

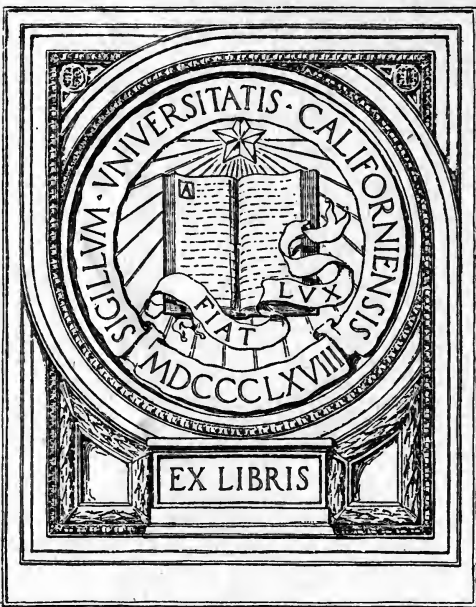
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EXTRACTS FROM THE DIARY OF A
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BIOLOGICAL PHYSICS PHYSIC & METAPHYSICS

STUDIES AND ESSAYS BY

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VOL. II.

PHYSIC

Circulatio Circulationum omnia Circulatio

LONDON

H. K. LEWIS, 136, GOWER STREET

1910

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UNIVERSITY OF GLASGOW
GLASGOW: PRINTED AT THE UNIVERSITY PRESS
BY ROBERT MACLEHOSE AND CO. LTD

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I. CLINICAL.

EXTRACT I.

ON CIRCULATION, IN ITS PATHOGENIC BEARINGS.

On the progress of Medicine and Surgery.

ONE of the pathological and histological results of the acceptance of the foregoing views (see Vol I.), modified by the application of criticism and subjection to everyday clinical experience, we hope, and we think, will be the removal of a large part of the diseases hitherto attributed to blood influences, to the continually increasing class of acknowledged nervine diseases—such, for instance, as a large proportion of the exanthemata, rheumatism, and gout, and to a considerable extent metallic poisoning and many of the bacterial diseases, including influenza, to which may be added tetanus, hydrophobia, we might almost say, *et hoc genus omne*, with many local as well as general ailments, which have hitherto not been specially localised or located, and a corresponding practical modification in the application of medical and surgical curative and ameliorative procedure, in accordance with the changed standpoint from which these diseases will then be regarded, and the increased possibilities of treatment which will in consequence be placed within available reach of the clinical pioneer.

The great mass of diseases, moreover, except *perhaps* the purely local and structural, and even many of these cannot fail to have their true nature more clearly and fully apprehended by a “light from within” being, as it

were, projected into, and upon, their inner nature, and working, and thereby revealing it may be, in novel and unaccustomed positions and relief, the essence, the methods, and manners of attack, progress, and result of the various morbid entities in their contentions for supremacy with the resources of the *vis medicatrix naturæ*. Figuratively speaking, the systemic nervous system, being the citadel and capital, so to speak, of the body corporate, and the habitat of its presiding *ego*, is liable to attack by the enemy disease through all the channels by which it—the central nervous system—communicates with its environment, immediate and remote; consequently it requires these channels to be jealously guarded to prevent invasion, and to be freely opened to expel the enemy, should it unfortunately have gained an entrance to that citadel, and should the forces of expulsion prove equal to the occasion. In other words, a fluid or lymph is omnipresent throughout the inter-spaces of the systemic nerve organisms, which is liable to become the scene of disease when its substance may become septic, chemically altered, or otherwise affected in quality or quantity, thereby necessitating the adoption of special medicinal and other measures to meet the special circumstances, apart altogether, or almost altogether, from the purely nervine aspect of the subject, which requires to be dealt with on its own lines and very much on its own merits. In view of the facts that the cerebro-spinal fluid cannot be called a living, organic, or nutritious fluid, but, on the contrary, a fluid, much of which is destined for elimination purposes, very much on the same lines and principle that the fluid secretion of the kidneys is, and that the bladder, or *viscus*, containing it consists or is made up of the whole inter- and intra-spatial lymph areas surrounding and inter-penetrating the systemic nervous system, central and peripheral. It requires, therefore, that the eliminatory mechanisms making up or composing that *viscus*, if we may call it so, should be equal, but not more than equal, to the performance of this vital function. Should this be quite normally accomplished, it must follow that the enclosed nervous system, in all its parts, is at full liberty, all other essential conditions being likewise normal, to perform unhindered its

multifarious duties, and should the component elements of the nervous system be likewise normal and intact throughout their full extent, then it must likewise follow that that nervous system proper will be entirely equal to its task. That this state of things may be attained, it is, of course, thus necessary that a state of perfect health should prevail throughout the whole non-systemic nervous system, and then will likewise follow that ideally perfect state of being described by Celsus in the oft-quoted phrase : *mens sana in corpore sano*.

