The doctrine of evolution in its application to pathology / by William Aitken.

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THE

DOCTRINE OF EVOLUTION

IN ITS APPLICATION

TO

PATHOLOGY.

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CORRECTIONS TO BE MADE IN TEXT.

Page 1, line 5—for "Surgeons or Probationers," *read* "Surgeons on probation."

Page 6, line 20—for "specifise" *read* "specificise."

Page 17, line 12 from bottom—for "*unlimited*, variability," delete , and *read* "*unlimited* variability."

Page 22, line 20—for "volution" *read* "evolution."

Page 45, line 8—for "proves" *read* "probes."

Page 49, line 7—for "*morli populairs*" read "*morbi populares.*"

Page 86, line 12 from bottom—for "contributions" *read* "combinations."

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DARWIN'S DOCTRINE OF EVOLUTION IN EXPLANATION OF THE COMING INTO BEING OF SOME DISEASES.

By WILLIAM AITKEN, M.D., F.R.S.,
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INTRODUCTORY.

THE series of papers under the above heading, which the writer is privileged to publish in the pages of the *Glasgow Medical Journal*, owe their existence to the necessity of finding a suitable topic for an address to young medical officers who, as Surgeons on Probationers at Netley Hospital, are about to commence their specific course of life in the British and Indian Military Medical Services of the Queen.

It occurred to the writer that, taking a subject which had much interested himself and many others in the profession both recently and in the old times before us, he might be able to present it in such a way as to induce them to look at various pathological questions from a comparatively new standpoint, different from that which they had been accustomed to during the short medical curriculum they had passed through to qualify for practice, when the time at their disposal did not permit them the opportunity even to think about them.

By the selection of a topic such as the following pages concern, he hoped to awaken in young, ardent, ingenuous, and impressionable minds a desire to work out for themselves various philosophical problems in pathology which the nature of the services they were about to join would give them not only leisure to study and work out, but would give them also opportunities which cannot be surpassed, in many climates and in many lands, to add to our knowledge in the direction hereinafter indicated, and of which the merest outline could only be given in a short address.

Pathology is a growing science, and its subject matter is extremely varied. "It must study disease on many sides—the side of its anatomy and its physiology—of its geography and ethnology—of its history, and of its natural history."

In the several editions of *The Science and Practice of Medicine*, the writer has dwelt much upon the necessity of specially investigating *doubtful* or *anomalous* cases of diseases, and especially of *fevers* commonly so called. These require careful methods of investigation. They are of the utmost importance to science and to our knowledge of diseases, so that extended information regarding them will either connect them with forms of zymotic diseases between which they seem to stand; or these *anomalous* cases will eventually separate themselves into distinct forms whose history is still unknown.

There is also the long standing question of the *de novo* origin of diseases, "concerning which, even if we are satisfied that the cases we may see are, in a sense, of *de novo* origin, we are still only at the entrance of one of the most important problems concerning the disease. A particular house, hut, or camp-tent having in it a case—say of enteric fever or of cholera—wherein do such particular habitations differ from the multitude of apparently similarly circumstanced habitations that have no fever or other ailment in them? And what are the circumstances of to-day that have produced the fever to-day, and that did not produce it six months ago? There must be differences, or the effect would not be different. The nature of these differences, however, is, for the present, beyond our present knowledge; and it is by the study of *differentiating circumstances* in cases where we can exclude antecedent occurrence of disease that we may best hope to discover the nature and affinities of the fever."*

By following such directions and methods of research as are suggested by a study of Darwin's theory of Evolution in explanation of the *coming into being* of various types of disease, constitutional and zymotic, the writer would indicate in these pages a standpoint from which to view diseases, which military medical officers have peculiarly favourable opportunities for investigating, and for increasing our knowledge of pathology regarding the special topics with which these pages are concerned.

"Is there any thing whereof it may be said, see, this is new?
It hath been already of old time, which was before us."—Eccles. i, 10.

* Dr. George Buchanan "On Some Directions for Scientific Work." *Medical Times and Gazette.* 30th October, 1875.

Section I.—*Questions for Special Inquiry.*

From information I have received from each of the fifty surgeons on probation assembled, to commence the fiftieth Session of the Army Medical School, and which is presumably authentic, I am in a position to say that your united ages amount to the sum total of 1,187 years, which gives for each of you an average of over 24 years—that the youngest of you is rising 22, and the oldest is rising 28.

That being so, about two years before the oldest of you was born, and eight years before the youngest of you made a similar advent—*i. e.*, just about thirty-one years ago, a war commenced between Russia and this country, when a British army of 25,000 men was landed at Gallipoli unprovided with field equipment, with no medical comforts, and the sick having only one blanket each, with a thermometer at night standing at 28° Fahr. No army ever took the field worse provided; and ever since that time, during the past 30 years, the state of the army and its organisation has been constantly before the public either by details in despatches or in private letters from the seats of many small wars, by speeches and questionings in Parliament, by reports of numerous and varied commissions, by boards of Parliamentary inquiry, and such like, the main object held in view as the aim of such attentions being to devise rules and regulations for our military service, embracing the functions of the medical staff, as most immediately concerned with preserving the health and prolonging the life of the soldier; and in these functions you will be prepared here for taking your part. The close of that war, commonly called the Crimean war, "was an event which proved the turning point in the health history of armies." During the past 30 years (while each of you has been growing up to man's estate) we have had a succession of wars of greater or less political importance, in the conduct of which the lessons learned from a dearly bought experience have been of the utmost value to military hygiene.

The conduct of the Crimean war, and of all the campaigns in the last decade of the eighteenth and the first 15 years of the present century was such that a very large proportion of the men engaged in them perished from causes which are not considered to be the necessary or unavoidable results of war. But we know that history is apt to repeat itself, especially in disastrous errors, so that the same question often repeats itself —namely, "Must what happened in these historic campaigns of the past and present century necessarily happen again?"

The great success which has attended the working of the army medical staff under its new organisation, as shown in the campaigns in Afghanistan, South Africa, Egypt, and the Soudan, warrants the hopeful belief that such unfortunate disasters are beyond the possibility of repetition;—that we are not likely again to hear of a British force being set down in a foreign land so unprovided for as was our army when it landed in Gallipoli in 1854; that the success which has attended the recent good work in Egypt and the Soudan imposes upon you and those who come after you the obligation of maintaining the high reputation which the medical staff has acquired under the present administration of its experienced chief; and of increasing the efficiency as well as the professional and scientific character of the service, so that it always shall be as it has been heretofore—"*a very present help in time of need.*"

There is a power in the human race "whereby the present ever gathers into itself the results of the past;" and you are here on probation to learn the lessons which have been gathered from the costly experiences of past times, which will be variously formulated for you by my colleagues, as they explain how an army is to be maintained in health in times of peace and of war; by what rules and principles you are to be guided in the discharge of your functions as an important part of the military machine, so as to prevent losses which are preventible, and which occur from sickness rather than from injuries received in the fight. "War pestilences are the real enemies with which the general and his soldiers have to contend." The military enemy they meet with in battle does comparatively little harm; and the first principle to be acknowledged as a guide, alike for the military commander and for the medical officer, is "that the sanitary care of an army is an essential part of strategy in all the operations of war, and that it demands knowledge of a special kind with prevision and preparedness, based on that special knowledge."

The records of history further teach us *that* it is not till long after a war has ended that the darker stories of famine, disease, and death, with all their harrowing details, become known to the world, and then mainly from medical journals and the periodical newspaper press; and also that there are many things concerning wars and campaigns which we never know. The great mortality, for example, that attended the expedition to Walchern in 1809-10 has never yet been explained as it might have been. An eminent provincial

medical man of that time—Dr. James Clarke, Physician to the General Hospital at Nottingham—called special attention to the cases of fever from this ill-fated expedition which he had under his care in the civil hospital of that city. His notice of them in the pages of a medical journal * struck a far-resounding keynote when he wrote that—"It certainly will be of great national advantage if the medical men who attended our army in Zealand, and since their return to this country, present the public with information on the following very interesting points of inquiry:—

"(1.) Topographical accounts of the different situations which the troops occupied, and in what manner they were accommodated.

"(2.) History of the disease at each of these stations, arranged as much as possible on a similar plan to afford a facility of comparison.

"(3.) The causes producing the disease, and whether referrible to one or to many combined. Whether the bodies of the soldiers were predisposed by previous hardship in Spain, or by any irregularity of diet, or by want of proper clothing on the expedition.

"(4.) Did one situation induce the intermittent and another the remittent fever; or were they considered degrees of the same disease, the former passing into the latter when most violent, and becoming again intermittent at the close of the disease? Or did this depend on constitutional disposition?"

These are questions which embrace a most comprehensive pathology; but they never have been, and are not likely ever to be replied to now as regards that particular campaign. Nevertheless, they may still be put *mutatis mutandis* as to the diseases which may befall our troops on foreign service, such as now in the Soudan, and generally in tropical climates. Therefore they are questions which continue to call for the attention of those like you, who in time to come will have the opportunities and the competence to answer them. Moreover, they embrace topics which eminently pertain to the subject matter of this series of papers.

The scope and methods of pathological investigation have vastly extended since the Walchern days, and the aspects of pathology "are so constantly changing that a single year's work brings us a multitude of new and often puzzling facts; and although the issues are of the most momentous kind, not

* *Edin. Medical and Surgical Journal* for July, 1810, p. 262.

even the wisest and most judicial minds in the profession can always see their way to a clear and definite opinion.*

Hitherto you have been learning how to diagnose diseases and to differentiate them one from another; and these functions will continue to be of very great importance for you to discharge *with the utmost care.* It appears to me, however, that more attention than heretofore must be given to differentiate more definitely the innumerable determining factors which combine to produce diseases, and that more attention must be paid to the *processes of disease* than to its *products,* and to the dynamic changes which precede the structural ones in the patient. Individual diseases must be traced more closely to their sources, so as to prevent the concurrence of factors which may originate them, and your attention must be ever alive to the sum total of circumstances preceding and surrounding the soldier's life, which are the determining factors that bring about his ailments.

The tendency of pathology during the past century, and especially since the days of Louis and Laennec, has been "to *specifise* diseases, and so to advance our knowledge of them by insisting on details in symptoms, and in the appreciation of minute differences."† So much has this tendency to individualise diseases prevailed, that it was at one time held that no two specific diseases could co-exist in the same person. But gradually this position has been shown to be untenable, and we are more and more forcibly reminded, by an accumulation of experience, that numerous disorders come before us as *anomalous cases,* in which disease, it is said, "does not breed true"—in which hybrid or nondescript symptoms are developed. Such "anomalous cases" do violence to our cherished theories, belie the descriptions of typical diseases in our text-books, and defy our best classifications of them—even that of the Royal College of Physicians of London, which has just completed a second effort in this direction.

Nature (as the aggregate action and product of many natural laws or ascertained sequences of events,‡) will have none of the hard and fast lines laid down in definitions of diseases such as our text-books and systematic treatises contain, nor will she always conform to the classifications of

* Dr. Charles Creighton "On the Autonomous Life of the Specific Infections."—*Brit. Med. Jour.*, 4th August, 1883.

† W. T. Collins, M.D., B.S., B.Sc.Lond., *Specificity and Evolution in Disease*, 1884, p. 2.

‡ *Variation of Animals and Plants in the State of Domestication.* 1868. Two vols. Vol. I, p. 6. By Charles Darwin.

Royal colleges. Her regularity is "the first postulate of science; at the same time, along with this regularity there is a vast amount of irregularity with which, as yet, science cannot deal."

All organic existences possess an inherent tendency to vary. "The world, as we see it, is full of changes; but these changes are found to be subject to invariable or almost invariable laws —the *law of variation*, which it is the aim of science to find out in all its departments," * and medicine is no exception.

We must therefore recognise this fact as regards diseases, that while uniformity is general, it is not universal. Hence it comes that, in our present state of science, our standard text-books and classifications do NOT embrace the whole phenomena of diseases; and in spite of the influence of even such precise and definite objects (seen or imagined) as "germs," "bacilli," or "bacteria," which have been identified or associated with numerous diseases, the hitherto accepted doctrine of the specificity of disease must to some extent be modified. But the modifications I am about to suggest as necessary are not at the instance of the bacillary discoveries which have been so extensively announced in recent years, nor at the instance of the varied hypotheses based upon these recorded discoveries, which involve so many points of contention. "While some of the points of contention appear to be proven, others are only probable, and they are neither universally nor unconditionally accepted. The exclusively causal agency of bacilli in the diseases with which they have been associated, although extremely plausible, is not conclusively proved; and a great number and variety of experiments of contrast are yet needed to satisfy a just scepticism." †

And, however difficult it may be (as confessedly, *it* IS difficult) to look at whole classes of facts *from a new point of view*, we must, nevertheless, sometimes make the effort, and endeavour to look at the causation of diseases from a higher standpoint than we have hitherto held. We must learn to expand our ideas so as to differentiate more efficiently the concurrent factors which make up the sum total of those surrounding circumstances and antecedents of life's history which produce diseases.

* Dr. Temple in *Bampton Lectures for 1884.*

† Sir Andrew Clark, Bart., M.D., Lumleian Lect.—*Lancet*, 4th April, 1885.

Section II.—*Darwin's Doctrines of Evolution in relation to Pathology.*

In our efforts to do this, we may, with advantage, recognise as a working hypothesis, Darwin's great doctrines of evolution as specially competent to account for the "coming into being" of some diseases, and as ruling and directing what we have hitherto called "specificity" as applied to them. It is only by the recognition of such a working hypothesis as that of evolution that we can account for the many "anomalous" cases to which I have referred—such cases as will not approximate or conform to our well known standard types, as described in text-books. But any medical treatise or classification to be complete must provide for such exceptional, anomalous, or nondescript cases, and while fully recognising the power and influence of some specific diseases to propagate their specific progeny by direct transmission as heretofore, we must also, I think, recognise the power and influence of evolution as competent to generate or call into being some diseases hitherto unrecognised otherwise than as nondescript or anomalous cases.

The doctrine of "specificity" in disease has hitherto ruled all pathology and therapeutics. It has been the key of medical science (Trousseau). But just as Darwin's theory of evolution goes beyond specificity, so in its application to the evolution of diseases it must to a certain extent swallow up the lesser and older theory, as it rules and directs our notions regarding the evolution and development of some of them.*

"The intellectual movement to which the impulse was given twenty-six years ago by the true English naturalist, Charles Darwin, in his celebrated work on *The Origin of Species*, has, within this short period, assumed dimensions which cannot but excite the most universal interest. As part of a universal theory of development, Darwin's scientific theory, as set forth in that great work, embraces in its vast range the whole domain of human knowledge; and this immense extension of our intellectual horizon must be looked upon as by far the most important and rich in results among all the numerous and grand advances which natural science has made in our day.† Darwin's account of *The Origin of Species* "has revolutionised our modes of thought in every department of

* Collins, *l. c.*

† *The History of Creation.* By Ernst Haeckel. 1876. Vol. I, p. 2.

mental activity." * "It is, indeed, a question whether there is a single modern work of any worth, on any subject whatever, on mind or matter, that is not the better for what Charles Darwin has done." † "His doctrine of evolution binds all existing things on earth into one, so that all things are embraced in one great design, beginning with the very creation." ‡

In scientific investigation it is permitted to invent any hypothesis; and if it explains various large and independent classes of facts, it rises to the rank of a well grounded theory. Such an hypothesis as that which Charles Darwin has expressed by the term "natural selection," or as Herbert Spencer has expressed by the phrase "survival of the fittest," has been put to the test of trying whether it will explain the geological succession of organic beings, their distribution in past and present times, and their mutual affinities and homologies. Finding that it does explain these things and stand this test, it has now assumed the rank of a theory—"The Theory of Evolution."

But although, with regard to pathology, the use of the terms "natural selection" or "survival of the fittest" would be altogether inappropriate as hypothetical terms to be used in explanation of the continuous evolution of diseases, yet the conditions of life are such that we may fairly adopt the hypothetical expression, "elective affinity" in the constitution of the race or the individual towards certain causal and concurrent factors of disease rather than to others, as determining whether or not any new disease might thereby be established on the one hand, or might be within the power of man to exterminate or stamp out altogether on the other.§ And if this principle, shortly embraced in the term "elective affinity" in the constitution of the individual or the race towards certain causal and concurrent factors of disease rather than to others, will explain large bodies of facts in pathology regarding the origin of diseases which hitherto have not received any satisfactory explanation, then the theory of evolution which it embodies may perhaps be received as explaining to some extent at least the "coming into being" of some diseases.

It so happens that, during the past ten years especially, a

* Dr. Lauder Brunton.
† W. K. Parker, F.R.S., *On Mammalian Descent.* 1885. P. 216.
‡ *Bampton Lectures*, 1884, Dr. Temple. Page 122.
§ Compare Charles Darwin, *Animals and Plants under Domestication.* Vol. I, p. 6.

vast array of cases and of facts in pathology and clinical medicine have been brought together by many experienced and observant men, which warrants a reconsideration, *at any rate*, of those concurrent factors which result not only in the evolution of some constitutional or inborn diseases, but also in the origin, development, and propagation of some of the zymotic diseases, viewed from a new standpoint, which shall be suggestive of a modification of our notions hitherto held regarding specificity in diseases to the extent that I have just indicated. Such variations in disease should be studied as Darwin studied the varieties of species; and "in the pursuit of new knowledge, his method ought to be a model to all." Sir James Paget tells us, from personal knowledge of the man, that Darwin would have studied these things "not by deduction as from a law exactly formulated, and from which he could trace the course of every change, but by a most careful collection of facts, and by a study as complete for every case as if no law of evolution had ever been discovered." *

The present Bishop of London, Dr. Temple, in his eloquent Bampton Lectures for 1884, has fairly and well described Darwin's theory "as resting on two main pillars, namely—(1.) The transmission of characters from progenitor to progeny. (2.) The introduction of minute variations in the progeny with each successive generation."

The former of these may be said to be well established; and we recognise it as a law of life that all plants and animals propagate their own kind. But the latter of these main postulates has, as yet, been hardly examined at all. Each new generation shows special slight variations. But what causes these variations? and what determines what they shall be? In Darwin's investigations these questions are but slightly touched upon, beyond the statement of the fact that "the varied conditions of life induce variability." The variations are treated as if they were quite indefinite in number and in nature. "As accomplished facts Darwin concerns himself only with the effects of these variations *after they have appeared;* and while some of these variations are advantageous, some are hurtful to life. Hence we are bound to look not only to the effects of variation, but to their causes."

The same method and argument hold good regarding diseases. We must look to the causes of *variations*. They cannot be due to something *only* in the progenitors, or otherwise the variations would be all alike, which they are not.

* Bradshaw Lecture. *Lancet*, 16th December, 1882.

They must therefore be due to external circumstances, the antecedents and surroundings of the individual. The very slightest variations may be the outcome of the action of the surroundings upon the habit of the animal body—by the food, by the temperature, by the climate, by the soil, by the numerous and varied accidents of life in the progenitors; so that these and other such like factors being taken into account must gravely modify the conclusions which we draw concerning the ancestry of any species now existing alike in animals, in plants, and in their diseases. If we try to trace things backwards, Darwin's investigations have made it exceedingly probable that the vast variety of plants, of animals, and of diseases have sprung from a much smaller number of original ancestral forms than now exist; and the unity of plan which prevails and pervades any great class of animals, or plants, or diseases seems to point to unity of ancestry, alike in them and in their diseases.

Section III.—*Basis of the Argument for the Doctrine of Evolution as applied to Pathology.*

As a basis of argument in support of the doctrine of evolution as applied to pathology, and for the recognition of a common ancestry in some diseases, I would instance:—Examples of non-specific conditions or ailments developing more specific characters—such as the ordinary stages of a common inflammation—a pimple, a vesicle, a pustule, or a scab, foreshadowing and typifying diseases in which one or other of these lesions (as stages of the disease) predominate, other characters being subordinate.*

Some pathologists have already accepted it as a fact that certain often so-called *morbid poisons*, the contagia of erysipelas, pyæmia, and tuberculosis, are intimately related to the common ferment, or ferments of *putrefaction;* and that the most vehement of these contagia can be developed by the artificial culture of successive transmissions in the living body from the comparatively mild contagium of any *common inflammatory process.*† Professor Sanderson's papers‡ also show that the occurrence of tubercle (characterised by more or less well marked features) may be derived by cultivation

* *Millican*, p. 107; *Collins, loc. cit.*, p. 44.

† Simon, Art. "Contagion." Quain's *Diction. of Medicine*, vol. i, p. 292.

‡ See successive yearly volumes of *Reports of the Medical Officers of the Privy Council for 1868 to 1877.*

from such a common inflammation as that induced by a chemical irritant. And it therefore "concerns us to remember that apparently every *common inflammatory process* includes more or less of textural changes which are necrotic and of septic tendency." * This doctrine of a common disorder acquiring specific power is not a new one. A class of cases is mentioned by Dr. Charles Creighton, † in which the mere contact of human beings in an average state of health and cleanliness sets up various epidemic disorders among the inhabitants of remote islands where strangers rarely come. Mr. Darwin, in his *Voyage of the "Beagle,"* quotes instances of this in the South Seas, on the excellent authority of Williams the missionary: and it is to typhus that Mr. Darwin compares these cases. "It would almost appear," he says, "as if the effluvium of one set of men shut up some time together was poisonous when inhaled by others, and possibly more so if the men be of different races." Sir Thomas Watson has also maintained the same doctrine, and relates the following facts:—

"The English troops that served in Egypt in 1801, under Sir Ralph Abercromby, suffered much from the ophthalmia of that country, which is always brought on by exposure to cold after being heated, by the glare of the white and parched ground, by the dust in the air, and such like causes peculiar to the climate of Lower Egypt. No one, in those days, thought that Egyptian ophthalmia was a specific infection. But some of the English soldiers returned with it uncured, and it soon became contagious in the home garrisons; and it was found, after a lapse of eight or nine years, that there were no fewer than 2,317 soldiers pensioners upon the public bounty from blindness in consequence of ophthalmia. Those who knew the disease as it occurs in Egypt denied that it was contagious, and those who saw it in England were as positive that it was contagious. Watson reconciles the two views. He says that 'there is nothing absurd nor unlikely in the supposition that diseases may first arise from some other source, and then become capable of spreading by contagion;' and he says elsewhere, 'My own creed upon the matter is this—that the disease may, and often does arise, independently of contagion, from the agency of ordinary causes of inflammation; and that, *having so originated, it acquires contagious properties, which develop themselves only*

* Holme's *System of Surgery*. First edition. Art. "Inflammation." Quoted by Simon.

† "Address on Pathology." *B. M. Journal*, 4th August, 1883.

under circumstances that favour the propagation of most of the contagious complaints.' A parallel to the Egyptian ophthalmia of 1801 may be found in certain cases of syphilis described by Baron Larrey in his surgical history of the same campaign. The Alexandrian syphilis, which the French troops contracted freely, was peculiarly free from 'grave symptoms' and 'easily cured;' but it proved very 'obstinate and difficult to destroy' in those who brought it back with them to France."

A similar doctrine was also held "by the thoughtful and talented writers who were known in Germany fifty years ago as *The Natural History School.* And in anything that concerns the natural history of disease we may go direct to Sydenham, who was the author of the phrase; and in Sydenham we shall find a very explicit statement of the doctrine. In the language of the humoral pathology of his day he says, 'The humours may, under certain circumstances, be raised to the dignity of a substantial form or to a species—a specific disease being one that takes its rise in the specific exaltation, or specification of some juice of the body; and he expressly mentions the antecedent condition of the humour before it had put on its species—*antequam hanc indurat speciem.*'" Hence Dr. Creighton concludes that this doctrine of a common disorder acquiring specific properties has not been absent from the thoughts of those who lived in the philosophical period of medicine.

Another interesting illustration of this doctrine is to be found in the possible and probable evolutions of small-pox, regarded as a skin disease which has acquired in course of time an independent and infective existence—"an ill-smelling condition of the human skin which one person may impart to another—one which "has been reproduced with the greatest accuracy and fidelity in millions of copies for hundreds of years; and the extraordinary closeness of its mimicry has given rise to the opinion that the disease is really the uniform effect of some unknown poison. But the anatomical structure and evolution of the pock Dr. Creighton considers to be too elaborate to be the simple and direct effect of an extrinsic poison; it is not like a flea-bite, or like the nettle-rash which comes out in some peculiarly constituted person after eating shell-fish. The pock is a complicated affair, and there is a history written in it, a history of character acquired bit by bit, as in the evolution of living things, a history which has been transacted within the body; and the stages of this history are run through with more or less completeness in

every case of the communicated disease. The papules had developed fluid in their summits, they had grown in a peculiar way, spreading in breadth, the original centre had become a distinct depression; and in the course of this evolution certain partitions had been formed in the interior of the pock. Further, the pock is more deeply rooted in the skin than most skin diseases known to us; for its base goes down to the vascular layer of the corium, and, when it scabs it, leaves a considerable defect of substance—a peculiarity among skin diseases which can hardly be matched unless it be in some of the tropical forms of impetigo. This skin disease is ushered in by much constitutional disturbance or fever; and, as in some other skin diseases *which are not contagious*, the fever abates when the eruption has come out, and the subsequent constitutional disturbance is exactly in proportion to the number of the pocks."

It is remarkable that all this complicity of anatomical structure, of stages of evolution, and of characteristic fever, should have preserved its unity and individuality through so many transmissions, in all sorts and conditions of men, and in all parts of the world.

The disease possesses now an independent existence in a high degree; and Dr. Creighton proceeds to inquire into its history previous to the acquisition of this independent existence. He shows, on the authority of Professor Hirsch,* that we must go to tropical countries—to Hindostan, and to the interior of Africa—for its original seats, and that we must go back to a very remote antiquity to find the beginning of it. Small-pox is peculiarly an African disease (Lichtenstein, *Pruner*); and was originally a disease of the black skin; "and it is in keeping with that historical and geographical induction to find that the black skinned races are by far the most susceptible of the disease nowadays, when it is set up only by contagion."

