the moon and stars, and believed that a knowledge of astronomy was indispensable to a physician. On this point the medical faculty of Paris, the most celebrated of the 14th century, in delivering their opinion of the causes of the black plague, make use of the following words:—"We are of opinion that the constellations, with the aid of nature, strive by virtue of their divine might to protect and heal the human race; and to this end, in union with the rays of the sun, acting through the power of fire, endeavour to break through the mist." (Hecker's *Epidemics of Middle Ages*, p. 51.)

Another class of physical means, which are available in the healing art, comprehends such applications as water baths, abstraction or temporary displacement of blood, regulation of temperature, removal of atmospheric pressure, anæsthetics, electricity, &c. But all these influences, though curious, interesting, and sometimes valuable, as aids to the physician, are entirely overshadowed by the importance popularly ascribed to pharmaceutical agencies in the treatment of disease. These so-called remedies are derived from all departments of nature, and comprise an enormous mass of substances in the form of gases, liquids, and solids. They are administered for various purposes, sometimes with the intention of enriching protoplasm, or supplying some deficiency in the quality of blood, as when iron or its compounds, and cod-liver oil, are prescribed in chlorotic anæmia; and hence between such and food there is little or no distinction. Others, again, are observed to have some decided action on one or other of the metabolic phenomena of the body, and for this reason they are classified into groups corresponding with the organs, tissues,

or functions, which they are supposed capable of affecting, as narcotics, tonics, stimulants, astringents, alteratives, antipyretics, diaphoretics, diuretics, expectorants, &c. Excluding the former, as belonging to the category of food, medicines may, therefore, be defined as substances which have the property of modifying the actual state of the body or its functions, independent of any nutritive qualities they may possess. That many substances, when introduced into the blood, have the power of acting in this manner is an admitted fact; and this may be true, though their *modus operandi* may be obscure or entirely unknown. But, supposing a medicine is known to have the property of invariably affecting the living animal in a given manner, either chemically, physically, physiologically, or psychically—and this is a matter capable of being determined experimentally—a still higher problem falls to be considered by the responsible physician—viz., what effect will its action have on the general constitution and well-being of the individual? It is not sufficient to demonstrate that a drug possesses some peculiar physiological action; it must also be shown that this action, when induced in a diseased and enfeebled body, is to be for its ultimate good by putting something right that was previously wrong.

To prosecute the inquiry here suggested requires more practical skill and special knowledge than I can lay claim to; but, nevertheless, I am tempted to advance a few considerations which, if not sufficient as a plea for the moderate use of empirical remedies, will, at least, remove any possibility of harbouring the idea of therapeutic nihilism. And first let me draw attention to the marvellous precision and nicety with which the selective power possessed by the respective organs and tissues of the body is exercised. How each working cell takes from the circulating fluid, which continuously bathes it with a rich choice of prepared materials, what it specially needs and allows what it does not need to pass by! Thus, the various glandular cells select what is requisite for the manufacture of their proper secretions. Muscular tissue not only seizes upon the materials from which, as in a laboratory, force and heat are generated, but also the proteid ingredients necessary to keep its own proper work in repair. And so with the other tissues. Brain selects one thing, bone another, and cartilage a third, &c. Within certain limits it matters not though the blood should contain too much of these constructive materials, as they either remain harmless in the vascular reservoir, or become stored up as fat for future use. It is quite