EXTRACT II. A.

ON BIOLOGICAL EVOLUTION, AND ITS INFLUENCE ON PATHOGENESIS, AND TREATMENT.

IN biological developmental progress we see the natural history aphorism, "the survival of the fittest," supplemented by the subsidiary, structural, and functional law of the *displacement or replacement of the less by the more fit*, the less fit gradually, but absolutely, disappearing with the altering environment of the developing organism in its successional progress by *natural selection* in tissue, organ, and organism, in part and in whole. The truth of these observations is abundantly evident, throughout the whole of animated nature, in the sequence of the steps of advance characterising the whole course of evolutionary progress, from the uni-cellular organism to the last and most highly differentiated and endowed living being—man. Man himself representing, in the various consecutive phases of his developmental experience, every stage of organic evolution as it is to be met with in the whole course and stages of the organic life of the globe, both as it has existed and now exists; with the additional and further evolution of great intellectual endowments and moral attributes, which latter are his peculiar and crowning possessions, although rudiments of intellectual superiority, with a faint glimmering of nascent morality, are not wanting in his higher neighbours in the animal scale.

It is by the evolution and development of nervine structure and function that every stage of organic advancement is achieved; the first, or uni-cellular, form of organism is animated, vitalised, or energised by a sub-

nervine or molecular form of materio-dynamic activity and metabolism ; and it is by the segmentation or kariokinesis of the uni-cellular organism that the multi-cellular organism is built up and energised, innervated, or vitalised by the first rudiments of developed and differentiated nervine structure, called, when fully differentiated and evolved, the sympathetic nervous system—a system which governs all organic or vegetative life processes throughout the total flora and fauna of the globe. Also, it is from this latter that a further evolution and nervine development takes place, in virtue of which is ultimately added to the attributes of organised beings, the crowning qualities of reason, will, and moral powers.

Man is thus a double being—or even a treble, if we regard his uni-cellular life—accordingly as we consider his nervine history and development, and is equally dependent for the enjoyment of his full manhood, material and dynamic, on the two elements of his dual innervation. His last developed nervous system, the systemic, brings him into relationship with a higher series of conditions than it was possible for him to reach with his sympathetic nervous system alone, and hence into a psychological and metaphysical sphere, where he is enabled to distinguish between the *ego* and the *non-ego*, and to penetrate far beyond the confines of his immediate surroundings and personal experiences, and to enter, it may be, into communion with kindred existences, and with far removed, but undeniable, realities.

It is a singular and striking embryonic developmental truth that the great neurenteric canal, the first of the great vascular arrangements to be evolved from the earliest histological elements of the ovum, should become subservient to the growth and maintenance of the two great nervous systems, the anterior, or ventral, becoming the alimentary canal, where the protoplasmic elements of tissue are first elaborated, and the posterior, or dorsal, becoming the cerebro-spinal canal, in which is laid down and stored up the food for the systemic nervous system—the two, even after their differentiation, maintaining a modified union, and ministering to each other's needs, as material and functional wants mutually determine. As these

two neurenteric tubes maintain an intimate material and dynamic relationship, due to original continuity of histological elements, so do their peripheral aspects assume, in the progress of mutual inter-mixture, inter-penetration, and dovetailing, a condition almost of homogeneity, which ensures a communal functional work as well as a dual control and independent action.

The formative results of independent histological existence and inter-dependent functional activities have far-reaching physiological consequences in the regulation of the general bodily health, and must necessarily determine, to a large extent, the incidence and progress of a large part of disease entities and neoplastic textural developments, facts which should, therefore, at all times be borne in mind, and utilised as far as possible.

The one nervous system gathers its nourishment directly from the alimentary canal, and converts it into protoplasm fit for its own peculiar metabolic purposes, while the other has its peculiar protoplasm prepared and stored for its immediate use in the cerebro-spinal canal, each part of the original neurenteric canal, thus, continuing to perform the common function of meeting the nutritive wants of its peculiar nervous system and structural dependencies, and, therefore, necessarily colouring the peculiar, or essential, formative activities of that system, as well as determining the formative results of their combined or dual metabolism, besides the manner and character of their pathological formations and processes; thus the early progress of pathological formative processes may so resemble the physiological as at first to elude observation, until the departures from the normal become so unmistakably alien in character and structural results that they compel recognition as fully established diseases.