In speculating on the rise and development of small-pox out of some common and frequent disorder of the black skin, under such influences as tropical heat and moisture, or under the peculiar conditions of life accommodation for the living, which obtain among the swarming populations of tropical countries, "one naturally thinks of a complex form of *febrile lichen*—a skin disease which Dr. Gregory admits *that he could not always diagnose from small-pox;* and if we imagine a widely prevalent kind of febrile lichen to follow somewhat the same development that Willan describes in a remarkable

* *Hand-book of Geographical and Historical Pathology.*

case of *lichen agrius*, we should have a not very remote analogy for a stage of existence to small-pox, both in its structural character and in that constitutional fever, before it became the independent and infective disease that we see it now to be. We are at least justified in thinking of some form of tropical skin disease, widely spread within a certain zone, very apt to recur in the individual, and with each recurrence to become more inveterate, and to develop a more complex structure. Given a number of people suffering from such a cutaneous disorder at one time, and some great invasion or migration, and we shall probably have the circumstances under which the skin disease would become communicable, would pass by contagion to the skins of those who had never incurred the disease by natural causes, and pass all the more easily to them if they belonged to an entirely different race, or presented the ordinary contrasts of civilisation and barbarism, of white skin and black."

The acquisition of this independent and contagious existence was probably a very gradual process of evolution; and, comparing it with the original disease, out of which it must have come into being, the following facts are worthy of note:—

1. The contagious small-pox generally occurs but once in a person's life; and in this it offers a remarkable contrast to inflammations, which, having happened once, are, for that very reason, more apt to happen again. Hence the impropriety of ranking small-pox under the head of cutaneous diseases; it would "more rightly be called a blood disease" (Sir Thomas Watson). But, as Dr. Creighton proceeds to show, there need be no antagonism between the view of small-pox as a cutaneous disease, and the view of it as an infection. Small-pox in its primitive stage, before it became the independent disease it is now, "would be precisely that kind of skin disease which, having happened once, is, for that very reason, more apt to happen again. It would recur in the same spots, as in the early stages of leprosy, and it would become more rooted and more inveterate each time it came back. The inveteracy of this morbid condition of the skin, due in part to neglect, would be its first step towards acquiring that remarkable power of semi-independence within the body which it has now acquired; and it is this acquired power that now enables it to pass to another person's skin as an individual state of the body, which can be, as it were, abstracted. Its individuality is also proved by the best of all tests of what constitutes an individual—the test of parentage; for the skin disease that springs up in the contaminated body is exactly like the skin

disease which must have been originally acquired. But the infected or impregnated body runs through all the stages of the malady—papule, vesicle, pustule, scabbing and scarring —in rapid succession in two or three weeks; and thenceforward it is done with that particular form of disease for ever. In this independent form of disease we have a brief abstract and chronicle of the whole protracted development or evolution of small-pox. It sums up its past; and just as it sums up its past, so it anticipates its future; and starting, therefore, from a non-specific inflammation or common fever, or from such an anomalous enteric fever as Sir Joseph Fayrer has described as occurring in India, may there not arise, under favourable conditions, an inflammation or a fever different from the parent stock and capable of reproducing itself, or of being reproduced when the originating factors are again concurrent? The same argument may apply to cholera, and to the varied forms of enteric fever, such as are alleged to occur in tropical climates.

Concurrently with epidemics of cholera in India, Sir Joseph Fayrer has also described a peculiar fever co-existent with such epidemics which may be similarly used in argument.

May we not therefore consider many typical and so-called specific diseases at present well known as having arisen first in a non-specific inflammation, or in a common fever, thereby recognising a common ancestry among certain well known diseases, now recognised as distinct from each other, and so far new?

Slight variations, moreover, are also being introduced in nature with every successive generation of existences. Many of these variations are transmitted to the generations which follow; and, therefore, in the course of time, from any one parent stock would descend a very large variety of kinds, and with them we should expect to find variation in diseases—constitutional, hereditary, infective and contagious.

But the true settlement of these and such like questions at issue can only be obtained when long and patient study shall have determined under what laws and within what limits the slightest variations and anomalies which characterise individual diseases have been brought about; and it is mainly in the philosophy which pertains to and characterises the Darwinian hypothesis, that we may look for aid in the elucidation of the question. St. George Mivart, in a series of interesting papers on "Organic Nature's Riddle," published in the *Fortnightly Review* for March and April, 1885, shows that many influences *must* come into play in the origin of new

species; and his argument is applicable alike to organic nature and to diseases. One most important influence is "*heredity.*"* It is a property of parental origin. It is the innate tendency which each organism possesses to reproduce its like. Another influence is the action of the environment upon nascent organisms. He further adduces evidence to show that certain variations are more apt to be inherited than others—*e.g.*, skin affections, affections of the nervous system, and of the generative organs—that modifications result from the action of unusual agencies on the embyro; and that processes of repair take place the more readily the younger the age of the subject; and it is probable that the action of the environment generally acts more promptly and intensely on the embyro than on the older young—so that the same organism will sometimes assume very different forms—*e.g.*, the *bacterium rufescens* as observed by Professor Ray Lankester.

The effect of changed conditions is also often very striking —such changes telling strongly in favour of the existence in living beings of certain positive inborn tendencies to change in definite directions under special conditions. It is also obvious that the very same influences (*e.g.*, amounts of light, heat, moisture, and so on) will produce different effects in different species—also that the nature of some species is more stubborn and less prone to variation than that of others; so that both the amount and the kind of variability differ in different races; and such constitution, capacities or incapacities, tend to be inherited by their derivative forms; and so every kind of animal must have its own inherent powers of modification or resistance—so that no organism or race of organisms can vary in an absolutely indefinite manner; and, that being so *unlimited*, variability must be a thing absolutely impossible.†

So also Dr. Wilks writes in his address to the British Medical Association that "Hereditary tendencies have much to do with the physical and mental characters of individuals; and that temperaments and idiosyncrasies so evolved are most important factors in the production of our ailments. Also, that our surroundings are in themselves sufficient to produce active disease—*e.g.*, a number of conditions tend to the prevalence of the gouty constitution in England, and this may be carried through several generations, while the same conditions operating on an individual predisposed, may actually induce an attack in him. Bright's disease and many other

* See also Roberts' definition in *British Medical Journal*, 1st August, 1885.

† *British Medical Journal*, 1st August, 1885.

diseases come about through the deleterious operations of our ordinary surroundings, both in the air we breathe and in the food we eat, and not from any well defined specific cause. Nearly all disease is slow in origin and progress, as in the words of Hippocrates, the father of medicine, who wrote that, 'Diseases do not fall upon men instantaneously, but being collected by slow degrees, they explode with accumulated force;' and it must still be the great aim of the physician to seek the causes of disease in our ordinary surroundings, and in the tendencies transmitted to us, and to try to remove them."

Variation must therefore be regarded as the result of the reaction of the special hereditary nature of each organism upon the stimuli of all the multitudinous agencies which environ it—a combination of "heredity" and "external influences" must be recognised as factors in the process of variation.

And, in addition to the action of these factors, there comes another to be reckoned with—namely, "a peculiar kind of action due to an internal force—an intra-organic activity," the laws of which have yet to be investigated. Comparative anatomy, pathology, and teratology combine to point out the action of this internal force.

Altogether, therefore, it seem undeniable that the characters and variations of species and of diseases are due to the combined action of internal and external agencies, acting in a more or less direct positive and constructive manner, suggestive of an "intelligent purpose, which is as it were incarnate in the living world."

Section IV.—*The Doctrine of Evolution not a new one in Pathology.*

The idea involved in the application of "the Theory of Evolution" to "the coming into being" of some diseases is not a new one. It has been floating about, as it were, in men's minds without having been thus definitely formulated long before the time of Darwin.

We have various evidences of this. For example, a work published in France about 1784, written in Latin, has the following title:—*De Præcipuis Morborum Mutationibus et Conversionibus, Tentamen Medicum,* by A. C. Lorry, a distinguished graduate of Paris, embodies this idea. This work was published after the death of its author, and was edited by his nephew, the celebrated Hallé. The subject had been

again suggested to Dr. Lorry by a small duodecimo volume printed at Frankfort in 1646, which has the quaint title—*Quæ ex quibus*, written by one Rodericus à Castro.*

Again, about 1792, Dr. John Ferriar, Physician to the Manchester Infirmary, published a series of *Medical Histories and Reflections* in 4 vols., and a second edition in 1810, in which two of the essays therein published have the following noteworthy titles—namely, "The Origin of Contagious and New Diseases," in vol. i, p. 261, and "The Conversion of Diseases," page 17, vol. iv. During the earlier and middle part of the present century we have also some foreshadowings of Darwin's teachings as applicable to diseases in the discussions which took place relative to "the changes of type in diseases and their tendencies to change." The type or form of disease being made evident in the order of succession observed to obtain among certain morbid phenomena, it was noticed that such types admitted of modifications from various causes (Copland).

It was also early recognised that the hereditary or natural constitution of the individual was an important element in determining and modifying the type of a disease; also that town life, as compared with country life, was another factor in modifying the type of many diseases; and the particular occupations of individuals furnished still other modifying factors. The characters of epidemics, especially of fevers, were noticed to differ. Typhus fever, for example, since 1843 to 1848, is known to have diminished in its relative mortality; its eruption has appeared earlier, and so also has its critical day (10th to 14th day as a rule, and rarely now prolonged into the 3rd week) in itself a great cause of diminished mortality, for a day's delay of the crisis in a case of any degree of severity is an immense addition to the risk.†

It was also noted that diseases have arisen which are more or less new, resulting from new combinations of various pathological phenomena. It had been further observed how, in this country, during the past and previous centuries, some epidemics of fever, dysentery, scorbutus, malaria, and influenza, greatly deteriorated the health of the population; and as we have gradually got rid of such severe epidemics, severe and unmanageable types of ordinary inflammatory fevers have become less common. It is also on record that the types of some diseases become modified by complication or combination with other diseases more widely spread; and the doctrine

* *Edin. Med. and Surg. Journal*, 1801, vol. iv, p. 331.
† Professor W. T. Gairdner, *Clin. Med.*, 1862, p. 156.

of incompatibility of two or more zymotic diseases concurring in the same subject was shown to be an error. One form of disease has been seen to complicate or overlay another in a manner that at one time was not thought of. On this subject an admirable paper was contributed by the late Dr. Charles Murchison in the *Med. Ch. Review* for July 1859, in which he described the co-existence of variola and scarlatina, of variola and rubeola; so that the co-existence of several of the so-called acute specific diseases have now been clearly shown; and even Pringle, a famous pioneer of military medicine, records how typhus fever and marsh fever occur together; and that bilious remittents have prevailed with small-pox in the West Indies, forming, as a veteran outspoken physician remarked, "the most infernal combination that ever affected the human frame." Moreover, it was held by a distinguished Edinburgh physician, Dr. Craigie, in the earlier decades of this century, that "it is quite possible for the same person to generate two distinct diseases," * as, for example, malaria, inducing in some an ague, and in others a dysentery. He further makes the observation—an important one for the theory of evolution—that every case of *synochus*, or the ordinary continued fever of this country, commences with the symptoms of simple inflammatory fever; and it is not improbable that *synocha* passes, in certain constitutions and in particular seasons, into *synochus* by insensible shades.†

Further, it has been noticed that as we approach certain well marked geographical regions of the earth, where characteristic types of disease prevail, the confines of these disease realms are found to mingle their types together, so that the diseases of one region merge into, and participate in, many of the characters peculiar to the other. Cholera has now extended and continues to extend its sphere much more widely over the earth than heretofore; fevers have been seen to change their type; and epidemics of all kinds to assume new characters as to their beginnings, their course, and their tendencies to fatal or favourable endings; and, as the late Sir Thomas Watson eloquently expresses the idea, in one of his lectures, "there are certainly waves of time, through which varied characters and types of disease prevail in succession." ‡

The "alliances of diseases" constitute another element in the history of this subject, as illustrated especially by the late Dr. Barclay, of St. George's Hospital, London.

* *Prac. Physic.*, vol. i, p. 439.
† *Loc. cit.*, vol. i, p. 286.
‡ Aitken, *Sc. and P. of Med.* 6th Ed., vol. i, p. 267, *et. seq.*

Again, in 1839, Dr. (afterwards Sir Henry) Holland, F.R.S., published a collection of *Medical Notes and Reflections*, which contain many interesting records bearing upon this question, notably the following chapters:—Chap. II, "On Hereditary Diseases;" Chap. IV, "On the Connection of Certain Diseases;" Chap. XIV, "On Epidemic Influenzas;" Chap. XXIV, "On Diseases commonly occurring but once in Life;" Chap. XXVII "On the Influence of Weather in Relation to Disease."

He especially notices examples of the revival of hereditary diseases, absent in one or more generations, and instances several children of the same parents being affected in common with a given malady, of which there were no prior examples in either family; and he remarks that "the extent and sudden development of disease in these instances may in itself be taken as a proof of *new elements* being introduced" (p. 36).

He is also of opinion that "numerous conditions will be found, capable of giving different aspects to the effects of *a* common cause of disease;" * and he further notices "the variety of anomalous symptoms which arise from scarlet fever imperfectly developed, and from erysipelas,† and how too exclusive attention may be given to the eruptive part of certain maladies because of a belief in the more ready diagnosis it seems to afford."

He notices further that "scarlet fever" has peculiar relations of its own, and is subject to greater irregularities than either measles or small-pox; that it appears more frequently in "incomplete forms;" that it seemingly blends itself more readily with other diseases; and when it prevails as an epidemic amongst children, we find many disorders prevailing which strongly warrant the suspicion of their being derived from the same source, yet so incomplete and irregular in aspect that it is impossible to define them as really forming part of the malady.‡ This, he observes, is particularly the case with regard to the forms of cynanche which attend the fever, and which occasionally appears as the only distinct evidence of constitutional disorder. Another class of deviations is in the irregular character and progress of the fever; incompleteness in some part of the development of the disease; and its recrudescence some time afterwards without fresh infection, sometimes more regular in type than in the first occurrence;§ or, cases where there has been an irregular or

* *Loc. cit.*, p. 90.
† *Loc. cit.*, p. 103.
‡ *Loc. cit.*, p. 405.
§ *Loc. cit.*, p. 406.

incomplete evolution of the disease, succeeded by a number of abnormal symptoms deviating greatly from those wanting to make up the natural type, yet sufficient to afford presumption that they are due to the same morbid condition; these are especially—glandular swellings, abscesses in different parts of the body, eruptions, and gangrene of more or less extensive parts of the integument, and vitiated secretions from the kidneys and bowels. He notices also "the varying liability of the same person at different times to these diseases, and a hereditary tendency to them," * besides many other similar records of his experience.

In 1852 Dr. S. H. Dickson published, in the *Transactions of the American Medical Association*,† a valuable paper "On the Blending and Conversion of Types in Fever."

Section V.—*The Theory of Evolution in its Application to Pathology as definitely formulated in recent years.*

Since Charles Darwin's great works were published:—(1) *On the Origin of Species* in 1859; and (2) on *The Descent of Man*, twelve years later (1871), we have had our ideas regarding "volution in diseases" much more definitely formulated as a result of the change brought about in almost every realm of thought by this great naturalist.

I would here name especially those whose writings have already suggested much of the argument, and its illustration. They are Mr. Lawson Tait (1869), Dr. G. de Gorrequer Griffiths (1875), Drs. W. G. Collins (1881), W. H. Pearse (1881), Sir James Paget (1882), Mr. Millican (1883), and Mr. Jonathan Hutchinson.

1. A paper by Mr. Lawson Tait,‡ Fellow of the Anthropological Society of London, and of the Surgical Society of Ireland, contains the following suggestive observations:—"In the pre-historic period of the 'stone age,' after struggles for existence with his fellow-vertebrates, man began, with stone weapons in his hands, to have struggles to the death with his fellow-men, the like of which we find in no other kind of animal. For this, his weapons increase in effectiveness, his powers of comparison and combination increase, and, while these do so at a slow rate, his powers for killing his fellow-man, and his inclination to do so, are sufficient to confirm the law of survival of the fittest in the struggle for existence.

* Holland, *loc. cit.*, p. 490, 410.
† Vol. v, p. 127.
‡ *Dublin Quarterly Journal of Medical Science* for Feb., 1869.

"Hence we find in the remains of Archaic man few or no traces of disease;" and such traces Mr. Tait concludes are rare, since he has never seen a single instance of diseased bone in the many he has examined for the purpose; nor has he met with a notice of such a circumstance. A skull with appearances of chronic periostitis once came under his notice, which was determined by Mr. Busk to be stalactitic, and not the result of disease.

But when civilisation grew, so that murder and war became less frequent, then the struggle for existence necessitated new conditions of living, *and disease slowly crept in upon mankind; arising as it would from many causes produced in their turn by advancing civilisation and consequent domestication.* Our knowledge of diseases is sufficient to furnish struma and phthisis as examples of how the law necessitates the introduction of disease among civilised animals. Then he quotes the influence of alteration of climate; and that with less war came more pestilence; and with greater civilisation the more terrible disease. As development in domestication advances, there is an increase in the tendency to disease, so that in direct ratio to the degree of domestication is the severity of disease, the average age to which people live, and the number of births. We know it also as a fact, that savage nations are comparatively free from disease until contaminated by a superior race, when all at once the virgin soil is covered by the weeds.

I would, further, especially instance the Fiji islanders in their dreadful experiences of epidemics of measles and hooping-cough, during recent years.

In the very eloquent annual oration to the Medical Society of London,* "On Old Age," Professor Humphrey of Cambridge introduces a similar argument. "Thus, in the economy of Nature, death is swift, and comes early, as soon, at least, as failure of strength renders the animal unable to protect, or provide for, itself; and man, it would seem probable, had no exemption from the sharp, though, on the whole, beneficent law of animal life. In early times, when the race was to the physically strongest, when health, and strength, and activity were necessary to provide the hand-to-mouth means of sustenance, and to give defence, when men and animals were much on a par in this and many other respects, early death must have been the common fate, being brought about by climacteric agencies, or by the tooth of the hungry beast, or by the hand of man himself. This, indeed, we still find to be the case

* *Brit. Med. Jour.*, 9th May, 1885.

among some of the rude races of mankind. But in man was the germ of a better order of things, the germ of sympathy with, of feeling and love for, others; which was besides and above the mere parental instinct, and which was calculated to counteract and over-ride the selfish bent, and to raise man in this, as in some other respects, above the mere animal. This has already done much, and it has still an ample field for future development. Through the growth of this germ, it was given to man to introduce a new factor into the economy of Nature, and, by forethought, by mutual co-operation, and by care for others, which are the very essence, at any rate the very best feature, of civilisation, to prolong life, when, by this very forethought and sympathy, life had become more valuable; and when the prolongation of it had, consequently, become more desirable; and scope was thus afforded for the carrying out of those descending or senile developmental processes which must have been nearly dormant in the earlier periods of human existence.

"It was not to be expected that this good seed should be without a blending with tares; and the scope thus given for the fuller development of the physiological processes gave scope also for the development of the pathological processes, *and enabled the various diseases to spring up and take their course, afflicting not man only, but those animals also which come under his fostering or protecting influence.*

"It may therefore be said that the prolongation of life into and through the periods of decay, and into and through the processes of disease—indeed almost, if not quite, the very existence of decay and disease—are the result of human forethought and sympathy. In other words, decay and disease are, by civilisation, substituted for quick and early death. Without attempting to balance the *pros* and *cons* of this, we know it to be a position from which there is not, and ought not to be, any disposition to recede; and if there were the wish, there is not the possibility. The onward march of civilisation is a necessity, and the onward progress of disease will tend to go with it. But it does remain for forethought and sympathy to narrow the range of the evils they have themselves engendered, or which have sprung up with them; and it is pre-eminently the noble work of our profession to contribute to this—to weed out, and check the growth of, the morbid tares, and to help the good seed to grow on to its full harvest—to prevent, that is, the origin, and to arrest the advance, of disease, and to give to the body the best opportunities for health and longevity. In this great physical

work, let it be remembered, we shall not, to any great extent, succeed, unless our efforts be accompanied by equal efforts to carry out the higher and more important work of removing those impurities in the moral atmosphere, for which civilisation has much to answer, and with which the sources and spread of disease are closely—more closely perhaps than we think—associated."

Dr. B. W. Richardson has also recently delivered an address "On the Sanitary Condition of our Houseless and Nomadic Population," in which he tries to show that the purely vagrant class having no home, are rather exempt than otherwise from many of the diseases which affect those who live in more comfortable circumstances. Epidemics of zymotic diseases, and diseases like consumption, are said to be rare in this class; and the individuals of this class seldom appear to be agents in the dissemination of contagion. On the other hand, amongst those who keep a van in which they live and sleep, epidemic diseases are by no means uncommon. Gipsies are constitutionally a healthy race; and so long as they follow their nomadic mode of life they remain comparatively free from the more fatal diseases of the community. And, generally, it may be concluded, that as men began to aggregate in close localities without regard to sanitation, they compared indifferently as regards their health with those who confronted Nature in her wildest moods." Domestication, more than anything else, by overcrowding has always favoured the generation and spread of diseases both amongst men and the lower animals.

2. In 1875, Dr. G. de Gorrequer Griffiths began to call attention to what he believed to be an axiom in pathology—namely, "The Unity of Poison in Disease"—meaning thereby not that the poison is always the same, but that the one poison—the one *origo mali*—whatever it may be, will originate several so-called different affections. This theme he has discussed in several papers in the pages of this *Journal* in 1882, and subsequently in the pages of the *Medical Miscellany* and *Provincial Medical Journal* in 1884 and 1885. He contends that the one *origo mali* may give to different individuals scarlatina, typhoid, diphtheria, erysipelas, sore throats diarrhœas, sickness, headaches, general malaise, pneumonia, pleurisy, serous inflammations, ulcerative endocarditis, and a vast number of diseases which have been considered distinct and specific, and which have therefore been described as typical or orthodox forms of disease.

The questions for discussion he states as follows:—"If it be contended that these so-called specific diseases require for

their production in every instance the application in some way or other of a specific poison, so that no fresh case can arise but from germs or noxious elements emanating from a person affected with the so-called specific ailment (as from the fœcal excreta of a typhoid patient in the case of that fever), so that each stricken person must be preceded by another suffering similarly, I am led to ask—How, then, about the first case? Whence came it? How did it originate?

"That these various symptoms, or grouping of symptoms (to which are given for purposes of distinction the different names mentioned in the previous lines), and many other affections are at times originated *de novo*, and each and all from the same source or sources" is considered by Dr. Griffiths to be "abundantly proved in the experience of every medical man;" and that "since this is proved, therefore also is proved their non-specificity." The relation of the so-called puerperal fever to the infective diseases as illustrated by Sir Spencer Wells in opening a debate at the Obstetric Society in 1875 in London, is quoted to show that "if these diseases" (specific diseases as they are supposed orthodoxically to be), all produce the same result in lying-in women affected by them—namely, puerperal fever of such a form and character that it bears no resemblance to the (specific?) fever, from which there is no doubt it has been contracted, is it not right to suppose that there is a unity of poison which will account for the same? He, moreover, considers that this interchange, intercommunicability, and transmutation proves a unity of poison, in the sense already explained; and that these diseases in their turn are intensified or modified by the puerperal condition.

Dr. Hicks has also further shown (as hospital cases prove) that while various circumstances can set up a malignant fever in puerperal women, which is of so permanent a character that it can be communicated to other pregnant women; we see, on the other hand, that in private practice, when the fever apparently spreads to non-puerperal persons, it becomes reconverted to the zymotic form from which it had originally sprung.

Dr. Griffiths therefore would not call these different affections, but rather the varied and varying expressions of the working in the blood and tissues of the body generally of the *one* poison—the outward and visible signs of the inward evolutions—the extended and extending working of the poison—that poison being one and the same—*originally introduced*, or *wrought in the person's self*, by chemico-physiological changes, such as are daily being generated in health as well as in disease.

We have, then, he contends, unity of poison—differentiation

of the resulting phenomena, *i.e.*, symptoms; such differentiation being dependent upon, not a diversity of poison, but a diversity of expression of the action of the poison dependent upon the pabulum or food afforded to the poison agent, and the idiosyncracies of the patients, their habits, surroundings, and numerous circumstances connected with them of which we cannot yet even take an account. This he illustrates by the action of a drug, such as iodide of potassium, during which rashes are developed one after another, vesicular eruptions, pustular rash, fever, head and back ache—transition stages, as it were, from measles even to small-pox!

Another example is seen in dissecting-room cuts from examining cases of peritonitis. One victim will die rapidly from acute blood poisoning; another will have multiple abscesses; another abscesses and pnuemonia, or pleuro-pneumonia; another the same *plus* meningitis, or kidney and liver mischief in more or less acute stages; or pericardiac affection; another with tendency to phthisis may fall into consumption (tubercular) or septicæmic pneumonia.

These examples show a series of developments or evolutions of a *one poison*—the *virus from the cadaver*—which, passing through the dissecting wound into the system, evolutes and develops such evolutions and developments dependent not on any difference in the poisoning agent (which admittedly is one and the same) but upon the idiosyncracy of the patient, a difference in the pabulum which feeds, nourishes, and develops the primal poison—a difference in the soil on which the seeds fall, and *other differences not existing in or pertaining to the poison*, or seed; but in or around (or both) the person in whom is the poison.

This unity and differentiation exists throughout Nature. It is seen that erysipelas is interchangeable in lying-in hospitals with puerperal fever (Playfair); also, that diphtheria and puerperal septicæmia are one and the same (Hicks); moreover, "the association of diphtheria and scarlet fever is not infrequent; and the appearance of diphtheria may be absolutely independent of any pre-existing case" (Broadbent).

Finally, Dr. Griffiths arrives at the conclusion that the ailments which he enumerates at the head of his paper may be generated *de novo*, and from one common source, as well as by direct communication with one already suffering; or by indirect methods, through some secretions, excretions, or through some thing or person that has been in contact or in communication with the sick. Further, he concludes that there are two forms of these diseases. There is, 1st, an

orthodox form, or that contracted directly from a previously existing case; 2nd, an unorthodox form, or that generated *de novo* from blood poisoning, such as occurs in puerperal patients and in surgical cases (the "surgical scarlatina" of Sir James Paget) from deleterious matters absorbed or otherwise passed into the blood, and thence into the tissues of the body more or less generally, or from noxious drains, sewers, the imbibition or ingestion of pernicious articles of drink or food—such as tainted water, milk, cream, decomposing animal or vegetable substances. To this form of disease he gives the name toxæmic, to distinguish it, as regards origin, from the orthodox or that contracted from a previously existing case.