a different thing, however, if there is a deficiency, for then the work is diminished. *No food—no work*, is an absolute rule among all the cellular communities which constitute the animal economy. When foreign bodies, such as drugs, enter the blood a general commotion ensues, and every organ, though not all equally affected, begins more or less to expel the unwelcome intruders. The result of the struggle that ensues is one of two eventualities, according to the dose administered, either the expulsion of the disturbing elements and the restoration of the organism to its normal condition, or its own complete disorganisation and death. These foreign elements act differently on the different tissues, and are probably influenced in this respect by their respective chemical constituents and affinities. Thus, prussic acid acts on some central portion of the brain substance and produces symptoms closely resembling those of epilepsy. Other narcotics are followed by various well known symptoms, such as obscurity of sight, paralysis of the muscles of voluntary motion, coma, &c. One drug is a local anæsthetic, another contracts or relaxes a muscle. It is interesting to note that narcotics, like the substances they affect, are all highly organised products, and belong exclusively to the animal or vegetable kingdom. Besides the obscure action of interfering with the metabolic processes of the body, drugs, in virtue of their chemical and mechanical properties, often play an important part in general health or disease. Acids and alkalies are neutralised by their corresponding reagents; foreign bodies are rejected from the stomach by induced vomiting; the peristaltic and secretive actions of the bowels are stimulated by chemical or mechanical irritants, with the object of expelling deleterious matters; parasites are killed and rooted out by various applications found to be destructive to the lower forms of life; local congestions are relieved by temporary derivation or displacement of the blood; and superficial inflammations are soothed by evaporating and cooling lotions. When drugs are therefore administered, with certain limitations as to quantity and frequency, their action may often be turned to good account by promoting the function of the mechanism by which they are being eliminated as in the case of deobstruents, diuretics, evacuants, &c. When, however, these ascertained limits of safety are exceeded, their action becomes too violent and injurious, and hence the same substance may be both a remedy and a poison. Taking advantage of these facts, the physician sometimes prescribes, as medicine, a substance which may not have any specific action on the diseased organ, but only the power of stimulating some other organ or organs,

with the object of lessening the work of the former, as when perspiration is promoted to relieve the function of the kidneys. The great store of therapeutic agents which constitute the remedial instruments of medical art is therefore resorted to for a variety of reasons which, so far as our present purpose is concerned, may be classified under the three following groups:—

1. Substances which have the power to relieve pain, promote sleep, or allay convulsions, or other spasmodic actions, which, if allowed to go on, might lead to secondary results of a more dangerous character. The object here is to allow nature to restore the equilibrium of the disturbed functions, or to permit of further interference by art, as in surgical operations.

2. The second group comprises such drugs as are prescribed with the intention of modifying the function of some other part of the body, though the medicines themselves may be acknowledged to have no direct action on the actual morbid state.

3. To the third group belong all remedies which act directly on morbid tissues, or are supposed, in some other mysterious manner, to remove or destroy the cause of the disease.

Although many of the objects here contemplated are sufficiently obvious, and attainable by appropriate remedies, as to require no further notice, such as the palliation of pain, and the local application of drugs to skin diseases and affections of mucous membranes, it must be acknowledged that there remains a much larger proportion of maladies over which these agencies have little or no control. In these circumstances, treatment is merely conjectural, having for our guidance neither precise indications nor positive results.

The study and classification of diseases from mere symptoms, irrespective of their pathological conditions, in conjunction with the acknowledged influence of drugs in modifying various states of the body, and producing in some instances phenomena closely resembling those of natural disease, have given rise from time to time to most contradictory theories regarding the rationale of the therapeutic action of medicines. The belief that Providence could not permit a disease to scourge humanity without also supplying the means of curing it, was as firmly fixed in the popular mind as that every poisonous plant in a field was accompanied by an appropriate antidote, a fact said to be discovered by the natural instinct of grazing animals. Of the conflicting opinions and ephemeral theories on this point, which agitated the medical schools of former days, there are only two which have come down to the present time. These are the rival theories of *allopathy* and *homœopathy*—both of which were known to Hippocrates. The prin-