In pathological formative processes we see the physiological manner of procedure, and results lead to a *reversal* of the *natural findings*, as elicited by science, biological and chemical, and discover that instead of the *survival of the fittest*, it is the *survival of the unfittest*, with the terminal effect of the extinction of the individual organisms affected, and perhaps, when widely distributed in incidence, the species implicated. In all such eventual-

ties, the dynamic and formative powers of the unal, or dual, nervous systems are responsible for the direction and administration of the alien influences at work, and for the accomplishment of their final results, be they innocent or malignant. Appeals, therefore, must be made to them individually or conjointly, in accordance with the *indications for treatment* deducible in each individual case.

EXTRACT II. B.

ON THE *INGESTA*, AND *EGESTA*, AND THE PROCESS OF DISPOSAL OF THE LATTER, WITH OBSERVATIONS ON THERAPEUTICS, AND PATHOGENESIS.

THE *ingesta* are *almost entirely* taken into the body by the mouth, the exceptions being atmospheric air, with its material admixtures, and the very uncertain quantity imbibed by the cutaneous surface. They comprise solid, liquid, and gaseous materials, with a conceivable quantity of finely disintegrated inorganic, as well as living organic, material, not amenable to measurement by the most delicate methods of detection yet known to science.

From the time these *ingesta* reach the stage of perfect metabolism, they begin to assume the character and pursue their course as *egesta*, and are ultimately disposed of at the innumerable points of exit, and surfaces of exudation and exfoliation, by the various egestive processes at work throughout the body, as residual or waste materials. The principal examples of these egestive processes are the alvine, the renal, the pulmonary, and the cutaneous. Some of the *ingesta* are cast out of the body directly, without metabolic change, in a more or less solid condition, as unutilisable or harmful, by the alimentary apparatus. Some, after a more or less appreciable interval of time and use, are cast out in a liquid condition by the kidneys, some are eliminated in a vaporous or gaseous condition by the lungs, while some are exhaled, transuded, or perspired in a more or less sensibly consistent condition, by the skin, and as more or less solid epidermal and epithelial

débris, after complete metabolism. The materials so egested, if we could possibly succeed in weighing them, would exactly, of physical necessity, correspond to the sum of the material ingested, plus, or minus, irregularity (if any) for the time being; the various chemical and physiological changes undergone by the *ingesta* and *egesta* would likewise represent the quantity of energy released and expended on the total functional work of the entire organism during the time occupied in the processes of ingestion and egestion.

The processes of ingestion and egestion must, therefore, balance each other, and form the counterparts of one great integrative and disintegrative process or whole, the various portions or parts of which, if health is to be secured and maintained, must completely dovetail and follow each other in unbroken succession and harmony.

Errors, therefore, in quantity or quality of the *ingesta* must inevitably be followed by egestive derangement, and consequent disturbances of the condition of health, while active or passive interferences with the process of egestion must likewise be followed by departures from the standard condition, proportionate to the nature and amount of the errors and interferences; thus obesity or accumulation may follow the former, and ailments accruing from emaciation or waste the latter. A large portion of the whole list of morbid entities, infirmities, and sufferings of humanity may, therefore, be said to be due to such errors and interferences with the balance which ought ever to exist between the quantity and quality of the food taken into the body and the amount of waste material given out. In pursuing the subject as thus outlined, we would take up more especially the latter half, viz. the process of egestion, or excretion, exudation, and exhalation, or the methods by which the body is relieved of its encumbering, or effete, materials; this process is a great compound process, whereas the process of ingestion, in at least its early details, is somewhat more simple. It is concerned with the final ejection of disintegrated and effete, or worn out, organic matter, in the forms of solid, liquid, and gas, or vapour, and is accomplished by appropriate excretory agencies or mechanisms located at the most convenient