Sir William Gull has also stated his belief that diphtheria may "*commence* locally, forming a poison which will propagate itself; and he claims a distinction between diphtheria and diphtheria poison, regarding the disease as beginning with a poison, but sometimes as *commencing locally and forming a poison which propagates itself.*" *

Dr. Griffiths further advocates not only the operation of the environments upon the poison itself, but holds that the environments may induce variation, and that they will impress a new character upon the original poison, which will then become a more or less permanent variation, tending towards the evolution of a new series or set of symptoms, and therefore to a new disease. Thus, he believes that new diseases are being, as it were, in daily process of evolution—new "quantities," "agencies," or "factors," unknown to our forefathers, being the cause of such evolution. He shows how the existence of certain dieases illustrates his argument—more especially "the existence of diphtheria and typhoid fever," as described by Dr. Paget of Cambridge,† and by the late Dr. Stokes of Dublin; also the occurrence of cases of diphtheria intermingled with mumps, so that as the diphtheria outbreak subsided mumps became more prevalent.

As further evidence of the changes and various influences of one poison, he quotes the following narrative by Sir James Paget‡ from Professor Huxley's experience, which is all the more significant inasmuch as all the patients were in as nearly as possible the same circumstances:—

"One of the crew of H.M.S. *Rattlesnake,* after slightly wounding his hand with a beef-bone, had suppuration of the axillary lymphatic glands, with which typhoid symptoms and

* *Brit. Med. Journal*, 3rd May, 1879, p. 666.
† *Ibid.*, 14th July, 1883, p. 67.
‡ *Surgical Pathology*, 3rd ed., p. 373.

delirium were associated, and proved fatal. His illness began the day after the crew left Sydney, where all the crew had been remarkably healthy. A few days after his death, a sailor who washed his clothes had similar symptoms of disease in the axilla, and for four or five months he suffered with sloughings of portions of the areolar tissue of the axilla, arm and trunk on the same side. Near the same time a third sailor had diffuse inflammation and sloughing in the axilla; and after this the disease ran, *in various forms*, through the ship's company, between 30 and 40 of whom were sometimes on the sick list at once. Some had diffuse cellular inflammation, some had inflammation of the lymphatic glands of the head, axilla, or lower extremities; one had severe idiopathic erysipelas of the head and neck; another had phlegmonous erysipelas of hand and arm after an accidental wound; others had low fever, with or without enlargement of glands. Finally the disease took the form of mumps, which affected almost everybody on board. The epidemic lasted from May to June. The ship was at sea the whole time, and, in the greater part of it, in the intense cold of a southern winter."

Here is, indeed, a wide range of maladies eventuating in an epidemic of mumps in a variety of persons, and apparently evolved out of the inward evolutions of one poison whence all the various symptoms proceeded.

The argument is still further carried out by examples of "progressive evolution," in which, passing from the benign or mild to the malignant or more severe, cases occur in which the initial or commencing disease may be of the simplest or mildest form; but from it will be evolved cases of a more severe degree, and so on till so many evolutions take place that the maximum degree of intensity is arrived at in the most virulent and malignant type of disease. Or, from the very first, the evolutions may be more and more complex, from the involvement of organ after organ, till the highest point of complexity is reached—the latest evolution being either the most virulent form of the original malady hitherto known, or a distinctly new disease—that is, a new set of symptoms which have never before been manifested. The capacity of minor or apparently trivial sore throats in families of young children to breed malignant diphtheria ought never to be forgotten or lost sight of.

An arrest in this process of evolution is also to be seen in many diseases, as, for example, in scarlet fever, when it is said to be "suppressed" or not fully developed. It is well known

that as its evolution goes on in an epidemic, so there is progressiveness in its virulence; but from the most simple or least well expressed cases—cases of so-called "suppressed scarlet fever"—it is often seen that scarlatina of the severest type may be produced, as well as many other affections or sets of symptoms usually considered to be entirely out of the range of the scarlet fever circle, diseases usually considered to be separate and entirely distinct. Hence, when scarlatina has become rife in a school, and the unaffected having been sent away, some boys (who have never been in communication with the infected, or, at least, have been free from the manifestation of symptoms) get "sore nose" or "sore eyes;" these, after every precaution as regards disinfection even to destruction of clothing and complete disinfection of their bodies, return home, and in it there will break out "sore noses," "sore eyes," and scarlatina, or scarlatina and a number of other affections more or less severe, and varying in intensity, thereby acknowledging a common ancestry. And rising, as it were, in the scale of evolution, scarlatina may in a variety of persons originate and cause the development of most malignant typhoid, puerperal fever, or diphtheria; or may cause the evolution of nephritis, pleuritis, pneumonia, or pleuro-pneumonia, without the expression of any scarlatinal symptoms whatever.

Again, scarlatina has been known to occur repeatedly in houses *associated with other cases of septic poisoning, clearly traceable to sanitary defects; and it is not unfrequently a drain disease* (Mahomed);* and after the first heterogenetic case has so arisen, this form becomes transmissible, and may then spread, as does the orthodox form—that is, by contagion or infection, or both.

This view of causation demands a revision of medical nomenclature accordingly. Thus, the disease may spread by contact directly with or exposure to the poison pre-existing in another or a previous case. Such is the *orthodox* form. But besides this form of the disease there is another which may originate from drains or from some source other than that covered by the term orthodox, and that it thus originates a form of scarlatina *de novo*. Such cases may arise *autogenetically* in some instances and *heterogenetically* in others. Thus, cases of scarlatina may be arranged under three classes:—

(1.) *Orthodox*, that is, the form admitted universally by the profession as propagated by infection or contagion, or both, from pre-existing cases.

* Harveian Society Discussion on Scarlatinas. Medical Journals, *passim* 3rd April to 15th May, 1884.

(2.) *Autogenetic* cases, which are those begotten, conceived, and bred—that is, evolved in and by the patient. Under this class comes puerperal scarlatina, originating in and proceeding from some offending influence, some *materies morbi* in the parturient track; and certain cases of surgical scarlet fever where a *sepsis* is evolved from the wound and passes thence into the system, *scarlatinising* the system throughout; and those in which the general manifestations show themselves primarily, the wound afterwards evincing evidences of this general disturbance.

(3.) *Heterogenetic cases* are those in which the condition of the patient is produced by a *sepsis* outside the person, such as when the disease is evolved *de novo* from foul drains, W. C.'s, and such like sources of insanitariness; from drinking foul water (such as the foul waters in the Egyptian camps, like Ismalia), decomposing fluids and such like; and from eating "high,"—that is, decomposing rotten game. To this latter custom, especially among the upper classes, is due some of the prevalence of diarrhœa, typhoid, scarlatina, diphtheria, fevers, and more ailments than perhaps is at present suspected.

The nomenclature here suggested by Dr. Griffiths may also hold good in a multiplicity of diseases such as puerperal, typhoid, diphtheria, diarrhœa, dysentery, cholera, and various fevers. He refers to a series of cases related by Mr. Mason in illustration of the spontaneous development of disease occurring in the same house, in which a child died in four days from hæmorrhagic scarlatina, the nurse suffered from severe diphtheritic throat, and the father from severe erysipelas before the dead body of the child had been removed. Inspection did not reveal any insanitary condition in the house itself; but decaying vegetable refuse was discovered in the area vaults. Moreover, cases of scarlatina are often observed to precede those of diphtheria; and throat illnesses of various degrees to precede the first undoubted case of diphtheria; and widespread, apparently trivial sore throats are apt to be unnoticed and unrecorded.

3. Dr. W. H. Pearse,* of Plymouth, gives instances of evolution of epidemics and of alliances of some diseases; and is of opinion that the alliances of diseases which appear to be different, such as scarlet fever and measles, have a greater place in nature than have their specific differences; and also, that the so-called "germ" and poison theories of disease will form minor parts in a greater theory of evolution.

* *Medical Times and Gazette*, Sept. 1881.

4. A very important letter in the *Lancet* * by W. J. Collins, M.D., and B.Sc., of the London University, in which he inquires —"How far our commonly accepted notions of specificity in disease should be modified by the doctrine of evolution; which he observes has hitherto made but a feeble impression on medical science and pathology"—gave a fresh impetus to inquiries on this subject.

5. Sir James Paget's very interesting Bradshawe Lecture, "On Some Rare and New Diseases," given at the Royal College of Surgeons of England, on 13th December, 1882, † is a most valuable contribution. In this suggestive lecture he seeks to illustrate a part of the natural history of diseases—too little studied—namely, that part which relates to "the *variations and combinations of diseases in hereditary transmission.*" He especially deals with those diseases hitherto classed as "constitutional" or "diathetic" diseases, in which the disease or the predisposition to it is, "inborn" or "inbred."

6. In 1883 a small but interesting work was published by Kenneth Wm. Millican, B.A., (Cantab), Fellow of the Medical Society of London, on *The Evolution of Morbid Germs*, in which he ingeniously, and with much originality of method, carries out the application of the Darwinian doctrine of the origin of species, as affecting pathogenic organisms. He assumes that germs in the form of bacteria or bacilli are the causes or agents of infection of the specific diseases, and he believes that "given a change of environment acting successively upon *a certain scarlet fever germ and its offspring, for say 1,000 generations* (*of that germ*) *may succeed by the end of that period* (*in bacteria representing about a fortnight*) *in impressing a very marked change of character upon the race of bacteria;* . . . so as to succeed eventually in ultimately transmitting (say) diphtheria in place of scarlet fever." And he specially insists upon the fact that the perceptible workings of the law of evolution are a matter of *successive generations* (of bacteria); and that *the time occupied will vary with the duration of individual life* (of these bacteria), and the rapidity of their reproduction; and that time with such "*existences*" is not measured by years but by generations."

But it is premature to assume as proven the causal agency of such like germs. "To study on broad biological principles these forms, and to find out, if possible, their real relation (if any) to any given disease, the cycle of their lives, and their behaviour under a variety of superinduced changes, is

* Of 14th May, 1881.

† The various medical newspapers of the 16th December.

the task with which the pathologist is now charged. But completeness, and thereafter accuracy of final results cannot be certainly obtained without a comprehensive knowledge of the entire group of bacteria, and the absence of this knowledge is a serious impediment to understanding the complete morphology of such forms as may *prove* "specific" in the pathogenic and in the septic series. To trace their life histories, and especially the variations to which they may be subject under altered surroundings, is of the utmost importance. Minute and prolific as these organisms are, time must be an essential element in their vital mutations; and they may yet prove to be subject to "variation" of an important kind "under domestication." The law of variation is as operative to-day as ever, and the rapidity with which generation succeeds generation in these lowly and minute forms, certainly promotes the chance of variation and survival. It is, therefore, conceivable that changes may happen which it is of the utmost importance for us to know." * As yet, however, we have no thorough knowledge of the life history of any of these organisms; and therefore the complete specificity of any one of them is not yet established. Those we know most about, appear to be merely putrefactive organisms, like the cholera "comma" bacillus of Koch, and his tubercle bacillus also, both of which appear to be merely incidentally present in the diseases with which they have been associated.

7. On 28th February, 1884, Dr. W. J. Collins amplified the topics of his letter in the *Lancet*, already quoted, in a paper which he read to the Abernethian Society of St. Bartholomew's Hospital.† In it he brings forward an array of cases and facts in favour of a modification of our present notions of specificity in disease, based on Darwin's doctrine of evolution.

Our ideas, therefore, on this interesting subject are being slowly but surely consolidated and formulated *themselves*, through a process of evolution and development through many minds and many generations. In this we have an example of how Darwin's teaching explains the development of human knowledge itself—how by it our knowledge grows as the ordinary every day experience of mankind becomes more and more extended in course of time.

But there is this difference between the evolution of

* W. H. Dallinger, *Contemporary Review*, March, 1885, p. 450.

† "*Specificity and Evolution in Disease.*" By W. J. Collins, M.D., B.S., B.Sc., Lond., 1884.

diseases in Nature and the evolution of our knowledge of them. The evolution of diseases in Nature results in forms of disease which are new, and which did not exist before; the evolution of our knowledge of diseases results in the perception of laws regarding them already in existence, but unknown to Science. * Hence it is necessary in this inquiry to distinguish between diseases which are really new, and such as only seem to be so, but which undoubtedly have been in existence, though not previously recognised and differentiated from others. But there can be no doubt that if medical men will exercise their powers of observation in the direction which Darwin's views suggest, there will eventually be brought together abundant evidence in favour of his theory of evolution being able to explain the "coming into being" of new diseases.

Section VI.—*On the Gradual Evolution of Constitutional Diseases.*

Looking first to the causation of constitutional disease in the individual (and excluding for the present parasitic and zymotic diseases), "Do we not find that, for the most part, *such diseases are of very gradual evolution*—the essential outcome of continued violation (consciously or unconsciously) of physiological laws, as they exist for the race, or as they are conditioned by the peculiarities of the individual—*that these violations are not exceptional and gross, but daily and minute; and that their specific effects, infinitesmal from day to day, become visible only after long periods of time,* and so escape recognition, except by those who are trained to discern the causal connection of subtile things?" †

Such is "an evolution unnoticed from its slowness." It is these minute and almost inappreciable conditions of daily life which practically make or unmake health. Hence it may be inferred that the long continued influence through many generations and ages of time, of hereditary influences and unsuitable but inevitable environments may establish new diseases of constitutional or autochthonous production; and if not absolutely new diseases, at any rate diseases of such very variable chronic types as are daily met with, and classed as general or constitutional ailments. The effects of physiological forces acting under unphysiological conditions consti-

* Compare Dr. Temple in *Bampton Lectures*, 1884, p. 127.
† Sir Andrew Clark, Bart., *Trans. Clin. Soc.*, xvi, p. 57.

tute the essential and true disease. Hence it may be argued that the persistent transmission by heredity of "changes, although merely of the relation of parts, of re-arrangements of atomic groupings, of recurring cycles of vicious chemical substitutions and exchanges, of new conditions in the evolution and distribution of nerve force, any or all of which may be invisible to the eye, inseparable from the life and undiscernible in death," must in time eventuate in the evolution of definite and characteristic ailments. "The appearance, for example, of definite structural alteration in the course of disease would introduce 'a new order of events, would set in action new combinations of forces, and create disturbances which must be reckoned with, even as mechanical accidents of the pathological processes.' But, in the active and dynamic changes which give the structural forms birth, and stretching far beyond the limits of pathological anatomy, and pervaded by the actions and interactions of multitudinous forces, a region exists teeming with manifold forms of disease unconnected with structural change, and demanding the investigation which it would abundantly reward. It is in this mysterious and fertile region of dynamic pathogenesis that we come face to face with the primitive manifestations of disease, and learn how much knowledge from various sources is needed to understand it aright; it is here that we see how, without help from physics, chemistry, and biology, collecting, converging, and meeting in a converse light, no single problem in disease can be completely solved; it is here that we are made to comprehend how the nature of a pathological product cannot be determined by its structural characters alone, but by the life history of the processes of which it is only a partial expression; it is here that we observe how, in therapeutic experiments, the laws of the race are conditioned and even traversed by the law of the individual; and it is here that we discover how clinical medicine is to become a science, and how she is already beyond question at once the mother and the mistress of all the medical arts." *

With such infinite variability in the combining dynamic factors which lead to the gradual development of constitutional diseases, not only through lifelong inheritances to be counted by generations, but also through long continued cycles of time, and having regard to the inherent tendency in all organic existences to vary indefinitely from the original type, are we not warranted in concluding that such variations may be naturally perpetuated through such

* Sir Andrew Clark, *Clin. Soc. Trans.*, vol. xvi, 1883, p. 54.

an evolution as new diseases under circumstances of environment favourable to such an evolution and to their continued existence?

If we study pathology as a branch of biology, the evolution of diseases will be more easily understood. When medicine is thus thought of as a pure science, and as something not necessarily connected with the curative treatment of diseases, it implies a "pathology" which has no more necessary subservience to practical ends than has zoology or botany; and the logical connection between this purely scientific doctrine of disease or pathology and ordinary biology has been thus traced by the master mind of Professor Huxley. "Living matter," he writes, is "characterised by its innate tendency to exhibit a definite series of the morphological and physiological phenomena which constitute organisation and life. Given a certain range of conditions, and these phenomena remain the same, within narrow limits for each kind of thing. They furnish the normal and typical character of the species; and, as such, they are the subject matter of ordinary biology."

"Outside the range of these conditions the normal course of the cycle of vital phenomena is disturbed, abnormal structure makes its appearance, or the proper character and mutual adjustment of the functions cease to be preserved. The extent and the importance of these deviations from the typical life may vary indefinitely. They may have no noticeable influence on the general wellbeing of the economy, or they may favour it. On the other hand, they may be of such a nature as to impede the activities of the organism, or even to involve its destruction.

In the first case, these perturbations are ranged under the wide and somewhat vague category of "variations;" in the second, they are called "lesions," "states of poisoning," or "diseases;" and as morbid states they lie within the province of pathology. No sharp line of demarcation can be drawn between the two classes of phenomena. No one can say where anatomical variations end and tumours begin; nor where modification of function, which may at first promote health, passes into disease. All that can be said is, that whatever change of structure or function is hurtful belongs to pathology. Hence it is obvious that pathology is a branch of biology, it is the morphology, the physiology, the distribution, the ætiology of abnormal life. Henceforward the connection of medicine with the biological sciences is clearly defined, and pure pathology is that branch of biology which defines

the particular perturbations of cell-life, or of the co-ordinating machinery, or of both, on which the phenomena of disease depend." *

"From this point of view pathology is the analogue of the theory of perturbations in astronomy; and therapeutics resolves itself into the discovery of the means by which a system of forces, competent to eliminate any given perturbation, may be introduced into the economy. And as pathology bases itself upon normal physiology, so therapeutics rests upon pharmacology, which is, strictly speaking, a part of the great biological topic of the influence of conditions on the living organism, and has no scientific foundation apart from physiology."†

So far, therefore, as the doctrine of evolution in biology has assumed a position and acquired an importance ever since 1859, which it had not possessed before, it is, I believe, specially capable of illustrating the pathology of constitutional diseases from the biological point of view here indicated.

From this point of view the constitutional diseases may be regarded as "sports" or "variations" from the normal line of health. Evolution may thus not only explain their origin, but may account for the persistence of some forms of diseases, unchanged through long epochs of time, while others undergo comparatively rapid metamorphoses. The causes and conditions of variations in constitutional diseases (as in biology) have yet to be thoroughly explored; and further inquiry may prove "that variability is definite, and is determined in certain directions rather than in others by conditions inherent in that which varies." . . . "It is quite conceivable that every species of constitutional disease tends to produce varieties of a limited number and kind," and that the effect of "elective affinity" in the constitution of the race, or of the individual towards certain causal and concurrent factors of disease, rather than to others, would be "to favour the development of some of these while it opposes the development of others along their predetermined lines of development."‡

There is a manifest tendency to the transmission by inheritance of these diseases. While they appear to be developed under the influence of agents generated within the body itself, through the customary exercise of its functions in the daily course of nutrition, development, and growth; the original organisation of the body may be of such a kind that the

* *Science and Culture, and other Essays.* By T. H. Huxley, LL.D., F.R.S. Macmillan, 1881. P. 326-345.

† Huxley, *loc. cit.*, p. 347.

‡ Huxley, *loc. cit.*, p. 307.

continuous exercise of its functions, in place of preserving the system in a state of health, ultimately leads to the evolution of diseases of various kinds, which, from this mode of origin and development, have received the name of constitutional diseases.* All of them are eventually attended with more or less obvious and severe manifestations of structural disease; some of so fixed a character and so strongly expressed that the local lesions are sometimes (although erroneously) looked upon as constituting distinct diseases; such, for example, as the joint or heart affection in rheumatism, or the bone affection in rickets. These local manifestations of constitutional diseases are invariably the result of the pre-existing unhealthy state of the system, determined mainly by heredity, and by the environment of the individual. It is now very generally understood that there are—(1.) Latent conditions existing in the constitution of the body itself. (2.) A tendency to the development of special and peculiar expressions of disease (sports?) during the course of the physiological nutrition and morphological changes between the solids and the fluids of the body; and which are constantly influenced by the operation of agents from without (the environment of the individual) acting as excitants to the morbid developments. The constitutional diseases are, therefore, all associated with "a bad habit of body"—a cachexia, as it is technically named. The lesions (or special "sports") which attend them are rarely limited to one part or organ, and before death ensues, several organs, tissues, or apparatus, not necessarily contiguous to each other, become further diseased, and new materials of a heterologous nature may grow up in their substance. In these local lesions are to be found those elements which mark the "anatomical character," or "anatomical signs" of the several constitutional diseases when fully expressed; but we do not yet know why one organ or texture should be either earlier or more constantly affected than another. Nor can it be explained why tubercle selects, at one time, the bronchial glands for its chief seat, and the lungs at another; nor why cancer infests, by preference, the mamma and the uterus; nor why rheumatism affects the white fibrous tissues; nor why rickets affects the bones. The proclivities and predilections of constitutional diseases to express themselves thus, through lesions of certain organs rather than others are still unexplained. Constitutional diseases are of long duration, thereby affording plenty of time for the development of variations, the

* Aitken's *Science and Practice of Medicine.* Seventh edition. Vol. i, p. 829.

tendency to repetitions of severe paroxysmal or aggravated attacks generally existing throughout life. The primary implication of the constitution is, in the greater number of cases, demonstrable. They are not traceable to the extrinsic action of any *virus*, and have none of the properties pertaining to infection. They are thus apparently generated, developed, and sustained through the influence of "particular perturbations of cell life, of the co-ordinating machinery, or both,"—the result of the perversion of the nutrition or assimilative functions of the individual; and are frequently determined by congenital constitution or hereditary tendency. In the greater number of them a more or less obvious disposition may be traced to symmetrical arrangement of the anatomical character of the local lesions already referred to, whether these be internal or external (*Walshe*). External physiognomical differences may generally be recognised as distinguishing one man from another, and due to the peculiarities of his constitution—"*personal peculiarities.*" These, again, are due to what has been called "*temperament,*" combined with that character of the constitution which tends to the repeated expression of some form of ill-health, always in the same way, and to which the name of *diathesis* has been given. Such external differences between man and man—such *personal peculiarities*—are known to be transmitted from parent to child—*hereditary transmission.* The *tendency* to the expression of certain forms of disease being thus born with the child is due to *hereditary predisposition;* and this tendency may be strong and evident, or it may be but feebly and faintly marked. In the former instance it will become expressed in the midst of circumstances even the most favourable to health. Another remarkable feature in the pathology of constitutional diseases is that the transmission of the hereditary tendency may fail to be expressed in the *children* of a family liable to diseases known to be so transmitted, and yet may appear in the grandchildren. The tendency is thus expressed in *alternate generations*—the law of "*atavism,*" as it has been called. The tendency, failing to appear in one generation, may lie dormant, and at last burst forth "in some collateral branch of the family tree;" thus proving that *tendencies* not obviously *expressed* by the parent may nevertheless be *transmitted* by him. A person, therefore, cannot be considered free from the inheritance of constitutional maladies simply because his parents may not have suffered from any of them; and now it is admitted that, beyond *three generations,* the investigation of hereditary tendency is uncertain. When one only of the

parents is the victim of constitutional disease, the tendency to similar constitutional disease is most obviously expressed in those children who most resemble that parent in physical conformation and appearance; and it has been observed that, when both parents suffer, the tendency will sometimes be expressed more often in the daughters of the family than in the sons, or more often in the sons than in the daughters, according as the physical conformation resembles most the one parent or the other.

From the nature of the CONSTITUTIONAL DISEASES as here expounded, it is to be noticed that there are three periods in the history of them to be recognised in their pathology. The FIRST PERIOD may be described as *the period of their constitutional development*; and during this period, unless a constitutional tendency to the disease is suspected, obvious, or known to be hereditary, it may not attract any attention. The SECOND PERIOD may be described as the period during which the *constitutional disease is fully expressed* by the phenomena and symptoms peculiar to each of them. The THIRD PERIOD in the history of these diseases consists of a *series of intervals*, during which the health seems to be improved between febrile paroxysms, or fully expressed conditions of ill-health.

In these three well defined periods we have again ample opportunity for variations as tending to promote the evolution of new diseases.

It is for the cure of the fully expressed disease that the physician is generally consulted—a period when he knows he can do the least good. But when the public become aware through better education of the extent to which health may be preserved, and constitutional diseases averted and mitigated by judicious management during the first and last periods here noticed, the physician will be more frequently consulted as to how the health is to be preserved and improved so as to ward off constitutional diseases. Whenever the physician has to treat constitutional affections in their fully expressed condition, if he is successful in subduing the symptoms for the time, *the interval of comparative freedom from the paroxysmal expressions of disease is a time most precious, which ought not to be wasted, but which ought to be taken advantage of in preserving and improving the general health,* especially by such complete change in the habits and environment of the individual, as his condition and life history may suggest.*

This Influence of Environment is one of the greatest and

* Aitken, *loc. cit.*

most substantial of modern biological doctrines. "Of the power of Environment to form or transform organisms, of its ability to develop or suppress function, of its potency in determining growth, and generally of its immense influence in evolution, there is no need to speak. But Environment is now acknowledged to be one of the most potent factors in the evolution of life. The Influence of Environment, too, seems to increase rather than diminish, as we approach the higher forms of being. The highest forms are the most mobile; their capacity of change is the greatest; they are, in short, most easily acted on by Environment. And not only are the highest organisms the most mobile, but the highest parts of the highest organisms are more mobile than the lower." * . . . And students of biography will observe that in all well written lives attention is concentrated for the first few chapters upon two points. We are first introduced to the family to which the subject of the memoir belonged. The grandparents, or even the most remote ancestors, are briefly sketched and their chief characteristics brought prominently into view. Then the parents themselves are photographed in detail. Their appearance and physique, their characters, their disposition, their mental qualities, are set before us in a critical analysis. And, finally, we are asked to observe how much the father and the mother respectively have transmitted of their peculiar nature to their offspring. How faithfully the ancestral lines have met in the latest product; how mysteriously the joint characteristics of body and mind have blended; and how unexpected, yet how entirely natural a recombination is the result. These points are elaborated with cumulative effect until we realise at last how little we are dealing with an independent unit, how much with a survival and reorganisation of what seemed buried in the grave.

"In the second place we are invited to consider mere external influences—schools and schoolmasters, neighbours, home, pecuniary circumstances, scenery, and, by and bye, the religious and political atmosphere of the time. These, also, we are assured, have played their part in making the individual what he is. We can estimate these early influences in any particular case with but small imagination, if we fail to see how powerfully they also have moulded mind and character, and in what subtile ways they have determined the character of the future life."

* *Natural Law in the Spiritual World.* By Henry Drummond, F.R.S.E., F.G.S. Hodder & Stoughton, p. 241.