ciple of the former, which, as a rule, guided Hippocrates in his practice, was epitomised in the words, *contraria contrariis curantur*, but that of the latter, though clearly discerned, was only available in exceptional cases. It was not till the close of the last century, when an ardent German visionary of the name of Hahnemann surrounded the words, *similia similibus curantur*, with a sufficiently pretentious fabric of mysticism and vaunted cures, that the medical system known under the name of Homœopathy was founded. The views of Hahnemann, when divested of their fanciful and absurd speculations, will be found to contain but one germ of truth, and that one is probably based on the acknowledged diversity of the action of drugs on the body—some acting on one set of organs or tissues and others on a different set. And even these vicarious processes may be merely the natural methods of expelling irritating and poisonous elements out of the system. Thus, arsenic and mercury, when administered in regular doses for a continued period, produce certain eruptions of the skin resembling some forms of skin disease, probably for the same reason that the virus of small-pox causes a pustule after a given interval of time. Sulphur, in the course of its elimination as sulphurous acid, irritates the pores of the skin, on the same principle that alcohol affects the epithelium of the uriniferous ducts of the kidneys. As long as the structure, organic functions, and cellular metabolism of the body were a sealed book, homœopathy was a plausible method of treatment, but, philosophically considered, its practice is only comparable to the habit of shaking a watch, when it mysteriously stops, with the hope that the agitation will put it right again. On the other hand, allopathists founded their practice on the principle of combating the phenomena of disease by striking at their morbid causes, a result which was supposed to be attained by giving something that had properties or produced effects of an opposite character. Between these theories there is little room for choice. Both may be true to a certain extent, but neither is comprehensive enough to form the basis of an exclusive system of therapy.

Regarding the treatment of disease by specific remedies, which has also elicited from time to time various contradictory theories, Sir John Forbes thus writes:—"In the earlier ages of physic, physicians, naturally participating in the notions of the vulgar, regarded the greater proportion of medicines as possessing some mysterious or special power over particular affections, and consequently placed the greater number of diseases in the class now under consideration. Overlooking

the wonderful powers of nature to cure diseases, and trusting to an experience and observation most imperfect, and beset by every sort of fallacy, they thought themselves justified in placing on the list of remedies, possessing absolute and specific virtues to cure particular diseases, hundreds of substances utterly without any power to affect the human body in either its healthy or its morbid conditions. Like the more ignorant practitioners of the present day, and the lay and amateur doctors of all times, they sought for no further verification of their inferences than the mere sequence of coincident but unconnected events—*post hoc ergo propter hoc*, the everlasting stumbling block in the reasoning of common minds.

“In all the works on practical medicine compiled previously to the last century, we see long lists of such so-called specifics ranged under the head of almost every disease; and their respective virtues set forth and vouched for, not merely on the ground of specious and subtle theory, but from the alleged evidence of the manifold and long experience of the most learned and most honest men!

“As general science made progress, and the medical art, in the hands of scientific professors, gradually assumed a more philosophical form, and observation and experience began to be more and more subjected to the dominion of a rational logic, those imaginary remedies fell, one after another, out of the armoury of physic, until nearly all had disappeared. . . . This expurgation has gone on increasing with the advance of medical science ever since, until at last it seems impossible to name even half a dozen remedies that can fairly be retained in the special or specific class.” (*Nature and Art in the Treatment of Disease*, p. 215.)

The diseases which this author mentions as amenable to specific remedies are the following six, and even with regard to them he makes the reservation that they are only generally so curable, and leaves it to be clearly understood that the medicines may have only removed “obstacles to the exercise of the restorative powers naturally inherent in the system itself.”

1. Ague and some forms of remittent fever; cured by cinchona and its salts, and by arsenic.
2. Syphilis; curable by mercury.
3. Scorbutus; curable by fresh lemon-juice, more certainly by fresh animal and vegetable food.
4. Bronchocele; curable by iodine.
5. Chlorotic anæmia; curable by iron.
6. Periosteal and other swellings on the surfaces of the

bones, syphilitic, gouty, or strumous; cured by the iodide of potassium.