points for its final disposal. The process itself consists of a continuation in inverse order of the circulatory phenomena which lead up to the metabolism of the *ingesta* by the various tissues and organs of the body, and begins with the first katabolic or disintegrative changes undergone by the organised or metabolised structural materials, continues by the collection of these into definite excretory vessels, glands, and hollow organs, and terminates by the unlocking of the various eliminatory agencies, by relaxation of their proper sphincters, escape valves, or structural safeguards. It follows axiomatically, therefore, from this that any failure of these circulatory and eliminatory agencies or media, or any stasis or arrest of the circulated material must give rise to a condition of *disease* which, if continued, must inevitably end in the production of a more or less definite pathological condition, the remedy for which must necessarily be, in all cases, primarily sought for in the rectification of the circulatory and eliminatory failure of the media involved, or in the overcoming of the stasis, or arrest, of the circulated material; hence, in whatever part of the egestal, circulatory, and eliminatory economy the diseased condition is to be found, there we must bring to bear the use of the most appropriate means which the particular pathological circumstances indicate, and let us hope we shall be enabled more and more to do so with a scientific security based upon physiological law and data, and with a warranted feeling that we are not absolutely "groping in the dark," nor "bowing to the idol" of mere empiricism.

Thus obstruction of the bowel or intestinal canal must be met by carefully adapted means, according to the indications yielded by each particular case, retention or suppression of the renal excretion, by the adoption of appropriate means, based on diagnostic analysis of each particular case; pulmonary excretional stasis, by appropriate expectorant means; closure of the sweat glands, by *diaphoresis*, secured by appropriate medicaments and mechanical unlockment of the gland ducts, and the consequent allowance of the escape of the imprisoned neural and other fluid; while retention of the septic results of neural excretion, or the more solid ingredients of neural

waste, in the shape of epidermal *débris*, must be secured by the use of appropriate means, therapeutic and mechanical, suitable or adapted, to the requirements of each particular variety and form of the large family of pathological conditions and more or less specific affections, owing their origin and persistence to arrested epidermal exfoliation or cuticular shedding.

From the point of view thus presented, we are amply warranted in computing that disease, owing its origin to hindered or arrested circulation of either, or both, the *ingesta* and *egesta*, whether of mechanical, structural, or dynamic origin, ranks first in numerical proportions in the list of morbid conditions whose etiological evolution it is at present possible to fathom or appreciate, consequently we would assign circulatory inability or disability, from mere stasis to complete arrestment of one or other of the circulatory processes to be met with throughout the body in texture or organ, as the principal etiological factor in the production of diseased conditions, locally and generally, and would, in the strongest terms possible, advise that the nature and sequence of the arrestment phenomena in every such case should be traced back to its source, in order that the treatment, directed to removal, should be carried out on strictly rational principles and properly indicated lines, so as to secure, if possible, the renewal of free circulation, and all that depends upon it of health of body and comfort of mind. Circulation in both areas—*i.e.* of ingestion and egestion, or throughout the whole living organism—being essential to and constituting the great physical work and basis of life, is responsive to every impression from within and without that organism of a material character, as well as to every dynamic disturbance within and without by which its highly endowed and sensitive nervation can be in any way influenced; it, therefore, necessitates a continuous and uninterrupted existence, if health is to be maintained in a condition even approaching to perfection, and it goes without saying that science and art, when called upon to treat its faulty behaviour, must endeavour to find where to begin and how to continue the work of rectification.

Should the circulatory “breakdown” be discerned

within the area of ingestion, then the curative agencies to be adopted under the particular circumstances must be chosen, accordingly as the traffic superintendent of a railway system finds out and prescribes the required emergency means in case of disaster in the area under his charge, and if, on the other hand, the "breakdown" be discovered in the latter half of the circulatory area—the egestive—then the curative agencies to be adopted to rectify that circulatory calamity must be chosen from the appropriate category of means adapted to secure its rectification. A true apprehension, therefore, of the general physiological circumstances comprising the whole phenomena involved in and constituting the processes of ingestion and egestion, as well as of the particular circumstances of the cases in question, thus become absolutely necessary, if the means directed to the removal of the primary cause and the rectification of the deranged organic traffic—which here means disease—are to be accomplished with any degree of technical precision or certainty and scientific accuracy.

Although the principles involved in the classification of therapeutic agencies have not been directed on such lines hitherto, we are convinced that the remedial classifications, which have from time to time been adopted, have conformed more and more to circumstances emanating from the grafting of physiological methods and requirements on the parent stem of empiricism and folk medicine, with the growing result that the ultimate goal of scientific accuracy becomes more and more apparent, and its final attainment more and more absolutely possible. According, therefore, to physiological and implied pathological law and necessity, we would primarily thus divide all therapeutic or ameliorative and curative agencies according as they are adapted for use in either ingestion or egestion, or partially in both, and so simplify our still somewhat cumbrous and miscellaneous "materia medica" and associated surgical procedure. This would necessitate the employment of two suitable descriptive terms, for which we would consequently suggest *ingestive*, or ingesto-provocative, and *egestive*, or egesto-provocative, as likely to be more applicable, more easily understood,

and less liable to misconception and misuse than such terms as absorptive and eliminative, secretive and excretive, integrative and disintegrative, anabolic and katabolic, astringent and diluent, etc., and other locally applied incidental adjectives.