"This twofold relation of the individual, first to his parents, and second, to his circumstances, is not peculiar to human beings. These two factors are responsible for making all living organisms what they are. When a naturalist attempts to unfold the life-history of any animal, he proceeds precisely on these lines. Biography is really a branch of natural history, and the biographer, who discusses his hero as the resultant of these two tendencies (as well as the physician who similarly discusses the life-history of his patient) follows the scientific method as rigidly as Mr. Darwin did in studying *Animals and Plants under Domestication.*"

"Mr. Darwin, following Weismann, long ago pointed out that there are two main factors in all evolution—the nature of the organism and the nature of the conditions. . . . But it must be remembered that the development of man under these directive influences is essentially the same as that of any other organism in the hands of Nature. We are dealing, therefore, with universal law, . . . and if now we substitute the more accurate terminology of science for the casual phrases by which the factors have been described, it will still further serve to complete the conception of the general principle. Thus, what biography describes as parental influences, biology would speak of as Heredity; and all that is involved in the second factor—the action of external circumstances and surroundings—the naturalist would include, under the single term, Environment."

"These two, Heredity and Environment, are the master influences of the organic world. These have made all of us what we are. These forces are still ceaselessly playing upon all our lives. And he who truly understands these influences, he who has decided how much to allow to each, he who can regulate new forces as they arise, or adjust them to the old, so directing them as at one moment to make them co-operate, at another to counteract one another, understands the rationale of personal development. To seize continuously the opportunity of more and more perfect adjustment to better and higher conditions, to balance some inward evil with some purer influence acting from without, in a word, to make our environment at the same time that it is making us, these are the secrets of a well ordered and successful life."*

Medical journals and Proceedings of Societies teem with records of rare cases, some of which, although apparently of common diseases, differ in some features from the usual type or standard of such common ailments, and therefore they are

* Mr. Henry Drummond, F.R.S.E., F.G.S., *loc. cit.*, pp. 253-256.

"anomalous" cases of disease, and may be considered as pathological "sports" from normal physiology. Of these Sir James Paget writes as follows:—"It would be of use if such cases were collected by the hundreds and thousands, and we ought not to set them aside with idle thoughts or words about 'curiosities' or 'chances.' Not one of them is without a meaning—not one but might be the beginning of excellent knowledge, could we but answer the question, Why is this so? Or, being rare, 'How or why did this instance happen?' In his eloquent Bradshaw Lecture he expresses his belief that there are rare cases which are also cases of diseases lately new and becoming more frequent, and which are mainly due to morbid conditions changing and combining in transmission from parents to offspring. In all these cases the personal factors are more potent than the conditional—the inner than the outer. We call these diseases constitutional, and the chief fact in them is, that they (or the necessary previous states or predispositions to them) are 'inborn' or 'inbred.'"

There are sufficient reasons for believing, and sufficient facts to justify the belief that some of these diseases were gradually coming into being any (x) number of centuries ago as *new diseases*, and that more recently (though still rare) they have become more frequent.

The following are given as examples of the evolution of new diseases:—

(1.) The peculiar joint disease discovered and described by Charcot in association with locomotor ataxia.

(2.) The peculiar disease of bones to which Sir James Paget has given the name of *osteitis deformans*.

(3.) Anomalous cases of gout (incomplete or suppressed gout), gouty or spontaneous inflammation of veins, such as the femorals and external iliacs, phlegmasia dolens in the male, also association of joint disease with formation of synovial cysts.

(4.) The peculiar disease called "dengue" is also regarded by Hirsch as a comparatively new disease.

May there not be some reasons for believing that "malignant endocarditis" is also a comparatively new disease, and also "myxœdema?" Endocarditis is admittedly an infective disease, a disease which may follow from a slight external lesion, in which an injury tends to fester and not to heal, and in which malignant septic infection occurs.

Such cases are most likely to have been slowly evolved, as domestication became more and more common, rather than when men lived free in the open air,

"As wild in woods the noble savage ran."

From these and other instances, it may be shown how a mingling of causes may produce a variety of effects, having but little resemblance to the antecedents which played their parts in the production of such compound results—the resultant bearing little resemblance to the parent stock from which it sprung. The combination, for example, of rheumatism with syphilis, or with gout, or scrofula, gives rise to new forms of disease in which it is difficult to separate the individual influence of each of the factors—so much may each be overlaid by the other.

It will *hereafter* become the business of the pathologist to decompose the pathological compounds, and so seek to ascertain the number and arrangements of the units or atoms of rheumatism, gout, syphilis, or nervous influence, which may have entered into the composition of so complex a disease as Charcot's joint disease; which, meanwhile, may be regarded as a form of chronic rheumatic arthritis modified by its occurrence in a patient the subject of locomotor ataxia, and so altered from its pattern by the intervention or commingling of the nervous ailment. (*Lancet*, 20th December, 1884.)

Thus, there are numerous cases and reasons to justify the belief that many diseases of constitutional origin are the results of various morbid conditions changing and combining in transmission from parents to offspring. And there can be no doubt "that changes of type in inherited diseases do take place; but we are prone *to think* too little of the variations—to regard them rather as unmeaning exceptions, or as the results of some unusual external conditions diverting diseases from their customary course. It will be better for us if we study in pathology as in natural history—varieties as much as species—changes as well as more stable forms. It will then be impossible not to perceive, to reflect on, and to appreciate 'the pertinacious persistence of some forms amidst the vast mutations of others.' Types of disease there are, the tenacity with which they are maintained—some even from pre-historic times—in all the varieties of the conditions of our lives, is one of the most remarkable facts in all pathology. But even *they* are not unalterable. Types vary in disease as in species; even in diseases which depend *least* upon external conditions, and *most* on the qualities which are transmitted by inheritance," and Sir James Paget proceeds to lay down rules for study especially applicable to these cases.

These rules are here reproduced, because they demand a very thoughtful consideration of the method to be pursued in the study of evolution as applied in pathology.

"(1.) We should very carefully study all cases which are not according to an admitted type. We should study all exceptions to rules; never thinking of them as unmeaning or accidental. Especially, we should never use, in its popular, but wrong, translation, the expression *exceptio probat regulam*, as if an exception to a rule could be evidence that the rule is right. If we use it, let this be in its real meaning; translating it, as surgeons should, that an exception proves a rule, tests it, searches it—as the Bible says, we should 'prove all things'—to its very boundary. In this true meaning, the words may be an excellent motto for the study of all diseases that deviate from types.

"(2.) We should look out for indications of the existence in the same person of two or more morbid conditions or dispositions such as may be derived from both parents or from several ancestors. For, as in plants and animals there are hybrids and mongrels, or, as in chemistry, many compounds and many mixtures, so are there in diseases. We see them in the multiform and confused varieties of what we have to call rheumatic gout; in gout crossed with scrofula, and syphilis crossed or mingled with scrofula or with gout. It is often not difficult to discern some of these combinations among our cases; and I know few things in practice more useful than to be able, even in some instances, to adjust our treatment to the proportion of each disease in the compound. But we may be sure that there is much more to be learned in this direction; and it is best to believe that we rarely have to do with a simple and unmixed morbid constitution. There are few worse habits in practice than that of commonly saying of one case, 'It is all gout,' and of another it is all scrofula, or all syphilis. We might as well say of any Englishman that he is all Norman, or all Anglo-Saxon, or all Celt. We may, indeed, sometimes see persons who appear to be as types of races unchanged in many centuries, but in practice we had better study every man as, for better or worse, a composite of many ancestors.

"(3.) We should have for all these cases a much more complete and exact study of all the personal conditions of disease than is now usual. Of course, this should include all that can be learned of each patient's family history—though there are few parts of medical inquiry more fallacious than this often is; and at the best it will need, besides, the exactest study of the patient's self. Perhaps the brilliant success which has been achieved by the recent studies of disease-producing organisms or other materials acting on us from without—a success not equalled in any other field of medical inquiry—has made some

think too little of those changes within ourselves which occur in such ordinary conditions of life that they may be called spontaneous. Yet these are not less important in the production of diseases, and these must be studied, just as in agriculture soils must be studied as well as seeds. This is true even in respect of those diseases whose essential causes are most evidently external, even of those which are due to specific contagia; their germs or seeds, if I may so speak, will not germinate in an unfit soil. I suppose there is not a day in which most of us do not inhale or come in contact with the germs of some frequent or contagious disease; but they do not germinate in us any more than do the seeds of tropical flowers in our streets or in the fields to which the wind scatters them —we do not offer the fitting soil. And even among those in whom they do germinate, the product varies according to the soil. And the study of this soil, this living soil, is yet more necessary in respect of diseases which come, in part or wholly, by inheritance; for it is in each as personal and distinct as any other constituent of personal character, and the study of it must be intimately personal, with an exact analysis of every disposition to disease. The aim of pathologists in this direction should be for knowledge like that of the keen family practitioner, who, as he says, knows the constitution of every member of a family."

The hereditary transmission and transmutation of diseases are therefore important points to be observed in connection with the evolution or "coming into existence" of new diseases; and the inquiry may be very much assisted by such family records as those which Mr. Francis Galton has reduced to a system. It is only through individual experience that we can obtain—

(*a.*) Authentic records of the transmission by inheritance through many generations of such constitutional diseases as gout, rheumatism, tuberculosis, scrofula, diabetes, and the constitutional form of Bright's disease, or epilepsy through two or more collateral branches of one family.

(*b.*) Instances there are of the transmutation by heredity of epilepsy, migraine or megrim, diabetes, hysteria, alcoholism, in which, through members of the same family, one or other of those affections are replaced by some one or other of them.

Personally I am persuaded of the frequency of epilepsy as an inheritance in families, assuming in some members of the afflicted family, diabetes rather than epilepsy; or of migraine as a form of epilepsy. Such may be regarded as evidence of the co-relation of these constitutional diseases.

From the point of view of Heredity and Environment as all powerful in the evolution of constitutional disease, there is perhaps no subject in the whole range of medical science which the student ought to study more carefully than the cachexia, or special forms of ill health, associated with the occurrence of *tubercle* and *scrofulous affections*. As a practitioner he will find that he becomes often painfully concerned in the deepest interest of families and society, through the threatened or actual ravages of scrofulous diseases. The extensive prevalence of the scrofulous cachexia—the great and almost inevitable mortality of the scrofulous diseases themselves when completely developed, stamp the morbid state associated with them as a topic which, at the outset of the student's career, ought to engage a large share of his study. Most assuredly the physician will have to turn his knowledge of the pathology of scrofula to account in every phase of his professional life. When he fully appreciates what experience has adequately demonstrated, that the scrofulous cachexia springs from causes over which the public (rather than the medical profession) have control, he must be at once impressed with the belief and encouraged with the hope, that when he acquires the confidence of families in the practice of his profession he may exercise a powerful influence for good in teaching how much the public may control the ravages of *scrofula* and *consumption* by prudent marriages, by sanitary attention to offspring, and by the necessity of free ventilation and of fresh air in dwellings. There are several circumstances which show the great influence of public sanitary measures in controlling the development of scrofula, when these measures are scientifically directed to the preservation of general health, especially where men are associated together in great communities—an influence much greater than the best directed efforts of the medical profession can establish through their *materia medica*. It is by the mode of life as citizens of the world, in the social relations of husbands and wives, parents and children; in the public relation of masters and workmen, that the extent and ravages of *consumption* and *scrofula* are to be controlled. It is by a strict attention to the rearing of offspring, and in the subsequent regulation of food, clothing, cleanliness, and occupation; in the choice of a profession, and by many other circumstances which have an obvious influence (perhaps at first sight inappreciable) on the maintenance of the general health, that our hopes of success as practitioners of medicine must rest in the prevention of that bad habit of body which develops, propagates, and

tends to the evolution of new forms of scrofulous diseases in civilised society.*

It is impossible to measure or estimate the relative importance of those two factors in the evolution of constitutional diseases, Heredity and Environment. The main influence may be assigned to Heredity; but in practice we are mostly concerned with the Environment of the patient. "What Heredity has to do for us is determined outside ourselves. No man can select his own parents. But every man to some extent can select his own Environment. His relation to it, however, largely determined by Heredity, in the first instance is always open to alteration. And so great is his control over Environment, and so radical its influence over him, that he can so direct it, as either to undo, modify, perpetuate or intensify the earlier hereditary influences within certain limits."

"The influence of Environment may be investigated in two main aspects. First, one might discuss the modern and very interesting question as to the power of Environment to induce what is known to recent science as variation. A change in the surroundings of any animal, it is now well known, can so react upon it as to cause it to change. By the attempt, conscious or unconscious, to adjust itself to the new conditions, a true physiological change is gradually wrought within the organism. . . . Not only changes of food, but changes of climate and of temperature, changes in surrounding organisms, in the case of marine animals, even changes of pressure, of ocean currents, of light, and of many other circumstances, are known to exert a powerful modifying influence upon living organisms. These relations are still being worked out in many directions, but the influence of Environment as a prime factor in variation is now a recognised doctrine in science." †

These principles, so eloquently and lucidly expressed by Mr. Drummond in his most impressive and remarkable work, from which these quotations are taken, cannot fail to be most suggestive in explaining the influence of evolution in the origin and development of constitutional diseases, thereby furnishing another important contribution to that scientific pathology which Professor Huxley has shown to be in reality the subject matter of ordinary biology.

* Aitken, *loc. cit.* Vol. i, p. 1,030.

† Mr. Henry Drummond, *loc. cit.*, p. 259.

Section VII.—*Gradual and Progressive Evolution of Zymotic Diseases and Classification of Anomalous Cases.*

With regard to diseases which were wont to be called zymotic, which possess the peculiar character in common of suddenly attacking great numbers of people at intervals under unfavourable sanitary conditions, and which are emphatically the "*morbi populares*"—"the people's plagues"—may we not regard the period as ripe for entertaining a belief in the probability that—*in addition to a mode of propagation direct from previously existing cases*, as of small-pox from small-pox, of typhus fever from typhus fever, or of enteric fever from the hypothetical germ passed from the intestinal canal of a previous enteric patient—there may also be another possible mode of origin, development, and propagation of such diseases—namely, by an evolutionary process, more or less external to the individual, but influenced by his constitutional pre-disposition, and mainly determined somehow by the conditions of his surroundings—environment—and of which as yet we not only do not know enough, but we scarcely know anything at all.

By the application of Darwin's theory of evolution to explain the "coming into being" of zymotic diseases, I think we may obtain a more comprehensive and satisfactory view of their pathology than we have hitherto been able to get; and with increasing power and efficiency in our efforts at preventing them. They are those diseases which possess the peculiar character in common of *suddenly* attacking great numbers of people at intervals in unfavourable sanitary conditions. In the eloquent language of the late Dr. Farr—"They distingush one country from another, one year from another; they have formed epochs in chronology; and, as Niebuhr has shown, have influenced not only the fall of cities, such as Athens and Florence, but of empires; they decimate armies, disable fleets; they take the lives of criminals that justice has not condemned; they redouble the dangers of crowded hospitals; they infest the habitations of the poor, and strike the artisan in his strength down from comfort into helpless poverty; they carry away the infant from the mother's breast, and the old man at the end of life; but their direst eruptions are excessively fatal to men in the prime and vigour of age."* These variable characteristics, as far as the succession of diseases can be traced in past ages, and the

* *Sixteenth Annual Report of the Registrar-General.* Appendix, 1856. P. 76.

peculiarities they have exhibited at different periods of the world's history, or even within comparatively recent cycles of years, point unmistakeably to their gradual evolution with the development of civilisation and with those factors which make up the insanitary environments of peoples and nations, cities, towns, and villages, armies and fleets, jails and crowded hospitals, and the insanitary habitations both of the poor and the rich. Thus the march of civilisation (so called) has had much to do with the evolution of zymotic diseases. "The breath of civilisation is poisonous to savages." * The bilious disorders, now the terrible scourge of the *tierra caliente*, were little known before the conquest of Mexico, in 1519. The seeds of the poison seem to have been scattered by the hand of civilisation; for it is only necessary to settle in a town, and draw together a busy European population, in order to call out the malignity of the venom which had before lurked innoxious in the atmosphere. The epidemic of the *matlazahautl*, so fatal to the Aztecs, is shown by M. de Humboldt to be essentially different from the *vómito* or bilious fever of our day. Indeed this disease is not noticed by the early conquerors and colonists, and, Clavigero asserts, was not known in Mexico till 1725. Humboldt, however, agrees that the same physical causes must have produced similar results, and so carries the disease back to a much higher antiquity, of which he can discern some traditional and historic vestiges.

When Cortes landed with his force on the very spot where now stands the modern city of Vera Cruz, little did he imagine that the desolate beach on which he first planted his foot was one day to be covered by a flourishing city, the great mart of European and Oriental trade, the commercial capital of New Spain. "But the place was surrounded by stagnant marshes, the exhalations from which, quickened by the heat into the pestilent malaria, have occasioned in later times wider mortality to Europeans than all the hurricanes on the coast. It was the first colony in New Spain. It was hailed with satisfaction by the simple natives, who hoped to repose in safety under its protecting shadow. Alas! they could not read the future. . . . . The light of civilisation would be poured on the land; but it would be the light of a consuming fire, before which their barbaric glory, their institutions, their very existence and name as a nation, would wither and become extinct! Their doom was sealed when the white man had set his foot on their soil." The visit of Narvaez with his fleet left melan-

* Darwin, *Descent of Man*, vol. i, p. 239.

choly traces amongst the natives that made it long remembered. A negro in his suite brought with him the small-pox. The disease spread rapidly in that quarter of the country, and great numbers of the Indian population soon fell victims to it. It spread far and wide till it reached the Aztec capital, sweeping over the land like fire over the prairies, smiting down prince and peasant, and adding another to the long train of woes that followed the march of the white man.*

Zymotic diseases and individual diseases, in place of being considered as "separate existences," ought to be looked upon as departures from the normal type or line of health, which every organism possesses more or less strongly—so that pathology is only abnormal physiology—"a branch of biology which concerns itself with the perturbations of the normal life,† so "that diseased states of the body are but modifications of healthy states, deviations from the beaten track, shortcomings of the physiological standard." "There is no definite limit where health ends and disease begins." And "to find the proper physiological analogies for disease processes is the task of modern pathology. The physiological idea is, indeed, the hope and inspiration of pathological science, as it is also of medical practice."‡

Hitherto we have been too much given to study cases as to how near their symptoms approach to certain clinical typical standards (as laid down in text books), and not as they merely show departures from healthy types, *i. e.*, from those normal physiological processes which maintain the state of health. (Hughlings Jackson.) It is such departures which make up the disease, and it is the aggregate of the clinical phenomena which are in evidence by which we recognise its presence. Hence it is this evidence, at the bedside, which the clinical student must seek out from accurate observation of the patient before him, rather than from the description in a book of a disease which may merely resemble the patient's symptoms.

Working in this comparatively narrow groove we have become oblivious to a great mass of facts almost insensibly increasing from day to day which cannot be explained on the older theories, but to which the cardinal truth of evolution would seem to afford a rational explanation—and much evidence is accumulating in favour of the theory of progressive

* *History of the Conquest of Mexico.* Prescott, vol. i, 254-298; vol. ii, p. 368.

† Millican, *loc. cit.*, p. 9; also Huxley.

‡ Dr. Creighton "On the Autonomous Life of the Specific Infections." *Brit. Med. Journal*, 4th August, 1883.

evolution as sufficient to explain, not only the origin of many forms of constitutional or "inbred" disease, but the progressive development of some fevers, like enteric fever, and like scarlet fever and diphtheria, from simple cases more or less anomalous—obvious departures from the usual normal types of these zymotic diseases gradually acquiring specific infectiveness as the cases multiply.

I have myself had experience of sore throats commencing in more or less acute tonsillitis, due apparently to indifferent causes gradually becoming more and more severe, as case followed upon case, till (as if by progressive development) they eventually culminated in typical scarlet fever, or in diphtheria with its unmistakeable sequelæ of paralysis. Such cases thus acquired by a process of evolution through several individuals, their typical infectiveness, each new one furnishing its quota of pernicious material to the surroundings and thereby adding to the virulence and to the amount of the concurrent factors setting up the disease. This question of "progressive development" has been especially illustrated by Dr. Millican in his work already noticed, and also by Dr. G. de Gorrequer Griffith; and under this heading the former writer describes "a series of cases at first indeterminate, or consisting merely of some symptom which is prominent in one of the ordinary specific or zymotic diseases, but becoming increasingly more and more typical, as it progresses through various patients, until at last we behold a distinct evolution of what is a specific disease," and he gives examples of a first case of diarrhœa developing eventually into cases of enteric fever, and of sore throat into diphtheria or scarlet fever.*

Instances of the evolution of scarlet fever through progressively developing bad sore throats are also recorded in detail.† Similarly, cases of diphtheria were shown by Dr. Thorne and others to be evolved from membranous croup, inasmuch as it was observed in several outbreaks of diphtheria that the earlier deaths were due to membranous croup, while the later ones were due to malignant diphtheria.‡ Over a large area there would be a great tendency to sore throat; then groups of cases would occur here and there in which the disease became decidedly infectious; and at last in a single village in the area an outbreak of diphtheria would occur in its most severe and fatal form.§

* *Loc. cit.*, p. 22 and 97.
† Millican, *loc. cit.*, p. 81.
‡ See *Report of Medical Officer of Health.*
§ Millican, p. 80.

But I could wish no better example, because without bias, as to the question of the gradual evolution of zymotic disease than that furnished by the Director-General of the Army Medical Department of the War Office, Sir Thomas Crawford, at p. 4 of the very comprehensive memoranda which he recently issued for the guidance of the officers of the medical staff of the Suakim Expeditionary Force. There it is written :—

"The events making up the medical history of an army in the field develop themselves with a regularity that is almost monotonous. Looseness of the bowels, under the name of camp diarrhœa, begins to be common almost as soon as the army takes the field. This is in a large number of cases compatible with apparently good health, and is doubtless attributable to the changed condition of life. Soon cases of fever appear, some of very brief duration, which are classified as heat fever, and some are attended with diarrhœa, marking the commencement of enteric fever in the force. The development of this disease and the proportions it will assume will be merely a question of time and circumstances. The disease embraces every variety, from the mildest to the severest types, from the so-called ambulant to the most fatal forms. The instances in which this fever occurs as a relapsing typhoid properly so-called, with an invasion fever period, followed by one or more febrile recurrences in which all the characteristic phenomena are repeated with intervals of apyrexia between them, are also not uncommon. The disease occasionally runs so mild a course as to resemble a febrile dyspepsia, and then the thermometry of the fever either fails to be recognised at all, or at any rate fails to be recorded with any degree of accuracy."

Again, no broad nor defined lines can be drawn between the severest cases of cholera and those slighter and generally curable cases which are seen during the prevalence of an epidemic, or which occur as sporadic cases during its intervals. An attentive observer may trace up every grade from the merest cholerine to the terrible disease which kills inevitably in a few hours. The cases may pass into each other and the one may induce the other, so that alliance at least is implied in such possibility. Abrupt lines of demarcation between such allied affections have no existence in nature. *

The recorded irregularities from the artificial clinical types of diseases are now so numerous that they form a very large class still standing alone—so large a class that comparatively

* Dr. E. A. Parkes on *Cholera*, p. 5.

the so-called typical cases become an insignificant minority.* Practically, for example, it has not been found possible to classify all the fever cases under the definite types described in books. Cases of an anomalous or mixed nature do occur concerning which a distinguishing diagnosis cannot be given. While certain distinct forms of continued fever are capable of being recognised as described in books, there can be no doubt that cases of fever do occur all over the world which run a continuous course, but having no other specific characters, and which in many respects do not seem quite the same as those with which we are so familiar, and which can at once be clinically recognised. For example, the late Dr. Murchison records in the forty-first volume of the *Medico-Chirurgical Transactions* that he had to leave out of consideration about 200 anomalous or doubtful cases which he could not classify as either typhus or enteric fever.

A similar class of doubtful or anomalous cases are seen to occur in places where yellow fever and remittent fevers prevail, and which cannot be classed as either the one or the other.

In the Mediterranean latitudes there is a "gastric remittent" fever described, which seems to have many characters in common with some forms of continued fever, but which cannot be identified with any of the known forms.†

Wunderlich and Murchison both describe febrile phenomena which are of so anomalous a kind that they refer them to a combination of the poisons of typhus and enteric fevers, so that the characters of each do not remain distinct. So likewise Professor W. T. Gairdner, in stating that of late (1853 to 1862) the cases of fever in the Edinburgh Royal Infirmary have not been more than seven or eight cases a month under his notice, but they included "*numerous anomalous fevers* which have quite overborne the numbers of genuine typhus and of enteric fever together."‡ A fever termed "gastric" was very distinctly described by the late Dr. Andrew Anderson, of Glasgow, which would also come under this head.

The "bilious typhoid" or "bilious remittent," described by Griesinger, of Tübingen, is another form of undefined continued fever.

* Millican, *loc. cit.*

† Craigie, *Practice of Physic.* Marston, *Army Medical Department Reports.* It is also described by Dr. Henry Veale under the name of *febris complicata;* and by Dr. J. P. H. Boileau. Appendix to *Outlines of Science and Practice of Medicine*, by W. Aitken, M.D., F.R.S.

‡ *Clinical Medicine*, p. 154.