The general truth of these remarkable statements of Sir John Forbes cannot be denied by any physician of long experience, and, indeed, in more recent times, this meagre list of specifics is being questioned. On scientific grounds I do not think the claim of specific remedies to a place among the rational agencies of treatment should be entirely ignored. The first two diseases in the above list are now known to be due to the living action of specific organisms or germs, and it is not improbable that the specific remedies may be excellent germicides, or antidotes to poisonous compounds secreted by these organisms during their career in the human body. As long as the pathology of itch was unknown, sulphur might be well regarded as a specific remedy, but the moment research proved that its primary cause was a small cutaneous mite, the mystery of the specific action of this drug resolved itself into a substance that had the power of killing the parasite. Chance remedies, though not impossible, are extremely rare, especially when the nature of the disease is undetermined. The secondary evils which are said to follow the continued administration of mercury may also be explained on the supposition that the destructive properties of this drug are not only germicidal, but homicidal when given in large and repeated doses. In scorbutus and chlorotic anæmia nutritive qualities are supplied by the lemon-juice, fresh meat, and iron, in which the blood was formerly deficient; and in supplying these the treatment may be considered specific. The action of iodine and its compounds may have a stimulating effect on the lymphatic and absorbent vessels, but otherwise there is no reason to look upon these drugs as specifics. At best they only assist the efforts of nature, as both syphilitic and strumous swellings disappear without any interference by medical art. The deobstruent powers of nature are well seen in the removal of extravasated blood and bloody tumours of the scalp by absorption.

I have now a few words to say on the use of antipyretics. Many drugs possess this property, especially narcotics and sedatives, which depress the vital functions by diminishing the sensitiveness of the nervous system. Pain is relieved by opium, not because the drug removes or destroys the irritating cause, but because it stupifies the nerve centres and renders them less cognisant of the morbid changes going on at the seat of pain. Hence, when the nervous system is in this condition, the entire metabolism of the body is disturbed and

functional processes are arrested, the continued exercise of which is essential to the welfare of the organism. The main question then is, When, or in what circumstances, are these abnormal pyrogenous conditions to be attacked by antipyretic drugs?

The primary source of all energy in the animal economy is food which, in the shape of highly organised products, previously elaborated by solar heat and other constructive forces, contains this in a latent form. The total income of this potential energy is converted by the metabolism of the body into heat and mechanical labour—about four-fifths being expended in the production of the former. The long well known theory propounded by Liebig—viz., that nitrogenous food went to build up the proteid tissues, while the non-nitrogenous or carbonaceous was exclusively used for calorific purposes, is no longer tenable, as it is now proved that heat is generated by the oxidation of all the tissues of the body, no matter what their composition may be. Heat is thus eliminated wherever 'metabolism of protoplasm' is going on, as in muscular contraction, glandular secretions, molecular changes in brain substance, &c. Thermogenesis is, therefore, coextensive with the oxidation of food, wherever this takes place, whether in the digestive organs—where its organised products are prepared for their final distribution, or in the act of supplying the tissues themselves *in situ*. When molecular nutrition is completed, the heat set free is lost to the body, chiefly by means of conduction and radiation from its surface, and evaporation of the aqueous secretions from the skin and lungs. Although the production of heat thus varies, within certain limits, according to the functional activity of the body, and its dissipation is also variable and, to a certain extent, dependent on external circumstances, it is singular that in health the temperature of the body neither rises much above nor falls much below a fixed standard. This standard is so uniformly maintained that a change of even one degree above or below the mean or normal temperature is considered sufficient proof that some unusual influences are at work in the organism. Hence there must be some kind of compensating mechanism which equalises the quantity of heat retained in the body; and the sensitiveness with which it acts may be estimated from the fact that the above limits are hardly ever exceeded by active exercise, sudden changes of temperature in the external environments, or, indeed, by any combination of the ordinary conditions of life; so that practically the temperature of the human body remains the same among all nations in all parts of the habitable globe.