A secondary and modifying therapeutic classification would of necessity arise in connection with the dual construction of the nervous system, since agents which are esteemed neuro-medicinal quite differently affect the two systems, the sympathetic and the systemic, and give rise to therapeutic influences entirely determined by the physiological and histological distinctness and independence, as well as by the mutual inter-dependence, functional and structural, of the two systems—the terms for which two classes of therapeutic agencies might be, *neuro-sympathetic* and *neuro-systemic*.

Flowing out of these heterodox views, which we have with some considerable pains, and for a long time, been endeavouring to evolve from the orthodox materials and views which we have possessed, the foregoing therapeutic divisions seem to us to possess the elements of truth, simplicity, and adaptability, although, did time and classical "license" permit, we might do fuller justice to our constructive efforts and the requirements of scientific terminology; be that, however, as it may, to those concerned, we give them for what they are worth, with the utmost confidence that *if found fit they will survive*, but *if unfit their future fate will likewise be fit*.

Involved in, and flowing from, the continuity of the circulatory phenomena of ingestion and egestion is the great principle of *onward progression* of the circulatory material in all its stages, ingestive, nutritive, incorporative, or metabolic, and egestive; stasis or retrogression in either of these resulting in the production of pathological phenomena, in accordance with, and determined by, the nature and incidence of the etiological factors engaged in the evolution of the particular morbid condition. Stasis and regurgitation in the alimentary canal produces its effects in a particular manner and order, mesenteric circulatory stasis and regurgitation its sanguineous circulation, its pulmonary, its nutritive, or its metabolic, and the many

egestive systems theirs, in accordance with the general and particular local conditions involved. It, therefore, becomes a matter of the greatest diagnostic importance to locate the position of the circulatory stasis in order to be able to prescribe suitable means for its removal, and the restoration of the *onward progression* of the circulating ingestive, metabolic, and egestive materials, and the regainment of the physiological circulatory equilibrium. Having *located* the position of the circulatory stasis, it will become possible to indicate a treatment, founded on the recognition of the great principle referred to, with greater scientific precision, and a greater hope of a successful result, than can be possible on lines largely dictated by the results of empirical experience, somewhat in-coördinated observations, and individual manners of deduction.

Every stage of the entire intra-corporeal circulation must, therefore, be "passed in review" as we proceed to discover the flaws in its course, and we feel assured that the labour of the reviewer will be amply repaid by a more or less full and definite appreciation of the morbid influence, or influences, at work in the production, character, and intrinsic nature of the morbid condition, and by the possible—nay probable—discovery of the lines on which that morbid condition can be rectified. On the accomplishment of this absolutely necessary preliminary diagnostic process, with, it is to be hoped, the detection of the site, or sites, of the circulatory derangement, amid the *pan-circulatory* activities of the diseased subject, we shall obtain the possession of a vantage ground from which to view the pathological results effected by the particular disease, to note the sequence of its morbid events, and to see our way—working backwards or forwards from that site, or these sites, as the circumstances of the individual case require—to re-establish the arrested, perverted, or deranged current of morbid circulatory phenomena and contingent altered material conditions, and thereby be enabled to cure or ameliorate the disease in question. Accordingly, therefore, as the morbid phenomena are observable in the ingestive, metabolic, or egestive circulatory areas, we must be prepared to lay our plans for the

conversion of a pathological into a physiological circulatory condition, and to work out, by whatever material and dynamic means can be made serviceable, the benign work of the restoration of the *status quo ante* with what definiteness and precision we can.

Circulatory stasis, or arrest, within the area of ingestion, speaking broadly, must be characterised by phenomena of plasma deprivation or perversion; circulatory stasis, or arrest, within the area of egestion, must, in inverse order and manner, be characterised by accumulation and retention of katabolic or effete matter within that area; while metabolic stasis may be defined as atomic circulatory delay, or nutritive arrestment, within the area of tissue metabolic change and exchange.