At the Clinical Society of London, so recently as 23rd October, 1885, Dr. Edward Seaton gave an account of "Characteristic Symptoms of a Febrile Epidemic Illness at a School."* This school was an Orphanage near London, containing about 600 children, and the outbreak of illness took place during the past summer. "The disease occurred in 157 cases; it was confined to the inmates of the school, and did not spread to houses or cottages close by; it began in June, and proved fatal in seven cases. The earlier cases were generally more severe than the later ones; and there were second attacks in at least five instances, in one of which the interval was sixty-six days. No adults, of whom there were about twenty at the establishment, were attacked. The onset of the illness was sudden, without any premonitory symptoms. The first symptoms were rigors and severe frontal headache, followed in a few hours by pyrexia, vomiting (often very severe), without diarrhœa, scantiness of urine, and almost complete absence of the chlorides therefrom. The crisis rapidly developed; fatal cases terminating within twenty-four hours, and in uncomplicated cases defervescence occurring, in two or three days in slight cases, and in four or five days in severe cases, by a sudden fall of temperature, which was generally simultaneous with the appearance of a herpetic eruption on the upper lip, and with perspiration, but no marked sweating. Earache, occasionally followed by otorrhœa, was a late symptom of the fever in some cases. There was absence of any other local pains, except those due to the straining of the muscles from vomiting. The illness rarely extended beyond four or five days, unless complicated with pneumonia. The pyrexia was variable, the highest temperature extending from about 101° F. in slight cases to 106° F. in very severe cases, and more than half the cases were of this latter type. The fall of temperature was as sudden as its rise, unless pneumonia supervened. The ear-mischief appeared to be due to extension of inflammation from the naso-pharyngeal passages up the Eustachian tube to the middle ear. In the only fatal case examined *post-mortem* there was pneumonia of the base in each lung, and patches of congestion of the ileum for some four or five feet above the cæcum. Dr. Seaton thought the disease was specific, that it was probably not contagious, and that its period of incubation was short. Dr. Bridges further gave some interesting facts respecting the etiology of the affection. He describes the school as very unhygienic; the land attached to it was only six acres in extent, and the earth-closet system

* *Brit. Med. Journal* and *Lancet*, 31st October, 1885.

had been adopted for the last twenty years. All the refuse from the earth-closets had to be distributed over the small area of land available—at most an acre and a half—so that this land was quite overcharged with fæcal matter. There had also been, in previous years, cases of sudden illness, and even death, which were ascribed to the unsanitary surroundings. The disease was quite unlike enteric fever. Dr. Bridges thought it was caused by the exhalations from the sewage sodden land on which the elder boys were put to work, and to which the younger ones, who ran in the playground, were not required to go; thus was explained the much greater incidence of the illness upon the bigger boys, as well as the escape of those boys who were confined to the Infirmary. It must not be forgotten, also, that the rainfall from June to September was only one-fourth of the usual amount; this fact may have partly influenced the outbreak. It is well that these facts should be known far and wide, because the extensive use now made of earth-closets in districts where there is difficulty in disposing of fæcal accumulations must be placing many localities in a condition similar to that of this orphanage; and if this kind of epidemic illness has any relationship to such surroundings, there will probably not be long to wait for proof thereof."*

This narrative clearly describes a fever which cannot be referred to any of the well known orthodox forms. Is it, then, a new disease which has sprung up *de novo* out of the environments of the orphanage—one of the innumerable forms of a "filth disease?"

A classification of "anomalous" cases, *i.e.*, of recorded irregularities or departures from type has been definitely formulated for the first time by Mr. Millican, under the following heads:—

Class I.—*Variability in transmission—as in cases where disease of one type appears to convey disease of another type.*

This class appears to me to correspond to the cases long ago described as instances of the "conversion of diseases," and embraces cases of every conceivable variety of diphtheria and scarlatina with and without rash, contracted, for example, from cases of simple excoriations with fever attributable to common cold. Cases in which scarlet fever and diphtheria appear to be interchangeable; in which cases of diphtheria appear to arise from scarlet fever, and scarlet fever from diphtheria; or in which cases of scarlet fever give rise to measles; or, lastly, in which rose rashes occurring in puerperal fever, connect them with sources of infection from scarlatinal

* *Brit. Med. Journal*, 31st October, 1885.

cases—such cases terminating in the ordinary symptoms of puerperal fever, arising in this way from sources of infection of zymotic origin. Thus the contagia of measles, diphtheria, erysipelas, typhus, and typhoid fever have been shown by Mr. Howse, of Guy's Hospital, to give rise to a septic form of puerperal fever.*

The important question of the occasional spontaneous evolution of general disease—(its autochthonous production—by self-infection through the products of abnormal processes within the body itself), has been already referred to, and has recently received further elucidation by Dr. Robert Barnes, obstetric physician to St. George's Hospital. He has shown how some forms of puerperal fevers may spring up in the patient's own system without having arisen from any external source (autogenetic). The event happens in this way: an active process of building up has been going on up to the time of delivery. But the moment delivery is accomplished, the reverse process of demolition and of carrying away the refuse is begun. Absorption and excretion are then the ruling energies, so that the refuse stuff may be cast out of the body, which, if not duly excreted, may be as poisonous as are the elements of urine when they are not duly excreted.

Moreover, the conditions which accompany the ailments of the parturient female distingush them from the diseases of all other persons, and the following factors must be taken into account in explaining how disturbance of the puerperal process may lead to the spontaneous evolution of puerperal fever. (1.) The blood of the parturient female has been very much altered during the construction and nutrition of embryo and uterus; and so it greatly differs from the blood of the woman in her ordinary state. It is in this blood that the *post-partum* and puerperal processes are wrought; and this altered blood is associated with universal changes going on in the body.

Science records new facts, day by day, which lead us to conclude that, in the pregnant woman, there is not a single fibre or a single drop of liquid which does not undergo some modification.†

At the time of labour there is an excess of that colloidal fluid called fibrine, with a diminished proportion of red corpuscles, increased proportion of water and increase of white corpuscles, so that, as Dr. B. W. Richardson observes, "the blood at that time is in a *trembling equilibrium*, ready on the slightest possible disturbance to precipitate it. There is also a diminu-

* *Guy's Hospital Reports*, vol. xxiv.

† Tarnier, quoted by Dr. Barnes in *Brit. Med. Jour.*, 13th Dec., 1884.

tion of salts in the blood—a condition still more favourable to the precipitation of the colloid fibrine. The woman has also been supplying to the child a mass of blood from her own body, which has now (suddenly) ceased to be supplied, so that practically she is in the condition of a person who has lost a limb, or a considerable portion of her body." She is also in a peculiar nervous condition. The fall in nervous and vascular tension involves a change in the dynamic state of the circulation. Then follows a period of comparative rest, following the labour, of about 48 hours duration, preparatory to the active processes involved in breaking up of tissues, now of no use, and of casting out the refuse stuff, for which adequacy of function in every organ is of the utmost importance. Hence, evidence of self-poisoning is rare before the third day.

Dr. Barnes further describes the progress by evolution of the febrile state, which, having thus been developed, is capable of being propagated by direct succession in circumstances favourable for its transmission. In other words, once autogenetically developed, it may continue to propagate itself by personal contagion or infection.

The peculiar condition called "Kussmaul's coma" or "diabetic coma," is another example of the autochthonous evolution of disease. It is an evolution which is shown to be not peculiar to diabetes, but occurs in pernicious anæmia and in the typhoid states, presumably through some (as yet unknown) chemical decomposition occurring within the body, and affecting the blood or other fluids. It has also been described under the hand of acetonæmia, in the belief that it is due to acetone in the blood. It usually betokens a sudden spontaneous self-infective poisoning, and a rapid death.

It must, therefore, be admitted that "the living tissue elements of the body itself play a much more important part in the elaboration of septinous and allied poisons than what has been of late ordinarily ascribed to them."*

Class II.—*Diversity from Unity, as in "cases where, from a common source, two or more specific diseases appear to take their origin," in which the same insanitary conditions have given rise to diphtheria and typhoid fever in different patients; to typhus and typhoid originating from the same source; to scarlet fever and diphtheria; to typhoid and typhoidal pneumonia; to cörelatives of sore throat and scarlet fever; to diarrhœa and typhoid; to diarrhœa and cholera; to catarrh and measles; to catarrh and rheumatic fever, and to many*

* Dr. T. R. Lewis, *Microscopic Organisms found in the Blood.* Calcutta, 1879, p. 57.

other named forms of disease; also to diphtheria appearing to be interchangeable with follicular tonsillitis, and having distinct pathological connection with other diseases, as in the use of bad water giving rise to cases of diarrhœa, purulent ophthalmia, erysipelas, or pharangeal diphtheria. *

Here the same poison apparently originates typhoid and diphtheria. The two diseases often occur and run side by side in different individuals in the same house.† Numerous cases are detailed by Dr. Millican, and are now of frequent occurrence in our medical journals.

Class III.—*Nondescript cases, which comprehend febrile diseases of an indeterminate nature, and some of them infectious;* as, for example, rötheln or German measles, which has now for some time been regarded as a distinct and comparatively new disease, allied to scarlet fever on the one hand and to measles on the other, and capable of generation *de novo*. Such cases have also been described as "hybrids," or rather as *nondescript* cases, because their characters are so indefinite that it is difficult to classify them while presenting features of an anomalous kind, as when cases of typhoid fever appear with a scarlatina eruption, or with a measle-like rash; or scarlatina, measles, and whooping-cough ending in a fatal form of enteric fever; fatal cases of scarlatina, accompanied by *swelling* of Peyer's patches, but no ulceration; and cases of *mixed* enteric and scarlet fevers, in which the concurrence of measles with variola subsequently gave origin to a case of scarlatina with variola; cases of typhus with scarlet fever rash and characteristic sore throat.‡ Dr. W. J. Collins also records his experience of cases of variola with scarlatina rash, of hybrids between scarlatina and diphtheria, of typhoid with typical rötheln rash, and of puerperal fever closely resembling typhoid.§

In an admirable paper on the Pathology of Scarlatina and the Relation between Enteric and Scarlet Fever,‖ Dr. John Harley (late physician to the London Fever Hospital), gives an account of the morbid anatomy of forty cases of scarlet fever, in twenty-eight of which he gives a consecutive history of the progress of the case and of the morbid changes from day to day. Until this time no connected account of the pathology of scarlatina can be shown to exist in medical

* Dr. Dickinson in Med.-Chir. Society, *Brit. Med. Jour.*, 24th May, 1879.
† Clement Dukes, *Brit. Med. Jour.*, 25th January, 1879.
‡ Millican, *loc. cit.*, p. 100.
§ Reply to Dr. Millican's circular, *loc. cit.*, p. 101.
‖ *Med. Chir. Trans.*, vol. lv, p. 103.

literature. Dr. John Harley found that the most fatal period is from the third to the sixth day, and so invariable are the essential lesions that it may be said there is no disease in which the morbid effects are more uniform, and which show that scarlatina is essentially a disease of the lymphatic system —*febris lymphatica.* It is attended with inflammatory action of this system of glands, *i. e.,* of the spleen, mesenteric glands, the tonsils, and the solitary and agminate glands of the intestines, and the primary lesions are those which result from their inflammatory action, others (and, it may be, secondary lesions) having reference to the condition of the blood and the bile, and that a more or less sudden death is likely to occur during the first week of the disease from the formation of fibrinous clots in the heart and great vessels during a pyrexial state, and this may happen during any period of the disease. It is indicated during life by the reduction, often sudden, of a full pulse of about 120 to a dribble of 150 or 160 almost imperceptible impulses, and this failure of the heart's action is commonly attended with orthopnœa and delirium from obstruction to the pulmonary and cerebral circulations. He further records cases in which he has observed the primary inflammation of the intestinal and sometimes of the other glands pass into the ulcerative change, and so lead to the development of enteric fever as a sequel to scarlatina.

From a careful analysis of his cases, Dr. Harley is of opinion that *one general conclusion is inevitable as to the connection of scarlet fever*—namely, *that the pathological changes accompanying an attack of scarlet fever include all those of the first stage of enteric fever, and are so far identical with them.* It follows, therefore, that the transition from the former disease to the latter is nothing more than a natural pathological sequence, readily determined by any cause which may increase the intestinal irritation.

The transition from scarlet fever to enteric fever is further shown to be very insidious in its progress and complete in its results, and Dr. Harley gives further examples of cases in which the symptoms of the two diseases co-existed, in which he also indicates the points at which the outward symptoms of the two diseases meet and overlap one another. A large number of cases of enteric fever may be traced back to their origin in well marked scarlet fever. It is therefore as incorrect as it is unscientific to divide the train of outward symptoms which constitute the phases of one morbid condition into two sets, indicative respectively of two specifically distinct diseases, as so regarded. All such classification puts an artificial line of

demarcation where no real limit exists, and for a time at least effectually bars the advance of truth.

Excepting perhaps the flushed cheek, the mark of persistent abdominal irritation, there is no feature of enteric fever which may not be observed in many cases of scarlatina, and conversely, a large number of patients who came under our notice for the first time, suffering from enteric fever, will present the pallid face, the excoriated nostrils, the large red lingual papillæ and tonsils, the moniliform glands, and, occasionally, the aural discharge of a declining attack of scarlatina. Dr. Harley has also given an instance in which albuminuria and general anasarca immediately followed an attack of enteric fever. *

This intercurrence and sequence of scarlet and enteric fevers has been noted by several authors, and attributed to accidental coincidence; but Dr. Harley's evidence is sufficient to justify the belief that it is due to a most intimate pathological relationship; and that the pathology of scarlatina is precisely that of the first stage of enteric fever; and to the contagious variety of enteric fever he has applied the term of "abdominal scarlatina," as an appropriate definition of a disease which is often to be met with. Finally, Dr. Harley asks his fellow-labourers to go one step further with him, in the interests of truth as opposed to dogmas worthy of the dark ages, and discarding those transcendental ideas of enteric fever which make of it a specific disease always dependent on one particular poison, open their minds to receive what experience will soon teach them—that enteric fever, and all its attendant phenomena, may occasionally become a part of almost any other general inflammatory condition, specific or simple.

Enteric fever is now also so universally known to be associated with malarial phenomena in malarious places that "typho-malaria" (in deference to American physicians especially) is now a typical form of fever so named in the recent re-issue of the nomenclature of the College of Physicians.

Numerous other examples of anomalous fevers are to be found in Dr. Millican's work, in reply to his circular, seeking for information on these points.

These, and such like examples as have been already given of the progressive development of disease from a simple to a more complex case—from a comparatively benign and common inflammation to a malignant and infective type, through a series of many cases proceeding from a common origin, furnish cumulative evidence of a very cogent kind in favour of Darwin's doctrine of Evolution as sufficient to explain the "*coming*

* Reynolds' *System of Medicine*, vol. i, p. 571.

into being" of some types or forms of zymotic disease. It therefore appears to me, as it has done to others, that "all the weight of *a priori* evidence tends to prove that in disease, as in Nature generally, evolution results in the origin of new diseases" *—that "perturbations of the physiological life may ultimately acquire an independent existence as infective diseases, and that common disorders may ultimately acquire specific power."

Facts are in request which will illustrate the natural history of cases rather than mere opinions as to their nature —facts which will make up a complete natural history of the hitherto unclassifiable and abnormal cases—facts which indicate variability in transmission, where one kind of specific ailment appears to have transmitted another disease—facts which suggest a hybrid development, such as the "German measles" (rötheln) out of measles and scarlet fever—facts which show that the same concurrence of factors generating disease appears to have originated in different persons diseases of different types—*e.g.*, enteric in one, diphtheria in another, scarlatina in a third—and, lastly, facts bearing on the *de novo* origin of diseases.† Here, too, as well as in constitutional diseases, heredity seems to have some influence, as would appear from the following example which is described as inherited immunity from individual to stock, from diseases usually transmissible by contagion or infection. Kaltenbach of Giessen‡ relates that he has twice met with such a case. A twin girl (one of a family of six) who escaped contracting scarlet fever, although twice exposed to the contagion when one or other of the children fell ill—including her twin sister—the child in question being thoroughly exposed to the contagion. In all other respects the twins suffered alike. They simultaneously contracted catarrhs and twice measles. The explanation given is that the mother of the child had scarlatina severely when 6 years of age (*i. e.*, 14 years before the period of conception of these twins). The one who enjoyed immunity resembled the mother in all her physical and mental qualities; the other as strikingly resembled the father, and it is argued that the transference of immunity from the scarlet fever gained by the attack by the mother is not more remarkable than the transference of bodily and mental characters.§

* Millican, *loc. cit.* p. 84.
† *Loc. cit.* p. 97.
‡ *Virch. Arch.*, Bd. 101, Hft. 1.
§ *Lancet*, 22nd August, 1885, p. 351.

Having quoted in the preceding section the opinion of one of the greatest surgeons of modern times, and the most philosophical of pathologists—Sir James Paget—as to the value of recording "anomalous" cases of "constitutional diseases," some of which come under the notice of the surgeon rather than the physician—I would now quote the opinion of one who was not less eminent as a physician—the late Dr. Parkes—as to the value of recording "anomalous" cases of continued fevers and zymotic diseases. "It is these 'doubtful or anomalous' cases, he observes, which require careful and special methods of investigation. They are of the utmost importance to science, for more extended information regarding them will either connect them with forms of fever between which they seem to stand; or the 'doubtful cases' will eventually separate themselves into distinct forms, whose history is still unknown. The power of observation in medicine is a kind of tact which ought to be cultivated with the same assiduity as the chemist practises when he learns how to manage his delicate manipulations. In medicine the observation and recording of phenomena have been held to be an easy and trifling task, which any tyro was competent to do. Hence half the error and uncertainty of medicine. Inaccurate, that is, erroneous and incomplete observation, has been the cause that, till within these few years, the fevers of cold countries have been so absolutely uncomprehended, and that the fevers in hot countries are still shrouded in obscurity. The most valuable addition any one could at present make to our knowlege of tropical fevers would be *a simple record of all the cases in an epidemic.* These cases should be observed with the keen tact of a Chomel, and recorded with the fidelity of a Louis. We want no explanation or word of comment added to them; we want merely the cases. Then, when the numbers are sufficient, we should certainly begin to put order into this chaos. And let not any one who may have the opportunities be deterred from the task by that fallacious and, we beg to say, most reprehensible argument, with which some people may favour him—namely, that his cases will be 'tedious,' 'heavy,' and 'unread.' Unread they will be, certainly, by some of the profession, who consider their routine practice as great an effort as their intellect will bear; but read and analysed, we will venture to say, they will be by those who think no labour too great if they can fix safely the foundations of medicine, and for whom, *if accurately reported,* no cases can be too long, no observations too minute. Only, before the task is commenced,

let the observer feel that his powers are equal to it; and let him bear in mind the example of Louis, who recorded most carefully for a long time, that he might train himself to this duty, and then, throwing his probationary cases aside, as too uncertain for use, began to make those remarkable series of observations which have linked his name for ever with the greatest improvements in modern medicine—the employment of a correct method of studying his science."*

SECTION VIII.—*Outcome of the Pathological Position and Question as to the Origin of some Zymotic Diseases* de novo, *in Man and Animals.*

THE logical outcome of the position arrived at is, "That we can conceive of any one of the so-called specific diseases arising *de novo*, as must certainly have happened at some period of the world's history for the first time; and that, having so arisen, it became capable of transmitting its like apparently only by infection." (Millican, *loc. cit.*, p. 46.)

I. *Enteric Fever.*—Alleged instances of the *de novo* origin of cholera, typhus fever, enteric fever, diphtheria, erysipelas, and puerperal fever are now comparatively common; and we have no right to assume that as yet we know *all the methods* by which these diseases may be generated or propagated. In this connection it may be here stated that so careful and cautious an observer as the late Dr. Parkes has recorded his doubts as to the generally accepted cause of enteric fever in this country being the only cause to which it may be referred.†

In India, in Egypt, and recently in the Soudan, the origin or causation of enteric fever has become a very important question; and the opinion is now extensively entertained that alike in India, in Egypt, and in this country, views as to the origin and causation of enteric fever are too exclusive and inadequate to account for all the facts. The evidence of medical men of extensive Indian experience, such as Sir Joseph Fayrer, of the Indian service; Drs. Marston, MacConnell, Clarke, Welch, Don, Pedlow, and others of the British medical service, fully substantiates this statement.‡

* Dr. Parkes in *Brit. Med. and Foreign Med.-Chir. Review.* October, 1850, p. 435.

† *Hygiene.* 1866 Edition. P. 455.

‡ Croonian Lectures. By Sir Joseph Fayrer.

A few years ago enteric fever was said to be unknown in India. But now enteric fever in India has been regarded by some as *the one disease of all others* from which our young soldiers die in that country (Bryden). By others, again, the very existence of enteric fever in India is still altogether denied. Such extreme views can only arise from one of two causes—either (1) the profession in India are not agreed as to what enteric fever is; or (2) sufficient opportunities have not been afforded to our students of medicine in this country for learning to distinguish enteric fever from other diseases, and of seeing and recognising its distinctive anatomical signs after death.*

At Meerut, in November, 1851, Surgeon-Major Scriven had the exclusive honour of identifying a case of enteric fever there on the lines laid down by Gerhard, in America, and by Dr. A. P. Stewart and Sir William Jenner in this country; and his diagnosis was confirmed by *post-mortem* examination, in which the ulcerations in Peyer's patches and other appearances characteristic of enteric fever were clearly demonstrated. Moreover, the life history of the case, in its previous symptoms, fully agreed with the view he had entertained of the true nature of the disease,† and from 1854 to 1857 he continued to record similar cases.

In 1855 Deputy Surgeon-General Dr. Joseph Ewart (then of the Bengal medical service) described enteric fever amongst *native* prisoners in the Ajmeer Jail at Rajputana.‡ He was thus the first to recognise the existence of the orthodox specific typhoid fever in the *natives of India*—a discovery he made quite independently of Scriven's first discovery of the disease among Europeans in India.§ Drs.

* Dr. James W. Allan, the physician-superintendent of the Belvidere Hospital in Glasgow—the only hospital receiving infectious diseases there—has thrown some curious light on this point in "Remarks Introductory to a Course of Clinical Instruction in Fever" at that hospital, which he has published in the *Glasgow Medical Journal* for June, 1885, p. 414. He had been invited to give such a course of instruction there, seeing that the students of medicine could not study cases of fever anywhere else; and the importance of the Belvidere Hospital being made available for clinical teaching was therefore fully recognised. In this most instructive introductory lecture he writes, "Accordingly, in the early part of 1884, I sent printed notices to the various medical schools and hospitals in Glasgow intimating that there would be a summer course of clinical instruction in fever at Belvidere Hospital. The result was that THREE students turned up, and those constituted my first summer class!"

† *Indian Annals of Medical Science.* No. 8. P. 512. 1857.

‡ *Indian Annals* and *Indian Lancet* passim.

§ Sir Joseph Fayrer. Croonian Lecture, p. 166.

Goodeve, Barclay, and my friend and late colleague Professor W. C. Maclean, C.B., recorded cases of enteric fever in Madras in 1859 and 1860. Surgeon-General Sir James A. Hanbury, when surgeon of 33rd Regiment, at Dessa, recorded cases of enteric fever in the autumn months of 1859.* It was also described by Dr. William Sim Murray (then surgeon of the 66th Regiment), at Bangalore, with *post-mortem* evidence of its characteristic lesions.† This brings the record down to 1860—Darwin's time.

Thus, from the period of its first recognition in 1851, we have it identified in various districts in India during the subsequent ten years, on the lines laid down by Sir Wm. Jenner and Dr. A. P. Stewart in this country, and now there can be no doubt of the existence of the true orthodox enteric fever in India, and it appears as the chief fever death-cause among our young soldiers in that country. It would, however, be as unreasonable to say that it had *not existed in England* before Sir Wm. Jenner and others defined it to be a specifically distinct disease as that *it did not exist in India* before Assistant-Surgeon Scriven pointed out its existence in that country, where, guided by the light thrown on it by British research, he separated it from remittent fever in India, as in England it had been separated from typhus.‡ It has also been identified more recently in Egypt and in the Soudan by numerous competent observers. But while there appears to be a preponderance of opinion in favour of a specific *origin* for all enteric fevers, there is at the same time a vagueness of idea as to the cause of typhoid fever, varying from its evolution from an indifferent, simple, non-specific *source*, from a specific *contagium*, or from the results of decomposition of organic matter generally, including malaria.

Sir Joseph Fayrer, who has had much experience in India, records his belief in the existence of an endemic or continued fever there which is neither simple continued fever, ordinary remittent, nor specific enteric, and which should for the present stand apart, its affinity being with malarial rather than with true enteric fever, although it has much in common with both.§

But mere ulceration of the small intestines and of Peyer's glands is not necessarily indicative of enteric fever. It occurs

* Army Med. Dep. Reports, 1861. P. 335.
† *Ibid.*, p. 516.
‡ Sir Joseph Fayrer, Croon.Lect., p. 166.
§ Fayrer, *loc. cit.*, p. 216.

also in remittent and continued fevers in India, in cholera, in protracted diarrhœa, in acute muco-enteritis, in scarlatina, and in malignant endocarditis, while in certain circumstances (undetermined), natives and Europeans in India are both affected by fever with enteric symptoms; and the more closely one studies fever and dysentery in India, the more closely do their etiological relations seem to be drawn together. Morehead also writes that disease of Peyer's glands, either in the state of turgescence or ulceration, is not a morbid state peculiar to typhoid or enteric fever. It occurs in cholera, in protracted diarrhœa, in acute muco-enteritis, or as an occasional complication of remittent fever, and is a frequent one in phthisis pulmonalis. Hence it is argued by the late Dr. Morehead and by Sir Joseph Fayrer, that we are not justified in deducing the existence of specific typhoid fever from the mere character of the *post-mortem* appearances. These require to be interpreted by the symptoms which have been present during life in order that they may be correctly understood.

But my experience leads me to maintain that the lesions of the bowel *in typical cases* of these specified diseases are so very different from each other, and so characteristic of each disease, that the one ought not to be mistaken for the other nor misinterpreted.

Nevertheless, Sir Joseph Fayrer is of opinion (and I concur in it) that there may be a too rigid adhesion in India to views of disease as seen in this country, and that sufficient allowance is not made for the influence of new conditions—*i. e.*, for the influence of environment—whereby disease is modified and made to assume features strange to it in more temperate climates. A too exclusive application of theories strictly appropriate in England may not be so in the tropics, so that views of disease in India may require modification, as compared with this country, after experience in India; and for enteric fever in India Sir Joseph Fayrer suggests that the range of causation be extended beyond mere sewage and fæcal contamination. He believes that the various fevers in India are closely allied etiologically, that a combination of climate and local causes acting on individuals of a certain age, race, and personal susceptibilities accounts for the difference of some fever processes that are set up. Typical cases of intermittent, remittent, and continued fever may be well marked and distinct, but it is often impossible to draw a line of demarcation between them, merging so gradually as they frequently

do into each other. Cases occur which at one or other stage present the phenomena of all these ailments concluding with those of enteric fever; and in India there is often great difficulty in differentiating one fever from another. The initial fever process being set up, the course and result are determined by individual peculiarity and by the general nature of the surroundings, rather than by any *one* specific cause. *

Much evidence has been brought forward which proves the existence of many anomalous cases of fever in India, compared with the typical enteric fever as seen in this country; and even in this country "a large number of the cases with which we have to deal in hospital are *not* typical." †

On this point with reference to India, Dr. MacConnell, the distinguished Professor of Pathology at Calcutta, writes that there is difficulty especially in diagnosing enteric fever from remittent. Neither the course of the fever nor the range of temperature is typical, and the presence of rose spots or specific eruption is quite exceptional. Malarial agency modifies the whole course of the disease.