The great regulators of animal heat are the vaso-motor nerves, which act by increasing or diminishing the cutaneous vascular areas. By this means the blood, in greater or less quantity, is exposed to the surface, and the surplus heat is given off or retained according to the requirements of the system. When the increment of heat is due to muscular exercise, as in the act of running, the special nerves of perspiration come into play, and the skin perspires freely. The evaporation of this water quickly absorbs heat, and so helps to neutralise its increased production. Under the influence of great external heat, the cutaneous vessels become quickly enlarged, blood flows freely to the surface; and, hence, as long as perspiration goes on, the temperature remains nearly normal. But besides this peripheral mechanism which, so far, only acts like the safety valve of a steam boiler, there are various considerations which have led physiologists to believe in the existence of some central nervous mechanism which tends to regulate, not only the production of heat and the maintenance of the normal temperature in health, but its abnormal variations in disease.

As the high temperature in fevers and inflammatory diseases is proved to be due, not merely to a derangement of the compensating functions of the skin and vaso-motor nerves, but, in a still higher degree, to an increased production of heat (and of this there can be no doubt as there is a corresponding increase in the consumption of oxygen and the production of carbonic acid), it becomes a question of the highest importance to the practitioner to determine its primary cause. And this production of heat is always a concomitant of inflammation whatever its exciting causes may be, whether a mechanical, chemical, or physical irritant. It is well known that the injection of leucin, pus, or septic materials into the blood, produces inflammatory symptoms; and it is now demonstrated, as I have already pointed out, that many epidemic diseases are entirely due to micro-organisms, which live as parasites at the expense of the tissues or blood of the unfortunate individuals afflicted. It has also been shown by Pasteur and others, that many of these microbes can exist quite independently of a supply of free oxygen from the atmosphere, preferring, indeed, to decompose the tissues in which they live for the sake of their oxygen. May not the ammoniacal products thus set free become a secondary source of poisoning?

In further prosecuting this inquiry, we are overwhelmed with difficulties. Does this high temperature, which we have just seen to be an invariable symptom of so many diseases,

proceed from irritation of the nerve centres, which are supposed to regulate the warmth of the body, or from actual accumulation of heat owing to a derangement of the cutaneous mechanism which prevents it escape! Or is it due to a thermogenic poison in the blood? Or is it a concomitant of the life functions of these anærobic microbes? I am not aware that any physiologist has answered these questions in so full and satisfactory a manner as to assign to each of these probable factors its proper share in the elevation of temperature in disease. Until this is done I hold that antipyretics should be used with much greater caution than is now the fashion. Not only are we ignorant of the exact primary causes of the increased temperature, which may be different in the different diseases, but we are ignorant of nature's intent, so to speak, in so invariably resorting to it. That it is used in some way or other as a means of defence, and forms part of the general plan by which the disturbing elements are being eliminated, is quite probable. In epidemic diseases, where the disturbing element is some chemical compound—the result of the vital action of micro-organisms, which would poison the system unless quickly eliminated—we see a probable field for rational therapeutics, as well as an explanation of the injurious effects of administering drugs which have a tendency to diminish the function of the excretory organs. Granted that quinine has some special influence on ague, and that it both shortens the attack and mitigates the suffering of the patient, does it for this reason follow that it should be prescribed in every case of disease that shows a considerable rise of temperature? Further, to say that the dose must be increased in proportion to the increase of heat is both illogical and irrational. So far as scientific research has gone, it points to the conclusion that the functional activity of different species of microbes produces different kinds of chemical substances. Of this the different kinds of fermentations afford some striking illustrations. According to recent investigations, the microbe of yellow fever has been discovered, and its function proved to be the secretion of an "alkaloid of a special character which resembles ptomaines, and acts on the organism as a violent poison." (*Brit. Med. Jour.*, 29th November, 1884.)

The rapid circulation immediately following increased muscular action, and the consequent additional production of heat, is quickly followed by cutaneous perspiration which carries it off. If we, therefore, follow nature's indication, one method of lowering the temperature ought to be by facilitating perspiration. This is the special physiological action of