These three varieties of circulatory stasis, thus, must give rise to phenomena of arrestment, and forms of disease, differing in intrinsic nature, but resembling each other in manner of occurrence, and requiring for their treatment measures based on their specific differences and resemblances, and their mutual and inter-dependent relationships, due to juxtaposition, and continuity of circulating textures and circulated materials—arrestment in one leading to arrestment in the others, according to the ordinary laws of statics and dynamics, modified by vital and organic influences, the physical character of the circulating media and the circulated materials.

Regarding, as we do, the various circulations comprised within the human body to be but parts of one great and indivisible circulation, beginning with the initial act of ingestion and terminating with the "thousand and one" acts of egestion, it follows that circulatory difficulties and derangements must be followed by local or general effects, in proportion to the intensity, extent, and persistency of these difficulties and derangements, and thus that all disease more or less is produced by, or is associated with, altered physiological circulatory phenomena.

A *great principle*, therefore, is deducible from this manner of viewing the initiation and progress of pathological phenomena, inasmuch as physiological completeness of the circulatory process is the foundation on which health is laid, and without which foundation a pathological

incompleteness, or disease, must exist—the physiological giving place to the pathological circulatory process, health giving place to disease, as cause leads to effect, with the inevitableness of “law and order,” without a break of continuity or breach of sequence of the circulatory chain of movements and events. On this chain of circulatory movements and events, moreover, the whole phenomena of life, healthy and diseased alike, from the cradle to the grave, are grouped in successional order, the one determining the other, as its various links are run out from its opening to its close—once more compelling the expression : *circulatio circulationum omnia circulatio.*

It would be easy to cite here diseases illustrative of the various classes embraced in the orders of ingestive, metabolic, and egestive, but suffice it to say that we have endeavoured to do this, although somewhat irregularly, in the clinical extracts relating to particular or individual diseases. As types, however, of the three orders of disease due to pathological conditions of the three *great* circulatory divisions, ingestive, metabolic, and egestive, we would instance *tabes mesenterica*, gangrene, and leprosy as respectively displaying the attributes of stasis, or arrestment, of circulatory movement, more or less complete, of the materials transmitted through the respective vasculatures. These three typical affections, thus tabulated together, respectively represent circulatory breakdowns within the area of ingestive, metabolic, and egestive distribution, and are characterised respectively by structural phenomena of *deprivation of nutritive pabulum*, *mal- or non-nutritive disposal of tissue protoplasm*, and *retention or non-excretion and non-exfoliation of effete or residual tissue débris.*

The lines of treatment to be followed in such affections must, therefore, naturally follow or flow from an exact appreciation of the etiological factors at work in their evolution, and the ability to adopt the means at present available or at our disposal for effecting the removal of the circulatory stasis and its dependent pathological phenomena, or to supplement these by inventing new or improved means to meet the indications of the particular case, and so to aid the work of placing the knowledge of

disease and its treatment, preventive, curative, and ameliorative, on a more exact and scientific basis.

As bearing on the course of modern research, these deductions, moreover, point to the necessity of our primarily possessing an exact knowledge of the phenomena embraced within *the area of transition* from the physiological to the pathological "state of things," in order clearly to apprehend the order and sequence of the events embraced in such disease processes as are now engaging a large proportion of professional and lay attention, as it would thus seem that many of the problems now being regarded as primary in the causation of these diseases are but secondary, and flowing out of or permitted by those of circulatory stasis, or arrestment. Thus cell mitosis, bacterial invasion, the renewal of developmental phenomena by embryonic "survivals," *et hoc genus omne*, but represent phenomena, due to pauses, more or less long and complete, in some part or other of the universal process of the human corporeal circulation, with the dependent greater or lesser suspension or modification of the work of organic life and the invulnerability of living tissue substance, due to its maintenance at the normal standard by vital activity with the implied power of vital resistance to the attack of pathological influences and agencies—the lapses of which latter constitute the opportunities for the successful initiation and evolution of pathological entities and processes, or disease. The key, therefore, by which to unlock the hiding places of disease generally is an exhaustive knowledge of the phenomena of hindered or arrested circulation within the spheres of influence embraced in the great areas of ingestion, metabolism, and egestion, with all of pathological change permitted or induced thereby.