The confounding of cases of enteric fever in India with remittent fever, especially in its adynamic forms, has long been well known, probably because *remittence is a characteristic feature of both fevers.* This has been abundantly testified to by the late Dr. Murchison, and also by Professor W. C. Maclean, C.B., as well as by Surgeons Hannah and O'Farrel (63rd Regiment), in an excellent account of enteric fever in Bengal. ‡

Dr. Joseph Ewart has also testified to the fact "that in both natives and Europeans, who have been subjected to the influence of malaria, the fluctuations of temperature in enteric fever are greater than in those who have never been exposed to the action of the two poisons. The morning remission in enteric fever, complicated with the malarial poison, being so marked as to delude the observer into the belief that he is dealing with a malarious remittent simply, when in reality he is called upon to encounter enteric fever modified by the malarious infection of the system. §

An American Surgeon-General, the late Dr. Woodward, also observes that, "In every great army that ever campaigned for

* Fayrer, *loc. cit.*, pp. 58, 59.
† James W. Allan, M.B., *Glasgow Medical Journal*, vol. xxiii, p. 414.
‡ *Ind. Med. Gazette*, 1871.
§ *Trans. of the Epidem. Soc.*, Feb. 4, 1880.

any length of time in a malarial region, the prevailing form of fever has been a hybrid between malarial fever and some form of typhus, the causes acting with peculiar intensity on strangers, and a scorbutic taint still more modifying the conditions. In 1861 a new form of fever was recognised in the American camps by men to whom the ordinary enteric fever was well known. They first called attention to a fever that differed in many important particulars from those to which they had been accustomed at home. It was called chicha-hominey fever, and believed it to be the combined result of malarial poisoning with the cause of typhoid fever." * The recently issued revised Nomenclature of the College of Physicians now recognises a typical "Typho-Malarial Fever" in deference to these American experiences.

Dr. Manson of Amoy observes, with regard to an epidemic of continued fever in China, † that "A proper classification of tropical fevers has not yet been found. We must get rid of the idea that there are only two possible combinations, *i. e.*, malarial and enteric. We are nearly entirely ignorant of a number of specific fevers which, *from time to time*, affect the inhabitants of foreign countries. There are cases which do not admit of diagnosis and classification, cases which do not conform to any recognised nomenclature, *e. g.*, Tamsuic Fever.‡ Every year there are such anomalous cases and *one gets little satisfaction from books on the subject.*"

Sir Joseph Fayrer has further collected the experience of others, and the following are some of these:—

Dr. Alfred Clarke, of the Army Medical Staff, with regard to fevers in India, writes that "a specific poison or germ for enteric fever is not a *sine quâ non*. Ordinary filth causes may develop it *de novo*, so may climatic influences acting on young and undeveloped constitutions. Genuine enteric fever cases occur in India where all filth causes, in ordinary sense of the term, were absent, and, once started, the disease may afterwards spread by contagion."

Brigade-Surgeon Dr. Don, of the same service, writes that "Amongst many true enteric fever cases in Bermuda, a large number were anomalous, in, for example, the characteristic rash being absent, the stools green, dark, or bilious; yet in fatal cases, the essential bowel lesion was found. The early symptoms were so much alike in all the cases that it was

* Fayrer, *loc. cit.*, p. 179.
† *China Imperial Maritime Custom's Medical Reports* for 1881.
‡ Fayrer, *loc. cit.*, pp. 206, 208.

impossible to determine what form the case might ultimately assume. Many times cases admitted under febricula would change to a simple continued fever, then to enteric, as characteristic phenomena supervened, and these cases occurred simultaneously, concurrently, and mixed up at the same time or place, and in the same regiment or country." He finally contends that the causes of all are similar.

In the late Zulu war, and also in Egypt and the Soudan, cases of enteric fever occurred in detachments of our young soldiers which no theory of specific contagion could explain, but were accounted for on the vague theory of the foulness of drinking water; and cases of enteric fever constantly crop up in hot climates which are inexplicable either by a theory of propagation or pure pytho-genesis.*

I cannot help observing, after having read many official reports regarding diseases in India and the tropics, and having seen much of their morbid anatomy, that opinions are still in many quarters divided, crude, and somewhat unformed as regards the pathology of fever and of fevers in these regions, just as they were in this country up to 1846, before Sir William Jenner's analysis of cases during life and dissections after death, gave the data for distinguishing enteric from typhus fever.† It is also curious to note, as Dr. Ewart observes, that the nature and character of the opposition to the views of those who contend for the endemic and widely scattered existence of enteric fever in India, in some measure resemble the nature and character of the opposition which Stewart and Jenner encountered in this country when they succeeded in splitting up common continued fever into three distinct and well-defined diseases. In India, for example, we have accounts: (1.) Of undoubtedly typical cases of enteric fever as we see them in this country. (2.) Cases of enteric fever, especially in the Madras command, which have been considered by Surgeon-General Gordon to be merely "malarial" or climatorial fever of the continued type, with intestinal complications, the *post-mortem* lesions in which are said to be the same as, and not to be distinguishable from, those of orthodox enteric fever. (3.) The enteric fever of India, which is regarded by many eminent physicians as common continued fever with bowel complaint, just as it is by some in this country and in Germany. (4.) Sir Joseph Fayrer has expressed his conviction that there is a form of "fever" in tropical climates which, as regards its cause, is not identical

* Fayrer, *loc. cit.*, p. 198.

† Aitken, *Science and Practice of Medicine*, vol. i, p. 584, 7th edition.

with the enteric fever of this country. * (5.) Dr. Broadbent † observes that "While in this country, and in Europe generally, all the evidence tends increasingly to confirm the dependence of typhoid fever on pre-existing cases, and the dissemination by drinking water as its chief mode of propagation, observations and investigations in India appear to show, either that typhoid fever cases there arise independently, or that there is a disease not yet distinguished from typhoid fever which has a different method of rise and spread."

From all this conflicting evidence, it appears to me that some one is required to arise and do for Indian and tropical fevers what Sir William Jenner did for the fevers of this country. These five varied views held regarding "fevers" in India remind us of the state of medical opinion 40 years ago, before the pathology of enteric fever, and the difference existing between that disease and the other continued fevers, were understood.

The *de novo* origin of the disease, alike in this country and in India, is still a question *sub judice*, and the specific question may be suggested:—"Has the disease appeared gradually by progressive development, or has it suddenly come into existence?" That the many "anomalous" cases of fever described both in this country and in India furnish abundant material for its progressive development, as previously explained in these pages, there can be no doubt. But it is only by the combined efforts of those who can investigate the origin of typhoid fever when it occurs as an epidemic, or in the form of severe local outbreaks, and who can examine into and report on the solitary cases occurring under circumstances favourable for the exclusion of fallacies, that we can hope for the solution of these questions. It is rare that solitary cases can be satisfactorily investigated in towns, where typhoid fever is practically endemic, and where the network of drains prohibits successful investigation. As the question at present stands as regards typhoid fever, Sir William Jenner has lately summed up the position when he wrote that "It well illustrates our ignorance, the difficulty of ascertaining facts, the danger of reasoning upon insufficient data, on an insufficient number of facts, on insufficiently observed facts, and the unwisdom of drawing general conclusions from facts which bear only on one side of a question."

II. *Yellow Fever.*—Dr. Charles Creighton has made an important contribution to pathology in his account of the

* *Croon. Lect., loc. cit.*

† Quain's *Dictionary of Medicine*, Art. "Typhoid Fever."

de novo origin of some specific fevers. He has shown that the "*progressive development*," *de novo*, of yellow fever has a remarkable historical and geographical history, especially as regards the following salient points*:—(1.) It seems to have appeared in the 17th century as "*a new disease*." For more than a century after the Spanish conquest of America, and for many years after the first English and French colonisation in the West, there was no yellow fever, and when it did come to Guadaloupe and Barbadoes, it was recognised as something quite different from the ever present malarial fever: (2.) There is something quite peculiar in its geographical distribution. At the present day we are apt to think of yellow fever as the fever of the Gulf of Mexico and Brazil; but it had been the scourge of Philadelphia, and even of New England, for many years before it broke out in New Orleans in 1796; and its first appearance at Rio was in 1849. (3.) It is curious to notice how much yellow fever has shifted its ground; for while it has always remained true to certain shipping places in the West Indies, the other great centres of its outbreak in Bancroft's† time have absolutely ceased to be the seats of yellow fever; and some of the places that are amongst the worst seats of the fever now, are not even mentioned in Bancroft's pages. Hence it is not latitude nor longitude that explains the peculiar distribution of the disease. (4.) There is only one thing that covers its history, its geography, and the remarkable changes in its distribution, and that is the slave trade. The localities where it is, or has been endemic or repeatedly epidemic are those found to be the creeks, wharves, and low shipping quarters of the ports of debarkation of the slave trade, together with a few much less endemic, but not less significant spots in Spain, and on the West Coast of Africa—the places to which vessels engaged in the contraband slave trade had gone on their return voyage. The single exception to this rule is Peru; but when the rule is *probed* Peru ceases to be an exception—in this way—that there are many points of resemblance between its coolie trade across the Pacific and the old African slave trade. (5.) An inquiry into the disastrous outbreaks at Barcelona in 1821 gave the first clue to the connection between yellow fever and the slave trade. That epidemic, and another at a small port in Biscay in 1823, were investigated by Dr. Auduard at the instance of the French Government—the facts being much the same in

* Hirsch, *On Geographical and Historical Pathology*. Vol. I; and Creighton, *loc. cit.*

† Bancroft, *On Yellow Fever*. 1811.

the two outbreaks, and suggested to this physician a general theory as to the origin of yellow fever, namely—"that it was a peculiar form of typhus due to the emanations from the putrid dysenteric discharges of the negro; and the fever owed its well marked specific type to the fact that the matters which excited it could be traced to the negro body." There was something, he considered, quite peculiar in the negro constitution; and it was not surprising that the discharges from his sick body should be able, *when fermented*, to produce in others a typhus fever of a peculiar type. (6.) It is also a peculiar fact that the slaves on board a slave ship did not themselves suffer from yellow fever; but they suffered much from dysentery and from the "horrors of the middle passage," so that a slave ship would arrive at her destination with no contagious fever aboard, but saturated with the filth of her human cargo, out of which the specific yellow fever "*came* into being." (7.) These conditions must have arisen often at all the Spanish ports where yellow fever was almost an annual occurrence; and the whole history and geographical distribution of yellow fever in America are of the same description; so that seaports where cargoes of slaves had been landed year after year became so saturated with the peculiar filth of the trade, that the wharves, landing places, and shipping quarters of these ports became foci of infection. In some places, such as Vera Cruz, the poison seems to have become peculiarly fixed in the soil, so as to defy all attempts to get rid of it; but in the great cities on the Atlantic sea-board of the United States, the fever was practically eradicated soon after the importation of negroes ceased. During the sixteen years after that date (1808), yellow fever appeared only seven times in the different ports of the Union, whereas, in the sixteen years preceding the abolition of the traffic it had broken out fifty-eight times. In the Spanish seaports, also, the great epidemics of yellow fever are an almost forgotton tradition. In Brazil, on the other hand, epidemics are of recent date, the first in 1849, when Brazil was, and had then been for some time, the great market for African slaves, when the ports of other countries (except Cuba) were closed to them. It has also been established in recent times in the sea-ports of Peru, the first outbreak having been at Callao and Lima in 1853, from ships excessively loaded with poor sickly Chinese, ill fed, ill clothed, and badly cared for on the voyage. Like the negroes, the Chinese did not themselves suffer from yellow fever, and they were said never to take it on shore; but they suffered from these dysenteric and other no-ncontagious ailments from

which the yellow fever "*came into being;*" and this Chinese immigration has profoundly changed the sanitary condition of the whole Peruvian coast. (8.) Dr. Creighton suggests another argument based on "the immunity of the negro from yellow fever, notwithstanding his great liability to cholera, and with common forms of typhus, including ship typhus. He observes that "this immunity is perhaps not so striking now, when the negro blood is less pure, but all the earlier authors were much impressed by it. Thus, Doughty, who saw much of yellow fever in Jamaica at the beginning of the century, says: "In the natives of Africa, the constitution appeared to me as secure against yellow fever as a person who has had the small-pox"—and he might have said the yellow fever itself—"is against its recurrence." Fenner, a more recent authority in New Orleans, says: "It is a well established fact that there is something in the negro constitution that affords him a protection against the worst effects of yellow fever, but what it is I am unable to say." Mr. Clarke, the author of a paper on the "Topography and Diseases of the Gold Coast," in the first volume of the *Epidemiological Transactions*, says: "I have heard and read of negroes taking yellow fever, but in no case did it happen at Sierra Leone during its prevalence in 1837, 1838, 1839, 1847; nor, so far as I can understand, in 1859; and no example of it occurred to any of my medical brethren in the course of their practice." This is certainly a remarkable testimony, when we consider that ninety-nine hundredths of the population of Sierra Leone are negroes. And to show that this is the immunity of negro blood, and not of acclimatisation, I take the most remarkable experience of all, that of the French expedition to Mexico from 1862 to 1866. There was a heavy mortality from yellow fever among the motley gathering of troops at Vera Cruz in the summer of 1866; not only the French soldiers, but Arabs from Algiers, Indians from the interior of Mexico, and Creole troops from the West Indies, were decimated by it; whereas, in a body of 400 negro soldiers from the West Indies, there were only three cases, with one death, and in a black regiment of 500 men raised in the Soudan and Nubia, there was not a single case."

If, then, we put together the facts of this remarkable disease: when we consider that its advent into the world coincided with the rise of the slave trade; that its habitat is or has been the ports of debarkation of the slave trade, and those places in Spain and the West Coast of Africa to which slave ships went on their return voyage; that its exacerba-

tions have coincided with the most lawless period of the negro traffic; that it gained a footing in the ports of Brazil in 1849, when the slave trade flowed into that channel; and that it has become endemic subsequent to 1853 on the Pacific coast of South America, in those parts of Peru which were the seat of an infamous Coolie traffic—we cannot but see in all this concurrence of testimony a proof that Audouard was right in describing yellow fever as *a peculiar form of typhus, originating at all its endemic centres in the filth of slave ships, just as he showed that it had so originated, as a matter of fact, in two of the Spanish outbreaks.* But if that evidence should not be enough, we have only to add the fact that the negro cannot take the disease, although it rages most in the very quarters where negroes live. The yellow fever still lurks about the wharves and shipping quarters of towns where cargoes of slaves used to be landed; and every few years, when the weather is at its hottest, it rises into a pestilence."*

It is also of interest to note that such important points in pathology did not escape the observation of Charles Darwin. "It is remarkable," he observes,† "how the same disease is modified in different climates. At the little island of St. Helena the introduction of scarlet fever is dreaded as a plague. In some countries, foreigners and natives are as differently affected as by certain contagious diseases, as if they had been different animals; of which fact some instances have occurred in Chili; and according to Humboldt, in Mexico, . . . wherever the European has trod, death seems to pursue the aboriginal. We may look to the wide extent of the Americas, Polynesia, Cape of Good Hope, and Australia, and we find the same result. Nor is it the white man alone that thus acts the destroyer; the Polynesian of Malay extraction has in parts of the Eastern Archipelago driven before him the dark coloured native. The varieties of man seem to act on each other—in the same way as different species of animals—the stronger always extirpating the weaker. . . . The Rev. J. Williams, in his interesting work,‡ says that the first intercourse between natives and Europeans "is invariably attended with the introduction of fever, dysentery, or some other disease, which carries off numbers of the people." Again, he affirms—"It is certainly a fact which cannot be controverted that most of the diseases which have raged in the islands during my residence there have been introduced by ships; and what

* Creighton, *loc. cit.*
† *Voyage of the Beagle*, p. 434.
‡ *Narrative of Missionary Enterprise*, p. 282.

renders this fact remarkable is, that there might be no appearance of disease amongst the crew of the ship which conveyed this destructive importation." But, "this statement," says Mr. Darwin, "is not quite so extraordinary as it at first sight appears; for several cases are on record of the most malignant fevers having broken out, although the parties themselves who were the cause, were not affected. In the early part of the reign of George III, a prisoner who had been confined in a dungeon was taken in a coach with four constables before a magistrate; and, although the man himself was not ill, the four constables died from a short putrid fever; but the contagion extended to no others. From these facts it would almost appear as if the effluvium of one set of men shut up for some time together was poisonous when inhaled by others; and possibly more so if the men be of different races. Mysterious as this circumstance appears to be, it is not more surprising than that the body of one's fellow-creature directly after death, and before putrefaction has commenced, should often be of so deleterious a quality that the mere puncture of an instrument used in its dissection should prove fatal." He further observes * that he has heard it stated in Shropshire, that sheep which have been imported from vessels, although themselves in a healthy condition, if placed in the same fold with others, frequently produce sickness in the fold. He further observes how the races of man differ in constitution and adaptability for acclimatisation, and in their liability to certain diseases. New diseases and vices are highly destructive to them;† and in every nation a new disease causes much death until those who are most susceptible to its destructive influence are gradually weeded out. . . . The first meeting of distinct and separate peoples generates disease; and "changed habits of life which always follow this advent of Europeans, induce much ill health."

Moreover, man shares with animals some of their diseases, which, again, are in many cases intercommunicable—*e. g.*, rabies, variola, glanders—while monkeys and many mammalia are liable to the same non-contagious diseases as we are, such as catarrhs, leading to consumption, apoplexy, inflammation of the bowels, diabetes, cataract, and fever during shedding of the milk teeth. Dogs are known to suffer from tertian ague.‡ The differences or variations from the normal or well recog-

* *Voyage of the Beagle*, note, p. 436.

† *Descent of Man.* Vol. i, p. 239.

‡ Maculloch, *Silliman's North-American Journal of Science*, vol. xvii, p. 305.

nised types of such diseases common to men and animals seem to be induced by the same general causes. In men and animals similar laws of inheritance prevail. The cause of each slight variation or of each monstrosity lies much more in the nature and constitution of the organism, than in the nature of the surrounding conditions. * Both in man and in animals the mental faculties are variable, and as these variations are inherited, so are their diseases.

III. *Typhus Fever.*—The "progressive development" and origin *de novo* of typhus fever, especially in association with the putrefying products of animal exhalations and the excrementitious matters of diarrhœal and dysenteric cases are strongly substantiated by more recent experience as well as by the records of campaigns and war pestilences long gone by, but which we can now read in a different way from heretofore, and interpret by the light of knowledge more recently acquired.

The idea that "the source of all typhus matter is to be looked for solely in concentrated human effluvia"—the idea that overcrowding in filthy and unventilated rooms affords the essential condition for the development of typhus foci and for the spread of the disease therefrom, has been completely borne out by the experience of all time. † The mode of origin of sporadic cases in the absence of any epidemic, and of outbreaks in public institutions and amongst isolated bodies of men, furnishes the more conclusive evidence of typhus arising *de novo.* The fever known as jail fever was undoubtedly typhus, and many observations show that it originated in the prisons from overcrowding and deficient ventilation. The prisons then became the principal foci when the disease spread, and the story of the various "black assizes" (six in number), in which prisoners brought up for trial gave typhus to the judges, counsel, and jurymen, is full of pathological interest, especially, as Lord Bacon observed, "that the prisoners were not suffering from typhus themselves."

The circumstances under which the fever appeared in jails and prisons in this country and on the Continent were always the same, and to the exclusion of every conceivable source of importation. ‡

On shipboard its origin *de novo* has a similar history; and with regard to war pestilences, in which typhus has largely decimated the ranks of armies, its origin has invariably been

* Surgeon-Major Dr. T. R. Lewis, *loc. cit.*, and *Descent of Man*, vol. ii, p. 388.

† Cheyne, *Dublin Hosp. Reports*, 1818, vol. ii, p. 53.

‡ Murchison, *Treatise on Continued Fevers*, 1st Edition, p. 106.

due to overcrowding, with bodily and mental depression; and it has been especially noted that in many parts of the continent of Europe, where typhus never occurs in time of peace, it becomes epidemic in time of war.

Similarly, it has originated in overcrowded and badly ventilated hospitals, and then it was originally described as "hospital fever" by Sir John Pringle.

A contagious fever similar to typhus has been known to occur amongst animals on board ships in which they were crowded in transit from England to America during the American War.*

Down to the commencement of the present century no doubt existed as to the spontaneous origin *de novo* of typhus fever. Lord Bacon expressed his belief that: "The most pernicious infection, next to the plague, is the smell of the jail, where the prisoners have been long and close and nastily kept, wherein we have had experience twice or thrice, when both the judges that sat upon the bench, and numbers who attended the business, sickened upon it and died." And the opinions of the great physicians of the past were to the effect that vapours were constantly being exhaled from the human body—that such vapours were subtle, acrid, and offensive to the smell; when retained in the body it became morbid, and if re-absorbed by the body they were highly deleterious. If a number of persons, therefore, are long confined in a close place, not properly ventilated, so that they inspire and swallow with their spittle the vapours of each other, they soon feel its bad effects. Bad food, nervous depression, add to the misery, and soon the seeds of a pestilential fever arise, dangerous to themselves and to others; and once produced, the fever easily spreads by contagion.†

The connection between yellow fever and the dysenteric, and other discharges of the negro body already noticed, is only a part of that general connection between dysentery and typhus, which has so pronounced a history in famines and war pestilences. The subject is full of pathological interest, and requires more investigation. There is evidence to show that these diseases are sometimes vicarious—dysentery in the black, taking the place of typhus in the white, man. The disease which carried off the miserable negroes in the crowded holds of the slave ships was dysentery and not typhus; but out of the dysenteric corruption and putrefaction typhus fever sprung: and there is much evidence to show that the active

* Murchison, *l. c.*, p. 111.

† Grant (1775), quoted by Murchison, *loc. cit.*

generating cause is a highly ammoniacal compound. The existence of ammonia in the blood has long been believed to account for the phenomena of typhus. Dr. Richardson has shown that ammonia introduced artificially into the blood "produces typhoid symptoms;" and Dr. Murchison * sums up the argument, from his own personal extensive experience in the London Fever Hospital, in the following words:—

"In severe cases of typhus, not only is there reason to believe that the blood is ammoniacal, but the exhalations from the lungs and skin, and the discharges from the bowels, contain a large amount of ammonia. It is a common observation that a pungent ammoniacal odour is given off by the skin and lungs in typhus, while the presence of a large quantity of ammonia in the breath admits of actual demonstration. It has also been ascertained that the cases in which the odour is strongest, communicate typhus most readily to persons in health; and in many of these cases where the symptoms of typhus have supervened immediately on exposure to the source of contagion, and where we may suppose the poison to have been unusually concentrated, the affected persons have been conscious at the time of exposure of a most disagreeable odour, pungent, and ammoniacal."

Hence, we may expect to find the origin of typhus in some physiological disorder of the ammonia-producing function—some relation between the common aberration of the functions producing ammonia in health and the self-existent specific infective disease known as typhus. Its spontaneous origin may be in this way explained. "The experiments of chemists show that ammonia is contained in the cutaneous exhalations in health, and minute traces of ammonia are constantly being exhaled in healthy respiration. And although the quantity may be much smaller than in typhus, it is probable that, when a large number of human beings are crowded into a small unventilated place, the ammoniacal exhalations are much increased and concentrated, and that by this putrefaction typhus fever is generated. Here we have another example as to how the living tissue elements of the body itself play an important part in the elaboration of this disease.† The first effect of overcrowding with no ventilation is to cause the respiration to go on in an atmosphere charged with carbonic acid; and it has been shown by experiment that even a small percentage of carbonic acid in the respired air is sufficient to leave a serious diminution in the amount of carbonic acid

* *Loc. cit.*, p. 114.

† Surgeon-Major Dr. T. R. Lewis, *loc. cit.*

thrown off, and of oxygen absorbed, with the result "that those oxidating processes which minister to the elimination of effete matter from the system must be imperfectly performed, and that an accumulation of substances tending to putrescence must take place in the blood. Hence, there will be probably a considerable increase in the amount of such matters in the pulmonary and cutaneous exhalation." *

The unrenewed air thus becomes charged, not only with carbonic acid, but also with organic matters in a state of decomposition, of which the chief product is ammonia.

The nominal quantity of ammonia contained in the breath is exceeded in other diseases besides typhus, a circumstance which may account for the spontaneous progressive evolution of typhus fever in unventilated hospitals under circumstances of crowding insufficient to generate it elsewhere; and also for the observation that a deteriorated state of the constitution predisposes to the development of typhus.

"From the present state of our knowledge, therefore, it seems not unreasonable to conclude that the disagreeable odour of the cutaneous and pulmonary exhalations of typhus patients, as well as the offensive smell generated by overcrowding are due to some unknown compound of ammonia." †

It appears to me, therefore, that like erysipelas and diphtheria, the weight of evidence and of argument is in favour of the occasional *de novo* origin of enteric fever, of yellow fever, and of typhus fever by "progressive developments," through as yet unknown and undetermined concurrent factors in the surroundings of the patient; his environment in the widest sense of the term, and that such *de novo* origin of these diseases does not exclude the possibility of their subsequent spread by contagion.

The process and products of putrefaction of dead and dying animal and vegetable material also require more careful, systematic, and exhaustive investigation than they yet have received at the hands alike of chemists and biologists in relation to pathology generally and the causation of disease in particular. It is now highly probable that the progressive development of enteric fever, erysipelas, diphtheria, typhus, yellow fever, and such zymotic diseases stands in a certain causal relation to processes of decomposition or fermentation in organic matters; and it comes to be a very important question whether the disease producing factor or factors are to be sought for amongst the decomposing products, or in

* Dr. W. B. Carpenter. *Human Physiology.* Fifth edition. P. 301.

† Murchison, *loc. cit.*, 116.

whatever ferment sets the decomposition agoing; or in any organic forms or products standing in causal relations to the processes of putrefaction or fermentation. The influence of putrefaction as a potential factor in causing disease is still an unknown quantity. As a process of fermentation which proteid substances in suspension or in solution undergo in presence of minute organisms of varied sorts at a suitable temperature, the results of the process must be recognised as having a special bearing on the origin and propagation of many zymotic diseases which require still to be investigated from this point of view—namely, that of fermentation and its products, and its influence both within and without the body. *

Chemists, when referring in general terms to acts of fermentation, speak of certain processes in language too vague for scientific needs, but which sufficiently indicates that forces lie beyond the range of their detection, and for which there is *no name*.†

Pathologists have recognised the fact that certain morbid elements of a contagious character are intimately related to common ferments, and to ferments of putrefaction, while *chemically*, it is admitted that no decided line of demarcation can be drawn between these immediately related processes.