salicin and its compounds, which act by causing a temporary paralysis of the vaso-motor nerves, and the special nerves which regulate the opening and shutting of the cutaneous pores. The physician rejoices when he finds the skin of a fever patient moist and soft; and this change is always coincident with a fall in the temperature. As long as antipyretic medicines are confined to moderate limits, such as aiding the clearly defined indications of nature, I believe they are capable of doing good, but when they are pushed to the extent of enfeebling, if not paralysing, the entire metabolism of the body—a result which I have often seen—I am equally satisfied that they do harm and greatly lessen the chance of recovery. On this subject I quote the following words from a speech of Professor Gairdner, at the last General Meeting of this Association. He said that “He could by no means admit that the one object of treatment in an acute disease was to keep down the temperature by hook or by crook. It was impossible to regard the human body in an acute disease as a mere mass of overheated tissues, or to suppose that, by merely cooling it down outside, one could restore health and function when otherwise fatally disabled. When it was said that one must absolutely cool down the patient till it became necessary to give him stimulants to set him up again, he thought that the limits of safety in antipyretic practice had probably been exceeded. When it was said that, failing the cold bath, it was necessary to give enormous and repeated doses of quinine; and, failing these, enormous and certainly dangerous doses of digitalis, aconite, and even veratria, with the single object of getting down, and keeping down, the temperature, in diseases certainly admitting of fairly successful treatment without nearly so much interference, he confessed that he had thought that the practice of medicine was running in a wrong direction, that they were likely to have the story of the past repeated once more—a time of energetic and active practice (so-called); that is, of extremely powerful, and in some cases dangerous and even poisonous remedies, so advocated as to make them appear indispensable, and to place them, as such, in the hands of every one all over the country. A system of that kind was very likely to run into abuse, and he could not, as a teacher of medicine, countenance it without considerable reservations.” (*Brit. Med. Jour.*, 6th December, 1884.)

Having now exercised our critical privilege to the extent of dethroning medical art from the divine position assigned to it in the earlier ages of the world's history, and rejecting all its hereditary theories and empirical doctrines, as affording

no rational grounds for the blind confidence placed in the curative powers of drugs, it remains to be asked, What are the principles, if there be any, which guide medical men in the treatment of disease? What is the *raison d'être* of the *ars medendi*? In the absence of positive indications from theories as to the nature of disease, must we consider each disease on its own merits, and, having dismembered it, as it were, treat its individual symptoms? If there is no consensus of agreement on these preliminary points, there is still less about the means by which the proposed curative ends are to be attained. Are we, therefore, to conclude that medical practitioners of the present enlightened era are like the Israelites of old when, having sinned against God and forsaken the ways of their fathers, "every man did that which was right in his own eyes." Considering the diversity of opinion that may probably exist among my medical *confrères* on these problems, it may be advisable to lay some phases of their solution before you in other words than mine. I will, therefore, adduce written evidence from two distinguished authors and teachers of medicine, and I select these, not only because their opinions appear to me diametrically opposed, but because they both happen to have expressed them at the same time. The first extract is from the writings of the late Professor Niemeyer, whose text book on medicine is largely used in this country; the other extracts are from medical addresses by Professor Gairdner, of Glasgow.

"My outspoken assertions of ten years ago have come true. I then denounced the error of postponing all medical treatment of disease until our knowledge of the action of medicines, and our insight into pathological processes, should be so far advanced that means of cure would be self-evident. I pronounced this ideal goal to be unattainable, and declared it idle to hope for a time when a medical prescription should be the simple resultant of a computation of known quantities. I lamented that physicians, instead of striving to promote the healing art by their own efforts, should seek aid from the institutes of physiology and pathology, or from the laboratory of the chemist, obtaining now and then an ingenious suggestion, but never gaining an idea serviceable in the relief of an afflicted fellow-creature. I further showed that experiments made with medicaments upon the lower animals, or upon healthy human beings, with all their scientific value had, as yet, been of no direct service to our means of treating disease, and that a continuation of such experiments gave no prospect of such service. I finally declared, without reservation, that

even the dazzling progress which pathology had made, had been of but little use to therapeutics; that, in spite of new discoveries, our present success at the bedside is scarcely more favourable than that of 50 years ago; nor in the future would pathological investigation promote therapeutic success, unless directed more in accordance with the requirements of general medicine than has been done hitherto." (Preface to *Text Book on Practical Medicine*, 7th edition, 1876.)