In the title of this study or extract, we have included, in particular, "the process or manner of disposal of the egesta." We, therefore, in addition to what has been already said on the subject, would make a few further observations. The *egesta* represent the used up and consequently effete and sometimes noxious products of ingestion and metabolism, and begin to collect and to become egestive products on their metabolic or katabolic

disengagement by the individual tissue fabrics ; they may be designed for direct and absolutely immediate discharge from the body, as no longer necessary, or as noxious and hurtful, to the physiological condition, or they may have important duties, mechanical, material, or dynamic, still to perform ere they are finally disposed of as altogether excrementitious or used up materials, whose disengagement and elimination have become absolutely necessary for the maintenance of perfect health. The *egesta* are finally eliminated by the alimentary channel, as more or less solid residuum ; the kidneys, as a fluid in which are dissolved or suspended a large amount of katabolic, saline, and other ingredients ; the lungs, from which is eliminated as vapour or gas a large proportion of the carbonaceous products of chemical reactions ; the olfactory, pituitary, and coccygeal glandulatures, and the skin, from which are eliminated the neural lymph, and exfoliated the results of neuronal growth and axonal extension and denudation. The three first representing the structural displacement and elimination of sympathetic nerve elements—with the exception of what escapes from the systemic into the sympathetic *via* the motor nervature and *rami communicantes*.

If the final acts of elimination, exudation, excretion, and exfoliation of effete matter be absolutely perfect in their performance, then it will follow that a larger proportion of the morbid processes, set in operation by circulatory stasis, will be non-existent, from the effect of obviated pathogenic incidence, by the maintenance of *exit patency* and *free surface denudation*.

If, on the contrary, these final acts of effete material disposal be interrupted by influences sufficient to induce stasis of egestive circulation, then it must likewise inevitably follow that morbid processes will be evolved from these stases in accordance with the anatomical position of the particular stasis and the character of the arrestment phenomena involved by it. Thus, obstruction of the bowel, gravedo, acromegaly, and coccydynia with retention of urine, asphyxia, retained perspiration, and hindered cuticular exfoliation, are produced, and produce arrestment phenomena in accordance with the anatomical arrangements of the circulatory media and the nature of

the circulating material, and entail the evolution of morbid processes exactly in accordance with their respective intrinsic pathogenic conditions and potentialities, neither more nor less. It is needless to say that diseased conditions, due to these stases of egestive circulation, may vary from the slightest and most ephemeral to the gravest and most lasting, as well as immediately fatal.

Besides stasis and arrestment of egestive circulation we necessarily have to deal with phenomena due to perversion and acceleration of that circulation, and, consequently, requiring for their treatment measures of an opposite character, but dictated on the same lines as those applicable to the treatment of the first mentioned, or stasis and arrestment.

The subject of acceleration and perversion of the egestive circulation opens up a very large and much traversed field, to explore which, by the light of these heterodox views, time and opportunity are both necessary. We, therefore, in the meantime, simply content ourselves by "broaching the subject," and calling for it the attention which its importance requires and its clinical adaptability entitles it to, letting it suffice merely to enumerate such typical examples as diarrhœa and cholera, *diabetes mellitus et insipidus*, bronchorrhœa, rhinorrhœa, seborrhœa, and hyperkeratosis, as samples of this aspect of the subject of pathological egestive circulatory rate and character, and diseases whose intrinsic nature may be more fully revealed by inspection in subjection to such light as these views can be made to afford.

EXTRACT III.

HEALTH, DISEASE, AND DEATH.

THESE are biological titles or terms under which we may possibly be able to say something from the point of view created by the views embraced in the preceding pages. Health is a term of the greatest significance to the individual and the community, and, generally speaking, its attainment and retainment have been more or less earnestly sought after by the human race in all ages and in all stages of civilisation.

A *folk medicine* has been practised usually in the first place, from which *professional medicine* has ultimately evolved itself as the progress of civilisation has advanced, the latter emanating from the former as the conditions of society have become more complex and artificial—the purely empirical stage being left behind as accumulating knowledge and the growing necessity for exactitude and a reasoned faith have made themselves felt amid the strife of human progress and the fitful advance of man's intellectual acquirements and ambitions. Health may be described as the condition of wholeness or "haleness" resulting from the faultless working of the entire structures and organs of the body, or from the existence of a bodily condition entirely in accordance with and emanating from the working of physiological law and necessity; any departure from which constitutes a pathological condition or disease. A pathological condition is therefore a departure from the state of health due to the annulment or negation of the state of ease characterising health, and therefore is equal to a condition of *disease*.

And thus death is the complete annulment of life, with what is implied of health and disease and the absolute dissolution or separation of the bonds uniting the material and dynamic entities comprising the living organism.