Biologically, it seems impossible to find a barrier dividing the organic forms which accompany the products of the changes respectively involved.

Hence differences of opinion are held regarding the relation of organisms to those processes:—

1st. On the one hand, it is maintained that microgerms are invariably the inciters of the chemical process, and that they (the bacteria, &c.), can only be derived from pre-existing organisms of a like kind (Pasteur and the morbid germ theorists).

2nd. On the other hand, it is held that germs are not essential to the process, which may be initiated in their absence; that the protoplastic elements which develop into bacteria may be generated from the organic elements of fermenting fluids, and that such elements are, in fact, just as much the products of the fermentive and putrefactive processes, as are the gases simultaneously evolved.

Bacteria are found as uniformly accompanying some general

* See Dr. Burdon-Sanderson on *Chemical Products of Putrefaction*—12th Annual Report of Local Government Board.

† Alex. Menzies Brown, M.D., *The Origin of Contagia*. 2nd edition, 1884.

and local morbid conditions as they are found attending those putrefactive and fermentive.

The question which has yet to be decided in both is—"Are the organic forms associated with these morbid processes the sole cause or inciters of them? Or, are they merely the concomitant products of such processes initiated in their absence, and, so to say, independent of them?"

The phenomena of fermentation require a more exhaustive study than they have yet received; and what merits most consideration is, not so much the extent or frequency of microgerms in disease, but the more important one as to the nature of their relations to the processes which constitute disease.

"Pathologically, the production of the microgerm of maladies transmissible by infection or inoculation is essentially a question of bio-chemistry. But for all practical and hygienic purposes, and uninfluenced by the prevailing theoretic mania regarding bacteria in everything, we may rest contented and safe in the conclusion that whatever the germs may be they are the result of natural processes alike in vegetable and animal substances under conditions favourable to these processes; that those benign and simple germs, so innumerable in variety, are not everywhere and invariably the same; that they do not continually reproduce their like, but that they are liable to modification, gradual or rapid, according to the ever varying media or conditions in which they arise, live, and multiply; that, in fine, under certain circumstances, climatic, hygienic, or pathologic, which the future may determine, the microzymes of the virus of anthrax or of small-pox, like those of marsh or cess-pool miasmata, may be naturally generated.

"It is argued that with certain prevailing morbid manifestations, dependent on contagious causes, distinct micro-organisms co-exist; and knowing something of the metamorphic processes, merely physiological, which cellular pathology has to deal with, the fact should not excite surprise. The order of phenomena teaches nothing new. In those morbid processes, the cells of which the structural substance of the body is composed work out the tissue changes by forces of selection and affinity consistent with organic laws. In germ pathology, with its metabolic processes, analogy would lead us to infer that some such principle was equally at play; a kind of physio-microgermic process of selection, in which germs of a like nature and family combine, interchange, or absorb each other, the degenerate and effete giving place to those which predisposition, media, and exciting causes favour most throughout the process; one purely evolutional and deter-

minate; that is, consistent with those conditions of which the malady, whatever it may be, is but the necessary manifestation or expression.

"The occasional uncertainty and indefiniteness with which disease at times declares itself would almost justify such a conclusion—one quite in harmony with the higher law; for, guided by its light, we are the better enabled to explain the nature of those anomalous cases, modified or irregular, which accompany every epidemic we are called upon to observe. In medical experience what is more remarked in the course of some prevailing eruptive fever of a specific character than the frequent occurrence of others of the class, but totally distinct, isolated or sporadic? Types the least expected may be met with.

"The well attested and familiar observation of facts of this kind ought to convince Pangermists of their error in refusing to admit the spontaneous development of zymotic maladies, such as variola. When we say spontaneous we use merely a convenient term. We are far from admitting that small-pox creates itself completely and at once within the system. What is implied is, that variola may manifest itself under certain predisposing conditions, internal and external, at the expense of the normal organic elements, by a simple combination of anatomic transformations, independently and in the absence of specific germs operating from without. Here, as elsewhere, the presence of the microzymes is not denied; but what we maintain is, that when the disease has not been communicated they are naturally produced, and that they always are so in the course of those maladies with which they are associated, arising under similar circumstances, and in relation to which they stand as products and elements of contagia. If asked, whence their progenitors? the answer is, those germs were elementary."* Contagia, infectious or inoculative, once constituted, the laws of their propagation and diffusion require no explanation. But if splenic fever, glanders, farcy, rabies, erysipelas, diphtheria, and the like may arise spontaneously under special predisposing conditions and environment, why should small-pox, enteric fever, yellow fever, or typhus fever be exceptions?

* Dr. A. M. Brown, *loc. cit.*

Section IX.—*Convergence of the Evidence and Conclusion of the Argument.*

In the previous pages my object has been to show how far Charles Darwin's doctrine of Evolution can throw light on some of the more complex problems regarding the origin and development of diseases—especially as to how far his teachings are capable of explaining the occurrence of those anomalous cases in which diseases depart from their usual types, in which hybrid or nondescript symptoms are developed, when diseases are said "not to breed true"—and generally to set forth in one continuous argument the evidence in favour of the application of the doctrine of Evolution to pathology.

It may be held, perhaps, that in thus adapting Darwin's teachings I have been led to apply his doctrine to unsuitable material. But when viewed by the light of our knowledge of the whole world of Biology, the meaning of the facts in this and the previous sections, to which reference is made, is unmistakeable.

Having regard to Pathology as "the Science of Life under other conditions than those of ideal perfection," * and as a part of biological science, it will be seen that the theory of Evolution is not inapplicable to its needs; but that it is a theory which is capable of explaining much that otherwise and hitherto has not been capable of explanation.

In the phenomena of Biology the general doctrine of Evolution finds a firm basis of operation, whence it may conduct its conquests into the whole realm of Nature.† But extended experience as to its true value in Pathology has yet to be obtained from many sources; and observation must necessarily proceed slowly to conclusive results, because the inquiry must be on a large—a universal scale.

Moreover, in the prosecution of such inquiries as are here but feebly outlined, every allowance must be made for the opposing influence of that human frailty by which "Truth provokes those whom it does not convert." ‡ It must also be remembered how difficult it is to get rid of old theories once embraced; how little evidence we have for many of even our oldest beliefs; and that whether in medicine or in any other department of science, few are willing to break up trains

* Simon's *Lectures on Pathology*, p. 14, 1850.
† Huxley—*Essays—Coming of Age of Origin of Species*, p. 311.
‡ Bishop Wilson, quoted by Mr. Matthew Arnold.

of thought to which they have been inured.* Emancipation from the thraldom of dogmatic opinion is a slow and difficult process; and the adoption of large and independent views more consistent with observation, reason, and philosophy, has only been possible under the influence of the general progress of scientific knowledge and the acquisition of sounder methods of applying its principles to the explanation of natural phenomena.† No one can be more fully appreciative of these truths than I am myself; for, like Miss Nightingale,‡ "I was brought up and taught to believe that small-pox, for instance, was a thing of which there was once a first specimen in the world which went on propagating itself in a perpetual chain of descent; and that small-pox would not begin itself any more than a new dog would begin without there having been a parent dog;" and that, in short, the germs of all contagious diseases are pre-existent, antecedent to each—to all creation—to all eternity. But such a belief can no longer be entertained in the face of opposing facts, and in opposition to all that Charles Darwin has so conclusively demonstrated in his work and teachings. I regret that in the various editions of *The Science and Practice of Medicine* which I have published, I have subscribed in them to an hypothesis § regarding the *uniform origin* of specific diseases, which now appears to me as unsustainable as it is undemonstrable. Therefore I have felt myself bound to re-model these earlier conceptions in pathology by the light of the new Darwinian hypothesis. In so doing, I feel that to some extent I have been writing "against the grain," but conviction of error demands its acknowledgment, and it is here most heartily made; all the more because I am convinced that the general aspects of the Evolution hypothesis, as applied to pathology, "beget the stronger faith in it the more closely it is investigated. It is altogether in keeping, and not opposed to, but closely allied with, the proved truths in other departments of modern science;" and it becomes more positive as observations and experimental sciences become more exact—uniting facts and rendering them intelligible.

The problem of Evolution in Pathology is to show how the complex, the differentiated, the heterogeneous have come from the simple, the undifferentiated, the homogeneous; and that

* Buckle, *History of Civilisation*, vol. III, p. 415.

† Dr. Allen Thomson, "President's Address to the 47th Annual Meeting of British Association at Plymouth."

‡ *Notes on Nursing*, 1861, p. 29.

§ Aitken, *Science and Practice of Medicine*, 7th ed., 1880, p. 356-382.

some of the present marked types of diseases have slowly arisen by transmutation and descent from comparatively a *few* primordial types. Since a time so recent even as that of Cullen (120 years ago), the mere enumeration of diseases, as set forth in his *Nosology*, has now almost doubled, whilst our knowledge of the facts relating to them have been more than doubled;* and "diseases, like other things, in becoming increasingly numerous, have become more and more different, or, in other words, more complex. †

The great principle of Evolution in Pathology stands out clear and firm when the groups of facts relating to disease are considered in co-relation to each other—such facts, for example, as are related to the mutual affinities of diseases in the same group—to the geographical distribution of diseases in past and present times; to their succession and progressive evolution in epidemics; to their progressive development, with increasing definiteness and differentiation, combined with increasing complexity—as slowly evolved in time and space from simpler forms by slow and gradual modifications, through varying elective affinities.

In all cases, the process of evolution of diseases implies a succession of changes in the combination of their phenomena, or in the character and grouping of the phenomena, by which one disease passes into another, step by step, from an extreme simplicity or relative homogeneity to a greater degree of complexity or heterogeneity. Variation in phenomena and in type (and heredity or natural constitution being an important element in determining and modifying type), it has been shown that the variations of diseases from well recognised types are extremely frequent and numerous—that the contributions of morbid phenomena or symptoms presenting themselves always in the same concourse or succession are not always uniform—that cases run by insensible gradations from one type into another. We also see diseases perceptibly getting milder and milder, weaker and weaker, and that they become rarer and rarer as they tend to become extinct altogether, just as races of mankind do. Such has been the case with plague, typhus fever, ague, and dysentery in this country. And although our ignorance of the laws of variation is profound, gradation is shown to prevail from extreme simplicity to great complexity in many diseases of the constitutional and zymotic class, and in their relationship

* C. J. B. Williams' *Principles of Medicine*, 1848, p. 522.

† Dr. J. Hughlings Jackson, F.R.S., "Bowman Lecture," in Medical Journals of 21st Nov., 1883.

to each other; and to some extent we have also seen that their variations admit of being classified.* This recognition of gradation is the first step towards the acceptance of the doctrine of Evolution in disease, although the nature of all the physiological factors to which the evolution of diseases may be due is still an open question.† "It is this continuously minute differentiations and integrations which constitute Evolution."‡

Through this process, then, it is contended that diseases of the type known as specific may arise *de novo;* that diverse diseases may own a common ancestry; that specificity depends on the soil in which the seed is sown, and on which it is subsequently cultivated; that the property of contagiousness or infectiveness, dominant in every inflammation and fever, increases in proportion to this specificity, in proportion to successful cultivation on suitable soil; that there is in diseases as in all nature a tendency of the common to become the specific, the homogeneous to give birth to the heterogeneous; that the distinctive characters of the acute infectious diseases have been and are being progressively built up from an ancestral amæboid common fever; and that the relation of the specific fever to common fever have an exact parallel and counterpart in the relation of specific local inflammation to common inflammation; that in anomalous or nondescript cases of disease we are dealing with natural variations of species under cultivation." §

It is further contended that in the processes of evolution "the living tissue elements of the body itself play a much more important part in the elaboration of septinous and allied poisons than what has been hitherto ascribed to them." ‖ Syphilis, erysipelas, necusia, metria, rubeola, scarlatina, and other zymotic diseases are also seen to put on different forms, which may be referred to the state of the exciter, the mode of its application, the matter on which the exciter acts, or the vitality of the patient, and furnish examples of the changes induced in diseases by the actual constitution of the individual and the mode of infection. ¶

* Section VII, *ante.*

† Compare Huxley, *Coming of Age of the Origin of Species*, p. 348.

‡ Herbert Spencer, *Principles of Biology*, vol. I, p. 80.

§ Dr. W. J. Collins' *Specificity and Evolution in Disease*, 1884, page 10.

‖ Surgeon-Major Dr. T. R. Lewis' *Microscopic Organism found in the Blood*, Calcutta, 1879, p. 57.

¶ *Vital Statistics*, by Dr. William Farr, a memorial volume edited by Mr. Noel Humphreys, of the Registrar-General's Office, for 1885, p. 247.

It is further seen that the healthy are liable to be attacked with other maladies differing from any prevailing epidemic apart from any direct contact or contamination. Unexpected cases of measles, diphtheria, scarlatina, croup, typhoid fever, or variola, are thus known to arise—all evidently spontaneous and immediate, not to mention complications, modifications, and variations more or less marked of the particular disease which comprises the epidemic, so that among the organised material causes of disease, however distinct or differing from each other, there are some similar or analogous in nature, which by processes of interchange and modification give rise to those of which conditions of predisposition and media favour most the evolution. And "in the morbid genesis or creation of disease which is incessantly at work, the processes of elaboration go on with an energy which knows no limits either as to variety or force. It seems to be merely a question of organic conditions and surrounding media whether the products of decomposition, putrefaction, or fermentation assume the benign and primary elementary forms or the more complex and organised, which under morbid aspects become the rivals of the effluvial marsh, the famine centre, or the city slum. Certain it is, however, that we must not expect to meet with transmissible malignant fevers without their filth or famine, any more than naturalists would expect to find fish without their waters."

But there are also organic products patho-chemically related—the cadaveric alkaloids or ptomaines, which are so energetic in their toxic properties, and so powerful as to destroy life instantaneously, and which became evolved in the course of putrefaction.*

Hence the foundation of the theory of Evolution in diseases lies in the fact that living bodies tend incessantly to vary—a variation, however, which is neither indefinite nor fortuitous, nor does it take place in all directions. It is limited by the general character of the type of disease to which the variation belongs. Every variation of a living thing and diseases are but variations from normal life—however minute, however apparently accidental—is inconceivable, except as the expression of the operation of *molecular forces* or "*powers*" resident within the organism. And as these forces certainly operate according to definite laws, their general result is doubtless in accordance with some general law which subsumes them all—the Laws of Variation including heredi-

* Dr. J. N. Brown, *l. c.*, pp. 9, 10, 63.

tary transmission—a natural process, the laws of which are for the most part still unknown.*

One fact cardinal in importance in the Darwinian hypothesis is—that the tendency to variation in a given organism may have nothing to do with the external conditions to which that individual organism is exposed, but may depend wholly upon internal conditions; and so it is with diseases, especially of zymotic and of constitutional and hereditary type, that the living tissue elements of the body itself play an important part.

Hence it is that hereditary transmission and environment need to be analysed into their constituent conditions by the further application of the doctrine of *elective* affinity in the evolution of disease. The conditions of Environment may not be so actively productive as to cause variation; but may passively permit and favour a tendency in that direction which already exists.

In 1852 Mr. Herbert Spencer wrote an essay in *The Leader* newspaper on Creation and Evolution, seven years before the publication of Darwin's great work.† There he maintains "that the supporters of the development hypothesis can show that the process of modification has effected, and is effecting, great changes in all organisms—subject to modifying influences . . . . they can show that any existing species—animal or vegetable—when placed under conditions different from its previous ones, immediately begins to undergo certain changes of structure, fitting it for the new conditions. They can show that in successive generations these changes continue, until ultimately the new conditions become the natural ones. They can show that in cultivated plants and domesticated animals, and in the several races of men, these changes have uniformly taken place. They can show that the degrees of difference so produced are often greater than those on which distinctions of species are in other cases founded. They can show that it is a matter of dispute whether some of those modified forms *are* varieties or modified species. They can show, too, that the changes daily taking place in ourselves; the facility that attends long practice, and the loss of aptitude that begins when practice ceases; the development of every faculty, bodily, moral, or intellectual, according to the use made of it, are all explicable on the same principle. And thus they can show that throughout

* Huxley on "Mr. Darwin's Critics," in *Critiques and Addresses*, 1873, p. 298.

† Mr. Grant Allen's "Memoirs of Charles Darwin," p. 83, in *English Worthies*, edited by Mr. Andrew Lang, 1885.

all organic nature there *is* at work a modifying influence of the kind they assign as the cause of these specific differences; an influence which, though slow in its action, does in time produce marked changes; an influence which to all appearance would produce in the millions of years, and in the great variety of conditions which geological records imply any amount of change."

In this eminently philosophical abstract is embodied the theory which would maintain the evolution of diseases, through "elective affinity," and as departures from primitive types—departures from the normal life.

In this constant and universal evolution, the diverse circumstances, antecedents, and surroundings—the environments—necessarily leave their impress of individuality, giving rise, in Pathology, to reversion to former types, to nondescript diseases, to variability in transmission, to anomalies of every shade and degree. Here also is to be sought the explanation of the extraordinary inherited immunity or the not less extraordinary susceptibility to disease which oftentimes runs through whole families,* and which has been illustrated in Sections VI and VII.

We have seen also that Clinical Specificity in disease has been shown to be only partially true. Numerous exceptions or departures from well-known clinical types have been recorded from time to time, alike in Constitutional and in Zymotic diseases; so that the inevitable questions arise—"How are such cases to be accounted for?" "To what do such cases tend?" and "How do lesser differences or variations become augmented into greater?" "How have species arisen in a state of Nature?" These questions in Pathology are equivalent to such a question in Physiology as is "*the origin of species.*" They are, indeed, but two phases of one question. The *anomalous* cases of disease cannot any longer be set aside. It may be that they are incipient species, and therefore much greater attention must be given to them than they have hitherto received, so that accurate records as to departures from type should be sought for and obtained, instead of forcible attempts being made to get the records of such cases to conform to type. It is their vagueness or indefiniteness which renders their true nature liable to be overlooked or misunderstood;† and in the appropriate language of our greatest of living surgeons and pathologists, they must be made "to *probe* or to test the rule."‡

* Millican, *l. c.*, p. 70. † *Ibid.*, *l. c.*, p. 23.
‡ Paget, *Bradshawe Lecture*, 1882.

The term specific disease arose from that clinical character which represented them as tending to reproduce their like with more or less similarity; and that a direct parentage could frequently be traced for their existence in individual cases. But it does not imply that *like* cannot transmit *unlike* by processes of variation under any or certain circumstances, or that one case inevitably proves infection from a pre-existent one. The weight of clinical evidence is now and has been rapidly accumulating against universal credence in such a belief—notably as regards cholera and enteric fever.

"Are we justified then in maintaining that the germs of contagia (infective or not) must result, and always have resulted from pre-existing germs?"

"Or, admitting their coming into being at a certain epoch, can we reasonably conceive the possibility of their arising otherwise than from organised material free from germs potentially efficient?"

"And, supposing their origin or creation to have taken place in accordance with the necessary determining conditions, may not the disease constantly renew itself on the recurrence of these same conditions?" *

I think we have abundant evidence to show that the potentialities of Nature are apt to be underestimated; and we must accept the doctrine in pathology as a part of biology that the Laws of Variation are ever operative in connection with the origin and development of diseases. Not only does it seem to me that there are good grounds for believing that new diseases are in constantly progressive phases of development, although we may not be able to appreciate them on account of their slowness of evolution, and because in point of time we are living too close to the changes which are constantly going on around us to appreciate their influence sufficiently. "Habitually looking at things rather in their statical than in their dynamical aspects, we never realise the fact that by small increments of modifications any amount of modification may, in time, be generated." † There are also grounds for believing that the old diseases are no less constantly being redeveloped side by side with those that are believed to be more widely spread by infection, perhaps because transmission by direct infection may seem to be a more easily recognised cause.

As to the succession of epidemics, they appear to be generated at intervals in unhealthy places, spread, go through a regular course, and decline; but of the cause of their evolu-

* Dr. A. M. Brown, *On the Origin of Contagia*, 1884, p. 13.

† Herbert Spencer, *Elements of Physiology*, vol. i, p. 350.

tions no more is known than of the periodical paroxysms of ague. The body, in its diseases as well as in its functions, observes a principle of periodicity; its elements pass through prescribed cycles of changes; and the diseases of nature are subject to similar variations.* But if the latent cause of epidemics cannot be discovered, the mode in which they operate may be investigated. The laws of its action may be determined by observation, as well as the circumstances in which epidemics arise, or by which they may be controlled. As an instance of slow but progressive evolution of an epidemic, there can be none more conclusive than in the facts recorded by Dr. Farr, in the work already referred to, as to cholera. It has been established by observation that cholera is most fatal in the low [lying] towns and in the low parts of London, where, from various causes, the greatest quantity of organic matter is in a state of chemical action;† and it may be admitted that cholera varying in intensity with the quantity is the result of *some change in the chemical action of this matter*, whether that change is spontaneous or the result of a zymotic matter from beyond the seas, and its diffusion is consonant with what is known of the etiology of other diseases.‡

An important discovery was also made in 1832, when it was found that cholera in its worst forms was preceded by diarrhœa, and that this diarrhœa was in some cases of a mild form, in others a first stage of the disease. Now, to arrest this diarrhœa is to prevent cholera, as to extinguish a spark is to prevent a conflagration. It further appears that the deaths from cholera and diarrhœa had increased in London in 1842, that they had increased still more in 1846, when the potato crop was blighted, and in 1849 this gradual increase culminated in the evolution of epidemic cholera.§ This diarrhœa was shown to be evidently a variety of cholera, proving fatal chiefly to young children and to old people.

This evolution was itself gradual and progressive. It occupied a period of seven years, and it is a fact well worthy of attention, that after the temperature of the Thames had risen above 60°, diarrhœa increased, cholera and dysentery became prevalent, and disappeared as the temperature subsided. The cholera reached London in the new epidemic form about October, 1849; it prevailed through the winter; and destroyed 94 lives in the second week of January, 1850, when the temperature of the Thames was 37°; it declined rapidly through

* *Vital Statistics*, by Dr. William Farr, M.D., C.B., F.R.S., 1885, p. 317.
† *Ibid.*, p. 349. ‡ *Ibid.*, p. 364. § *Ibid.*, p. 383.

April and May. The night temperature of the Thames then rose to 62° in the week ending 2nd June; with some fluctuation it went up to 68° in July, and remained above 60° until the middle of September (week ending 15th September). The deaths from cholera registered during each of the 16 weeks were 9, 22, 42, 49, 124, 152, 339, 678, 783, 926, 823, 1,230, 1,272, 1,663, 2,026, 1682. The mean night temperature of the Thames fell to 56°, the deaths from cholera to 839 in the week September 16th-22nd; the temperature gradually fell to 38° on the last week in November, when only *one* death from cholera was registered. *

"The mere accumulation of masses of living people within narrow limits or in close apartments either generates or ensures the diffusion of epidemic diseases." † Thus, place lying-in women in close proximity to each other, or mix them up with patients of a general hospital, and they die of puerperal fever; place many wounded men in a ward where cleanliness is neglected, and erysipelas, pyæmia, gangrene spring up; imprison men within narrow walls, or crowd them in rooms, and typhus breaks out. Hence the dangers which accrue in large general and special hospitals from the assemblage of great masses of sick people within the walls of one building, so that the efforts of the most skilful medical officers are frequently defeated. ‡ And although it is impossible in the present state of science to reduce under any simple law the phenomena of disease-development; nevertheless, disease-development is evidently associated with the like development of species, and has with it some analogies. It is, for instance, found by the English Life Table that of 1,000 children born alive, 703 live to the end of the 10th year, 297 die in the 10 years of current life; and the deaths, frequent at first, become less frequent as the age of puberty is approached. The deaths run down rapidly from 149 in the first year to 5 in the tenth year of life; and they are the results of many types of disease, springing up in a certain order. The rate of death is, under the same conditions over a series of years, nearly constant. There is a determinable law of morbility, as there is a determined law of mortality. "Although no regular Registers of Deaths were kept before the Reformation, the chronicles show clearly enough that England has been periodically devastated by famines and plagues from the earliest times. A large proportion of the population of the island has been more than once swept away

* *Vital Statistics*, *loc. cit.*, p. 342.
† *Ibid.*, p. 324. ‡ *Ibid.*, p. 321.

by these visitations. The great plagues of the sixth and seventh centuries, which destroyed, according to some estimates, half the inhabitants of the Eastern Empire, extended to Britain. Besides the Black Death in the fourteenth century, the sweating sickness of the sixteenth century, and the plagues of the seventeenth century, terminating in the plague of 1665, described in detail by the historians, a long catalogue of famines and epidemics may be given, which though briefly and imperfectly noticed in the chronicles, were perhaps not much less fatal. After the Revolution the great plagues ceased; but the mortality was kept up by typhus, small-pox, influenza, and other zymotic diseases. The writings of Mead, Pringle, Lind, Jackson, Blane, Price, and Priestley—the sanitary improvements in the navy, the army, and the prisons—as well as the discovery of vaccination by Jenner—all conduced to the diffusion of the sound doctrines of public health, and had a practical effect, which, with the improved condition of the poorer classes, led to a greatly reduced mortality in the present century. Since 1816 the returns indicate a retrograde movement. The mortality has apparently increased. Influenza has been several times epidemic, and the Asiatic cholera reached England and cut off several thousands of the inhabitants in 1832. It re-appeared and prevailed again, as we have seen, with no mitigated violence in 1849. The health of all parts of England is not equally bad. Some districts are infested by epidemics constantly recurring; the people are immersed in an atmosphere that weakens their powers, troubles their functions, and shortens their lives. Other localities are so favourably circumstanced that great numbers attain old age in the enjoyment of all their faculties, and suffer rarely from epidemics."*

At what epoch of the world's history man came into existence and disease began we have no evidence whatever; but the discoveries of recent years have proved that man inhabited Western Europe at any rate before the occurrence of those great physical changes which have given Europe its present aspect. And as the same evidence shows that man was the contemporary of animals which are now extinct,† it is not too much to assume that the origin of our race and of our diseases dates back into "a dim past of immeasurable antiquity."‡ History therefore cannot teach us anything as to when or how diseases first began as we see

* *Vital Statistics*, 1885, Dr. Farr, *loc. cit.*, p. 150.
† Huxley, *Critiques*, p. 164.
‡ Sir Charles Lyell, *Antiquity of Man*, 1863.

them now. A disease as well as "a race does not attract our attention in Nature until it has in all probability existed for a considerable length of time, and then it is too late to inquire into the conditions of its origin." * Evolution cannot take the place of history. It is only by studying such history as Hirsch's *Geographical and Historical Pathology*, and learning what it can teach us, that we can speculate from the known to the unknown. We may thus attempt to reason out the probable and necessary prehistoric antecedents of diseases from facts still within our reach. Alike in geological and biological sciences we must reason from what is going on round about us, in order to appreciate the changes in the past which have influenced the conditions of the present, and will continue to influence the conditions of the future in all the sciences, amongst which pathology can be no exception. "The cumulative importance of separately infinitesimal elements is the very keynote and special peculiarity of the biological method of thinking" which Charles Darwin has taught us to employ. He has shown us that the infinitely small, infinitely separated, may become in process of infinite years infinitely important; † and systems of changes now in progress in the organic world will afford, when fully understood, a complete key to the interpretation of the living creation in past ages." ‡

And still more to help us to interpret the past from the present, results such as those elicited by the statistics of the late Dr. Farr "are as valuable as an experimental philosopher could have deduced from his experiments if he had had the power to expose the population to great vicissitudes of heat and cold, of dampness and dryness; to the changes incidental to differences in the prices of food; to air and water of different degrees of impurity; and to destructive epidemics.