On the other hand, Professor Gairdner writes as follows:—
"The art of medicine is at this moment in a peculiar position. The day of *orthodoxies* is over, the day of *real science* is only just dawning. It is no longer possible to condemn a man, even by implication, for having ceased to believe what our fathers believed; but it is extremely difficult to state in general terms what we believe ourselves, and still more difficult to forecast the future, and to lay the foundations of the faith of our successors. . . . When we try to express in definite words the beliefs under which we act in our daily practice, how much there is of imperfect knowledge, how little of secure and clearly defined conviction! Is blood-letting useful in pneumonia or in apoplexy; and if so, in what cases, and to what extent? Are alcoholic liquors useful in fevers, under what circumstances, and to what extent? What is the cause, and what is the preferable treatment of acute rheumatism? Is mercury to be given in pericarditis, or other acute heart disease? Or in syphilis, and if so, when and how? Are diuretics useful in Bright's disease, and when? Is opium needful in delirium tremens, and when? How would you treat acute dysentery? with calomel, or leeches, or ipecacuanha, or opium, or with none of these? How would you treat cholera? with opium, or with purgatives, or with neither; and if with either, in what cases and under what conditions? Who does not feel that in most of these instances questions have been started in which the old orthodoxies have been rudely shaken within the last twenty years, and in which nothing more definite or fixed can be alleged as having come in their place? Who does not feel that to set up a new creed in any of these particulars now would be to insult the dignity of science, and to do incalculable injury to the cause of truth? For in almost every one of these instances the wise and skilled physician, of fully formed experience, has profited largely, and his patients have profited still more, by the destruction of authoritative beliefs involved in most of these questions."

Professor Gairdner, writing subsequently with reference to the address from which the above quotation is given, says—

"The sixteen years since these words were written have been years of immense activity in research, and very much of what has been done in them tends, at least, to fulfil the promise of a medical art of the future founded not on mere hypothesis, still less on dogmatic statements fortified by authority, but on accurate, continuous, and patient demonstration of fact. In the first place, the art of diagnosis is constantly being improved by the introduction of new methods; and the basis of all these methods consists in this, that diseases hitherto quite obscure, or called only by their conventional names corresponding to their most obvious symptoms, are being daily defined and rendered into much more exact conceptions in the light of an improved physiology and pathology, resting on observation and experiment. . . . Every day and every year removes us farther from the period when it is possible merely to make chance hits in therapeutics, and so, by an individual happy thought, or particular prescription or nostrum, to compete with those who are investigating cautiously and experimentally the result of remedies in disease." (*Medical Education, Character, and Conduct*, p. 20, *et seq.*, Addresses 1866 and 1882.)

From whatever standpoint these authors contemplated the phenomena of diseases and the means of curing them, it is impossible, by any process of levelling up or levelling down, to reconcile their teaching. Professor Niemeyer actually laments that physicians should seek aid from the institutes of physiology, chemistry, pathology, and the results of experiments made on healthy man or the lower animals. By the most liberal interpretation of his doctrines, scientific medicine would be made to hang exclusively on accumulated experience and clinical observation, or, in other words, on rational empiricism. Ignorant and indolent physicians may take shelter under the cloak of an art that pretends to penetrate the secrets of nature without the trouble of understanding or investigating her methods of action, and gives scope for a belief in an acquired empirical skill to cure diseases and meet all their critical emergencies in the most satisfactory manner, with no higher philosophy than is involved in the oft-proved fallacies of the *post hoc ergo propter hoc* argument; but, for my part, I cannot, and will not, endorse pretensions that are so contrary to the spirit of research which, in other departments of natural science, has so signalised this century by its marvellous discoveries. Nor must it be forgotten that empiricism, sometimes of the most rational kind, and clinical observation, have both been coeval with the earliest development of medical art; and, in the hands of such acute philosophers as the Greek physicians,

headed by the immortal Hippocrates, we have an example of the utmost they were capable of doing till a further expansion of natural knowledge took place. But whatever their value may be as means of investigating disease, they are not discarded by the methods of study and research advocated by the scientific school of progressive medicine.

In summarising from these scattered thoughts with which I have attempted to delineate the scientific principles that underlie the medical art, and link its various instruments and appliances with the common substratum of the ascertained truths of natural science, the following are the categorical conclusions arrived at:—

1. The keen, persevering, critical, and deep insight cultivated by trained observers in the study of natural phenomena and their bearing on the various phases of organic life is fast extending to medical science; and already, not only have its methods of investigation been improved and extended, but many of its antiquated cobwebs have been brushed aside. Hence, many of the past medical landmarks, though professedly founded on observation, confirmed by experience, and backed by the authority of great names, have been found, when subjected to the searching light of modern research, to have no foundation in fact, and are consequently rejected. All the phenomena of disease are connected with material causes; and must, therefore, be referred to the same biological laws which regulate organic life in health. Diseases are as much the product of natural laws as health.

2. One of the first fruits of this far-reaching philosophy is the foundation of the science of preventive medicine, which aims at the discovery and destruction of the physical causes of disease, as it were, in embryo; and the benefit already conferred on humanity by its legislative enactments, in the actual saving of life, is incalculably greater than all the other achievements of scientific medicine; and yet it is the one department of the medical profession whose students are most neglected, and for whom there is no adequate remuneration.

3. The special province of the physician, however, is not the prevention of disease, but its treatment. This necessitates, as a mere preliminary step, not only an accurate knowledge of the normal phenomena of the human body, its cellular, nutritive, and chemico-vital processes, and the functions of its various organs, and how far the operation of one organ relieves that of another, but also a corresponding acquaintance with the abnormal symptoms excited by the various diseases, their primary causes, progress, duration, and natural termina-

tion, the therapeutic and physiological action of drugs, and the processes by which poisonous and foreign elements are eliminated out of the system. The object of all treatment is to assist the curative efforts of nature; and the prudent physician must be rationally satisfied, under the full light of scientific investigation, that his plan of interference is not opposed to that of nature or, if so, that it is superior to it, and will be for the ultimate good of the sufferer. Treatment may be directed towards a variety of objects, as the removal of causes, palliation of suffering, establishment of favourable hygienic conditions, and the stimulation of the function of one organ, or the abatement of that of another, &c., according to circumstances. One poisonous element is removed through the skin, another through the lungs, kidneys, or bowels, and a third may be counteracted or destroyed by drugs. The discovery of remedial agents is greatly assisted by a knowledge of the nature and properties of the injurious substances to be removed; hence the trial of suggested remedies, within safe limits, is to be commended in proportion to their scientific reasonableness. As an illustration, we would say that experiments, directed towards the discovery of a remedy for small-pox, would be more likely to be successful now than when we were ignorant of the fact that this disease is due to a specific micro-organism. Without, therefore, altogether rejecting this suggested, or rational, form of empiricism, it must be acknowledged that, to whatever extent it may be carried, all treatment founded upon it should ultimately be explained by natural laws.

4. If it be true that scientific medicine is dependent on our knowledge of the laws and phenomena of the immediate and collateral sciences which regulate human life, it follows, that the field of action for medical practitioners is almost illimitable. It not only affords abundant scope for all kinds of manipulative research in physiology, pathology, and therapeutics, but involves the consideration of logical deductions requiring the exercise of the highest intellectual faculties. To ascertain and describe the exact influence of a given drug on a highly developed organism like the human body is, in my opinion, one of the most profound problems that can be submitted to the ingenuity of man. The power of observing correctly is a logical faculty which, when applied to the complex phenomena of life in health or disease, requires much training, knowledge, and experience. To a marked defect in medical education on this point, and the proverbial proneness on the part of the public to believe in sensational cures, must be ascribed most of the defects, pretensions, impostures, and quackery still prevalent in the medical profession.