"Thus we learn that in the same circumstances the same number of people die, at the same ages, of the same diseases, year after year; organised bodies being governed by laws as fixed as those which govern the stars in their courses."

Certain changes of condition, within certain limits, produce no appreciable effects; but beyond those limits, the effects are in some regulated proportion to the intensity of the causes; *varying, however, also with the state of the bodies submitted to their action*, as is evident by studying the effects on the two sexes at different ages. § Mr. Darwin also makes special refer-

* Huxley, *Lay Sermons, Addresses, and Reviews*, p. 324.
† *Memoir of Charles Darwin*, by Grant Allen, *l. c.*
‡ Lyell, *Antiquity of Man*, 3rd ed., 1863, p. 393.
§ *Vital Statistics*, by Dr. William Farr, *l. c.*, p. 142.

ence to the transference (sexually) of character in relation to disease. He shows that the tendency to profuse bleeding which is congenital (as is also colour blindness) must be determined at an early embryonic period—also that such diseases are often limited in their transmission to one sex. He further notices that characters which appear late in life in one sex are transmitted exclusively to the same sex; but with respect to sexually limited diseases, we know too little of the period at which they originate to draw any fair conclusion. Gout, however, seems to fall under the rule, for it is generally caused by intemperance *after* early youth, and is transmitted from the father to his sons in a much more marked manner than to his daughters. From the fact, also, that abnormal peculiarities become attached to the sex, long before sexual functions are active, we may infer that there must be a constitutional difference of some kind between the sexes at an extremely early age * which influences the pathology of diseases in them. And as with embryonic development, so with diseases. "I cannot conceive any doctrine professing to bring the phenomena of (diseases) within a general law, which is not like the theory of Darwin, consistent with their fundamental identity, their endless variability, their subjugation to varying external influences and conditions, and with the possibility of the transmission of the vital conditions and properties, with all their variations, from individual to individual, and in the long lapse of ages, from race to race." †

And, so far as history teaches us, the populations of Europe, Asia, and Africa were twenty centuries ago just what they are now in their broad features and general distribution. The ethnological part of man shows him substantially as he is now.‡

Therefore the explanation of the past is to be sought in the study of the present: and as in physical science, so in pathology, any explanation of what happened ages ago must not be sought for outside the range of known natural causes as interpreted by the current events of the day. The fundamental doctrine of the "origin of species," as of all forms of the theory of evolution as applied to biology is:—"That the innumerable species, genera, and families of organic beings with which the world is peopled have all descended each within its own class or group from common parents,

* Darwin, *Descent of Man*, 1872, vol. i, p. 292.

† Dr. Allen Thomson, President's Address at 47th Annual Meeting of British Association at Plymouth.

‡ Huxley, *Critiques and Addresses, Methods and Results of Etiology*, p. 156.

and have all been modified in the course of descent." * And if we may apply the analogue of the argument derived from the facts of geology it would run that "all existing diseases are the descendants by evolution from those which existed amongst animals and plants of the period of the most ancient life of the earth. And it is an obvious consequence of this theory of descent with modification that [all diseases], however different they may be, must at one time or other have been connected by direct or indirect intermediate gradations; and any appearance of isolation presented by various groups [of diseases] must be unreal." †

"What changes in his environment does such a lengthened existence involve!" "It is, indeed, somewhat startling to reflect upon the prodigious changes which have taken place in the physical geography of this planet since man has been an occupant of it, ... and just as the rudest and most primitive families of the earth were thrust, in the course of long series of generations, from land to land, impelled by encroachments of sea, or of marsh, or by severity of summer heat, or by winter cold, to change their positions, what opportunities must have been offered for the play of 'elective affinity' in preserving one family variation and destroying another!"

"Suppose, for example, that some families of a horde which had reached a land charged with the seeds of yellow fever, varied in the direction of woolliness of hair and darkness of skin. Then, if it be true that these physical characters are accompanied by comparative or absolute exemptions from that scourge, the inevitable tendency would be to the preservation and multiplication of the darker and woollier families, and the elimination of the whiter and smoother haired. Again, how often, by such physical changes, must a stock have been isolated from all others for innumerable generations, and have found ample time for the hereditary hardening of its special peculiarities into the enduring character of a persistent modification." ‡

"It is, moreover, a well-grounded belief that men of different stocks differ as much physiologically as they do morphologically; but it is very hard to prove in any particular case how much of a supposed natural characteristic is due to inherent physiological peculiarities, and how much to the influence of circumstances. There is much evidence to

* Darwin, *Origin of Species*, p. 457, 1st Edition.
† Huxley's *Coming of Age*, p. 315, *loc. cit.*
‡ Huxley, *Critiques*, *l. c.*, &c., pp. 164, 165, 166.

show, however, that some stocks enjoy a partial or complete immunity from diseases which destroy or decimate others. Thus, there seems good ground for the belief that negroes are remarkably exempt from yellow fever; and that among Europeans, the melanochrous people are less obnoxious to its ravages than the xanthochrous." * There are thus grounds for the belief that immunity from disease may be inherited. †

Nevertheless, the succession of changes in the evolution of diseases must have been of a slow and gradual character. For, "if we confine ourselves to positively ascertained facts, the total amount of change in the forms of animal and vegetable life, since the existence of such forms is recorded, is small and even very slight. And as in each group of the animal and vegetable kingdoms there are certain forms that are "persistent types," which have remained, with but very little apparent change, from their first appearance to the present time;" ‡ so it may be argued that there are some diseases whose type has remained similarly persistent, and as "the continuity of living forms has been unbroken from the earliest times to the present day," so too we may infer that the continuity of some diseases has been similarly unbroken.

Carrying out further the palæontological analogue of the argument, may we not say that every disease "which takes an intermediate place between forms of disease already known," so far as it is intermediate, is evidence in favour of evolution, inasmuch as it shows a possible road by which evolution may have taken place, and is presumptive evidence in favour of its evolution and in explanation of the coming into being of new diseases? "The mere discovery of such a form does not, in itself, prove that evolution took place by and through it, nor does it constitute more than presumptive evidence in favour of the evolution in general of disease." §

Carrying out Mr. Huxley's palæontological analogy still further, as regards special pathology—Let us suppose A, B, and C to be the three forms of disease which we know as *measles* (A), *scarlet fever* (B), and *enteric fever* (C); and that *scarlet fever* (B) stands intermediate between the two. We know that the occurrence of measles in a person or family renders that person or family more predisposed to other ailments—such as to B

* Huxley, *Critiques*, p. 157.
† Section VII, *ante*.
‡ Huxley, *l. c.*, p. 183.
§ Compare Huxley, *l. c.*, p. 187.

and C; and that an epidemic which begins with measles may finish in scarlet fever. Viewed in the light of the doctrine of evolution, there are thus four possible alternatives as to the "coming into being of these diseases." A (measles) may have become C (enteric) by way of B (scarlet fever); or C (enteric) may have become A (measles) by way of B (scarlet fever); or A (measles) and C (enteric) may be independent modification, of B (scarlet fever); or A (measles), B (scarlet fever), and C (enteric) may be independent modifications of some unknown factor (D).

But if it can be shown that A (measles), B (scarlet fever), aud C (enteric) exhibit successive stages in the degree of modification or specialisation of the same type (and there seem to be good grounds for the belief); and if, further, it can be shown that they have occurred with some uniformity of order in successive epidemics at different epochs (A) measles characterising the beginning of each epidemic, and (C) *enteric* ending it, and (B) *scarlet fever* being in the intermediate place; then (B) *scarlet fever* would have this importance that it would be a link in the genetic evolution of (C) *enteric fever*. In the former class of evolutionary processes the intermediate one would furnish *intercallary* types of disease; in the latter class of intermediate forms in epidemics the types of evolution would be *linear*. In the former term, the fever (B) *scarlet fever* is intermediate between (A) *measles* and (C) *enteric fever*, without affirming or denying any genetic relation between the three diseases; but when the term *linear* is applied it would express the opinion that the three diseases—*measles* (A), *scarlet fever* (B), and *enteric fever* (C) constitute a line of descent, and that scarlet fever is part of the lineage of enteric fever. Compare this exposition with Dr. John Harley's account of scarlet fever in relation to enteric fever in Section VII.

It need not be difficult, therefore, to indicate intercallary diseases, either in zymotic or in constitutional ailments.

One of the immediate consequences of the acceptance of the doctrine of evolution in pathology is that the present distribution of life and of diseases upon the globe is the product mainly of two factors—the one being the distribution which obtained in the immediately preceding epoch; and the other the character and extent of the changes which have taken place in physical geography, in climate, and in environment generally from one epoch to another.

We may therefore conclude that in the known agencies and known processes that are actually and constantly going on around us at present, we find quite adequate causes for the influence of evolution in the generation of disease, and that

the same agencies were in operation in old times just as now in furnishing the sources of disease.*

The causes of a high mortality are various; "but the greater number of known causes may be referred to five heads:—1, excessive cold or heat; 2, privation of food; 3, effluvial poisons generated in marshes, foul prisons, camps, cities, [towns, villages]; and epidemic diseases, such as typhus, plague, small-pox, and other zymotic diseases; 4, mechanical and chemical injuries; 5, spontaneous disorders to which the structure of the human organisation renders it liable."

These, in the order of their beginnings as above stated, may be regarded as representing the origin of primeval diseases in their order of commencement; and as in epidemics "plagues" were the first diseases distinguished, although the characteristic symptoms of the early pestilences escape the notice of even the classical historian; famine would naturally take the first place as a cause of disease,† which would be followed by dysentery, typhus, and fevers "of sorts."

The most powerful agencies which furnish the sources of disease in the present as in the past have been classified as—1. Intensity of the struggle for existence—the more intense in proportion to the aggregation of the people. 2. The ever-recurring tendency towards concentration in hamlets, villages, towns, cities; and the tendency of the more rural population to migrate to those centres. 3. Increase of mortality in population and concentration. The more crowded a community, the greater the amount of abject want, filth, crime, drunkenness, and other excesses—the keener the competition the more feverish and exhausting are the conditions of life. In such crowded communities, the more dangerous and unhealthy industries are carried on. These are the factors which mainly increase the dangers of aggregation. And while the hereditary nature of acquired properties must not be lost sight of, the diseases incidental to special occupations have also a special influence. It is with regard to the action of those several factors separately that information is constantly required to see how far and in what manner they respectively add to the mortality of towns. The influence of "occupation on death-rates" is a very marked and important one; and still more important is the share in the death-rate that is due to each disease.‡

Particular classes of diseases reign in different regions and

* *Vital Statistics*, 1885, Dr. William Farr, *loc. cit.*, p. 139.

† Lyell's *Antiquity of Man*, p. 409.

‡ Dr. Ogle in *Supplement to 45th Annual Report of the Registrar-General of Births, Marriages, and Deaths in England*, 1885.

seasons; but cases appear to occur in all climates to demonstrate that every kind of malady can arise where man can subsist. This tendency to varying diseases—the morbid diathesis—is seen in families that are surrounded by the same external circumstances; where some suffer from asthma, some from gout, some from insanity, some from phthisis. There must, it is evident, be here a predisposition to disease, or it would not be stronger in one than in another, and different families would not be peculiarly subject to this or that form of malady, this or that kind of death. The human race, and every large section of the race, may then be considered as having hereditary predispositions to pathological phenomena in such a way that children are not generally born with disease, but in the successive changes which they undergo, from the first throb of life to their final evolution, there is, besides the upward onward impulse, a principle which draws a certain number within the sphere of disease and mortality. *

The laws of vitality, the variations of those laws in the two sexes at different ages, and the influences of civilisation, occupation, locality, seasons, and other physical agencies, must all be recognised as factors in the generation of disease; and the extent to which epidemics vary in different localities, seasons, and classes of society, are indicated by the registered diseases. From inquiries carried out on these lines it has been discovered how the characters of diseases change—how diseases and the constitution of the population present striking discrepancies when town and country districts are compared; how the modifications in the character of diseases and in their medical treatment are indicated perhaps more accurately by the prevailing epidemics than by either the temperature, the hygrometricity, or any other appreciable condition of the atmosphere; and it was Sydenham's doctrine that the treatment of acute diseases should have a reference not only to the immediate symptoms and to the seasons, but also to the epidemic constitution of the year and place.† So also the late Sir Robert Christison tells us that during the first half of his life "acute local inflammations were attended with a violence of arterial action unknown in the later half. . . . The younger generation of physicians may follow their leaders by decrying the occurrence of any such change in the constitutional character of diseases; but they can be no fit judges who were not practical observers of both phases of the case; and all my professional brethren old enough to have seen both agree with

* *Vital Statistics*, by Dr. William Farr, 1885, p. 216.
† *Ibid.*, p. 213.

me that for a long time past they have never met with such pulses for force and hardness in pneumonia, pleurisy, nephritis, rheumatisms, as they encountered in their earlier days." *

"Changes corresponding with the seasons also occur in the human organism; although these are better marked in some of the lower animals, such as the deer. In them the antlers bud regularly in spring and reach perfection just at the breeding season. It is possible that the abolition of the practice of bleeding in spring and the changes in other plans of treatment formerly adopted, may not be altogether due, as some suppose, to increased knowledge on our part, but rather to the occurrence of a "*change of type*" not only in diseases, but also in slight ailments, and to the need for such treatment having disappeared. Formerly, before the introduction of coaches, and still more of railways, locomotion was difficult and transportation was expensive; in consequence of this the food consumed by the generality of people was different in character, loaf (wheaten) bread being very little used, and salt meat often used for weeks and months together during the winter; with comparatively few vegetables. Such a diet might naturally lead to a condition of body which would be benefitted by bleeding or purgation." †

Sporadic diseases are found to differ from each other in their symptoms, course, and termination; and in the organs which they affect. Two or three diseases may co-exist; or may give place one to the other, run into various complications, and present irregularities which sometimes render diagnosis difficult. ‡

"It must be admitted, with respect to all the forms of those diseases, that the body, in the cycle of external circumstances through which it passes, may run into them spontaneously; for it is impossible to trace them invariably to infectious sources; it is not *a priori* more improbable that they than that other diseases should arise spontaneously; and it is impossible to account for their existence in the world upon any other principle than that of spontaneous origin. Still, the property of communicating their action and effecting analogous transformations in other bodies, is as important as it is characteristic in these diseases," which Dr. Farr

* *Life of Sir Robert Christison, Bart.*, edited by his Son, 1883. Vol. I—*Autobiography.*

† Dr. Lauder Brunton, *Pharmacology, Therapeutics, Materia Med.*, 1885, p. 36.

‡ *Vital Statistics*, Dr. William Farr, 1885, p. 217.

"therefore proposed to call in that sense zymotic—as a general designation of the morbid processes and their exciters." *

In looking back, therefore, through the prodigious vista of the past, while we can find no record of primeval diseases, still less can we find any record as to the commencement of life; nor can we form any definite conclusion as to the conditions of its appearance. But happily the question of abiogenesis or of biogenesis is not of importance as a factor in the evolution of diseases. In fact, it finds no place; for if Charles Darwin's doctrine of evolution is accepted, the question as to the spontaneous origin of diseases does not present any difficulty in its application to pathology. The spontaneous generation of diseases is in no way analogous, nor is it comparable with the spontaneous origin of life. The existence of disease already implies the existence of life. In the diseased patient we already have a living being in whom the disease is but a variation from the normal line of healthy life; and as soon as such a variation was appreciable, we must recognise in it the potential beginning of an evolution of disease, merely as a biological necessity. Hence, in questions regarding the spontaneous generation of disease, biogenesis or abiogenesis does not come up for discussion. A great gulf has been placed by Nature between the living and the dead. "The present state of knowledge furnishes us with no link between the living and the not-living." †

The coming into existence of life does not, therefore, concern us here. The process is completely beyond human comprehension, and therefore it can never form the subject of scientific inquiry; but, as far as science can show, this doctrine of biogenesis, or of "life only from life, is victorious along the whole line" at the present day. ‡ "The experiments of Tyndall and Dallinger have practically closed the question of spontaneous generation; and a decided and authoritative conclusion has been arrived at in science, so that, so far as science can settle anything, this question is settled. The attempt to get the living out of the dead has failed. Spontaneous generation of living things has had to be given up, and it is now recognised on every hand that life can only come from the touch of life." §

Mr. Grant Allen, ‖ in his eloquent memoir of Charles

* *Vital Statistics*, Dr. William Farr, 1885, p. 246.
† T. H. Huxley, *Encyclopædia Britannica* (new edition), Art. "Biology."
‡ T. H. Huxley, F.R.S., *Critiques and Addresses*, p. 239.
§ Drummond, *loc. cit.*, p. 63.
‖ *Lives of English Worthies*, edited by Mr. Andrew Lang, 1885, p. 42.

Darwin, suggests that "the equatorial zone is the true school for the historian of life in its more universal and lasting aspects." The tropics are, indeed, biological headquarters. "They preserve for us still, in all their jungles, something of the tangled, thickly-peopled aspect which our planet must have presented for countless ages, in all latitudes, before the advent of primeval man. We now know that throughout the greater part of geological time, essentially tropical conditions existed unbroken over the whole surface of the entire earth from the Antarctic continent to the shores of Greenland; so that some immediate acquaintance, at least, with the equatorial world is of immense value to the philosophical naturalist for the sake of the analogies it inevitably suggests; and it is a significant fact that almost all those great and fruitful thinkers who, in our time, have done good work in the wider combination of biological facts, have themselves passed a considerable number of years in investigating the conditions of tropical nature."

Hence it may be argued that now, in tropical regions, we may expect to find, as we do find (see Section VIII), the greatest variations of diseases from their types, as compared with the variations in more temperate regions; and that as we must reason from the present to the past, in order to anticipate the future (since material does not exist to reason from the past to the present), it is in tropical regions that we must look for existing evidence of such modifications of disease as are capable of leading slowly by variations in disease-types to the evolution of new diseases.

From such a view of pathology as we get from the standpoint furnished by Darwin's teachings, it follows that our existing classification of diseases must be regarded as a purely artificial and arbitrary arrangement, founded upon obvious and more or less accidental resemblances. It must, therefore, give place in the future to a more natural one, with less definite and more elastic boundaries, just as the artificial botanical system of Linnæus had to give way to the more scientific, because natural, methods of classification of Jussieu, D'Candolle, and Lindley. The botany of Linnæus was a splendid contribution to human knowledge, and did more in its day to enlarge the view of the vegetable kingdom than all that had been done before. But all artificial systems must in time pass away. Nature must be read in her own light. The Reign of Law has gradually crept into every department of nature, transforming knowledge everywhere into science. The process goes on, and

nature slowly appears to us as one great unity until the borders (even) of the spiritual world are reached.* Furthermore, evolution having now been recognised as a power in so many different sciences, the likelihood is that it is a universal principle not less applicable to pathology than to other sciences. It has been so recognised in Biology, as interpreted by Charles Darwin and Alfred Russell Wallace, and expounded by Herbert Spencer, Huxley, and others; in Geology by Sir Charles Lyell and Geikie in this country; and by Leidy, Marsh, and Cope in the western territories of America; in Astronomy as expounded by Kant, Sir William Herschell, and by G. H. Darwin; and in Theology, as recently expounded by the Bishop of London in his eloquent *Bampton Lectures* for 1884.

"Further, it is clear that 'Conservative medicine,' rendered more efficacious by reason and social institutions, must in the long run banish transmissible and contagious diseases, as well as maladies due to climate, diet, occupation; nay, the hope of relief may be extended to all other diseases whose remote causes may probably be recognised." And "Mr. Darwin, accepting the law of the increase of animals in geometrical progression, instead of viewing it as a reason for an eternal stand-still of misery, traces to this constant struggle for existence the survival of the fittest, and the progressive development of creation from its lowest to its highest forms. He contends that living matter in the past was perfectible; and that this is an argument for the indefinite perfectibility of men through future ages. The great source of the misery of mankind is not their numbers, but their imperfections, and the want of control over the conditions in which they live."†

But it has been said that while "medical science is mitigating suffering and achieving some success in its warfare against disease; that at the same time it enables the diseased to live. It controls and sometimes half cures the maladies that spring from profligacy and excess; but in doing so, it encourages both, by stepping in between the cause and its consequences, thus saving the victims from their natural and deterring penalties. It reduces the aggregate mortality by sanitary improvements; but those whom it saves from dying prematurely, it preserves to propagate dismal and imperfect lives. Hence it is argued that the law of "natural selection"

* *Natural Law in the Spiritual World*, by Henry Drummond, F.R.S.E.; F.G.S., pp. 12, 13, 37.

† *Vital Statistics*, by Dr. William Farr, 1885, p. 136.

is a failure in the case of man; and that deterioration of the physical constitution is the result.*

But there can be no equality in the world either in health or in property, and the "law of variation" prevents such a condition ever being attainable; so that individual inequality must always exist; and the law of "*natural selection* by survival of the fittest" has not failed in man, notwithstanding all the disturbing influences of progressive civilisation and of sanitary knowledge. Does not also the relation between disease as a means of natural selection, and the progress of civilisation, with the consequent decline of other eliminating influences, account for the fact that every century (or great cycles of time) seems to have an epidemic more terrible than the epidemic of the century preceding—apparently in the same ratio as the differences in the condition of the people of the countries in point of progress in civilisation.† So far as this is true it gives support to the doctrine of the evolution of diseases.

"All we can do, therefore, is to keep steadily in mind that each organic being is striving to increase in a geometrical ratio; that each at some period of its life, during some season of the years, during each generation or at intervals, has to struggle for life and to suffer great destruction. When we reflect on this struggle we may console ourselves with the full belief that the war of nature is not incessant—that no fear is felt, that death is generally prompt, and that the vigorous, the healthy, and the happy, survive and multiply.‡‡

So excessive is the mortality in towns, that Dr. Price having compared it with the mortality in the country, and, finding human life shorter by one-half in cities than in the country, adds:—"From this comparison it appears with how much truth great cities have been called the graves of mankind. It must also convince all . . . that it is by no means strictly proper to consider our diseases as the original intention of nature. They are, without doubt, in general our own creation. Were there a country where the inhabitants lead lives entirely natural and virtuous, few of them would die without measuring out the whole period of the present existence allotted them; and death would come upon

* *Fraser's Magazine* (Sept., 1868) "On the Failure of Natural Selection in the Case of Man."

† Mr. Lawson Tait, *Dublin Quarterly Journal of Medical Science*, Feb., 1869.

‡ Darwin's *Origin of Species*, Introduction, pp. 4, 17, 82.

them like a sleep, in consequence of no other cause than gradual and unavoidable decay." *

Thus Darwin's great work comes to be in accordance with the teachings of physiology and pathology in this respect that "disease is not inevitably the fate and birthright of every born child; but that much of it is, in fact, of our own making; that it is not outside our knowledge and our power, but that much of it is within our own control; that filthy conditions and the imperfect removal of effete material without and within the body are the most powerful concurrent factors alike of constitutional ailments and of the zymotic pestilences which aforetimes 'walked in darkness,' but which are daily being made plain by the revealing light of science."†

"Slowly but surely, evolution brings about an increasing amount of happiness; all evils being but accidental. By its essential nature the process must everywhere produce greater fitness to the conditions of existence, be they what they may. There is in all cases a progressive adaptation, and a survival of the most adapted, and the evils accompanying evolution are ever self-eliminated." ‡

Hence there is in Darwin's doctrine of evolution throughout all nature the comforting belief that "it implies the design of a perpetual progress." But his too enthusiastic followers have attempted to carry his hypothesis farther than he did himself. They have endeavoured to push the doctrine of evolution so far as to make it account even for the origin of life itself—a problem which Darwin never attempted to solve; but this much is certain that "all evidence, up to the present, negatives the opinion that 'LIFE' is a mere evolution from organic matter;" and while the origin of diseases *in the beginning*, like *the first origin of life on the earth*, as well as the continued life of each individual, is unaccounted for by science, and quite beyond its scope, the doctrine of evolution demands (as Darwin himself assumed), 'that we should look on the Almighty as creating the original elements of matter;—determining their number and their properties; creating the law of gravitation, whereby, as seems probable, the worlds have been shaped;—creating the various laws of chemical and physical action by which inorganic substances have been combined; creating, above all things, the *law of life*, that mysterious principle which plainly contains within itself such wonderful possibilities, and thus providing *once, and for all time*, the ultimate

* Dr. Price, quoted by Dr. Farr, *l. c.*, p. 153.
† Collins, *l. c.*, p. 28.
‡ Herbert Spencer, *Principles of Biology*, vol. i, p. 354.

development of the many forms of nature by which we are surrounded."

Surely, "We can conceive of nothing grander than this one original creative act from which the infinite variety of the Universe has come, and more is coming yet."

And this doctrine of Evolution further teaches us, "that we are looking on a work which is not yet finished; that we are looking on a world in which the occurrence of pain, of disease, of death, and such like imperfections, are but a necessary part of this large design, the general outlines of which, thus far, we have been permitted to see, but the ultimate issue of which, with all its details, is still far beyond our perception." *

* Dr. Temple, *Bampton Lectures for* 1884, p. 168.