Health and disease are alike qualifying conditions of life, and are more or less familiar in the experience of every living organism, colouring and affecting its life's progress from inception to close, and terminating only with its death, or dissolution. Both are the outcome of the degree of perfection characterising the working of the various parts of the organism, and the ease or freedom from friction enjoyed in its entire life experience, material, and dynamic, the one or the other predominating according as its organic work accords with the requirements of the organic laws possessed by the particular organism.

EXTRACT IV.

ON THE POPULAR TERM "SICKNESS," AND THE CLASSICAL PHRASE "SICK UNTO DEATH."

THAT the term "sickness" contains a "world of meaning" the human family and all animated nature, at least the most highly organised division of it, fully appreciate, and, stimulated by that appreciation and the fear of what is to follow it, have endeavoured, and are still endeavouring, to find out means whereby it may be mitigated or prevented. In virtue of this continued endeavour, medical science and art have been called into being, and, sustained by the clamancy of the appeal, the individual observations and experiences of succeeding generations have been taken note of and systematised by the predecessors and followers of Æsculapius, and a more or less scientific body of teaching deduced as the solid ground of fact has been touched from time to time until now, when medicine and surgery have reached a stage of development that libraries are required to contain their mere literature.

In the stage at which we now find it, we see arising a belief in the truth of the necessity of means being used, whenever and wherever possible, of preventing the existence of disease and its accompanying sickness, and thus of allowing life to continue and be enjoyed as long as it is possible for the individual organism to survive the natural wear and tear of life, or, in other words, the "natural term of existence." Along this line it seems reasonable to expect that the human race may reach, if not Utopia, at least the goal of the greatest happiness

of the greatest number, and to the most lasting extent.

Sickness is a term evidently of great antiquity, and we should suppose it has existed in a general or more or less concrete form in every language and dialect that has been spoken since Adamic times; moreover, it is likely, notwithstanding the use of every means to extinguish it, to continue to be a well-understood term, if its meaning is only casually realised, until the physical nature of man undergoes a radical change through the elimination of discordant influences and the growth of such as make for perfection.

The term sickness is far-reaching in its meaning, but most indefinite in its true and exact appreciation, inasmuch as every individual man and woman who is asked for a description of it gives a different account of its intrinsic effects upon him or her, and of the character of the phenomena, physical and mental, of which it is composed. Although, therefore, it may be regarded as the first, and more or less ever recurrent, ailment of humanity, in its essence it is less understood than any morbid experience from which it suffers, it would thus seem that we must still wait for a scientifically true estimate of its nature and incidence until the sciences constituting the foundations of descriptive medicine have been placed in the category of the more, if not most, exact.

Meantime, it behoves us, however, to endeavour to form some estimate of what it is, however imperfect, in order that we may be able to prevent or to neutralise its attacks on somewhat more exact lines and principles than those which have hitherto served us. What is it then?

Sickness, bodily, seems to us to be primarily a nervine ailment, and to arise out of, in most cases, a disturbed condition of the non-nervous or sympathetically innervated elements and textures situated, roughly speaking, at and around the epigastric region, where the great automatic ganglionic or sympathetio-systemic nervature reaches its most highly organised and complex functional development, and where the phenomena of *peristalsis* and *anti-peristalsis* radiate from and are maintained for the highest physiological purposes and organic necessities, and any

interference with which is consequently of nothing less than vital importance.

Primarily, therefore, it would seem to be the result of disturbance of a most sensitive neuro-muscular mechanism, one of whose functions is to guard against the entrance of toxic and harmful agencies and influences into the domain of the organic life of the body, by rejecting their intrusion or expediting their removal by a purposive combination of neuro-muscular phenomena. These neuro-muscular phenomena may be experienced in all degrees of intensity, and at times reach an extremity of development inconsistent with the continuance of life, when the literal truth of the classical expression "sick unto death" becomes an accomplished reality.

Viewed thus, sickness is the outcome and effect of the functional working of a great safe-guarding physiological endowment placed at the entrance to the *prima via*, and so it may be regarded as almost altogether salutary in degrees of ordinary intensity, and as a symptom vitally injurious only in those cases of a hyper-exaggerated character.

Situated as it is at and about the first great digestive stage of the alimentary circulation, the safety of the organic life processes beyond it are more or less perfectly secured through it by its directing the avoidance of dangerous articles of diet, and septic material generally, by the excitation of *anti-peristalsis* and, it may be, *peristalsis*, and the consequent rejection or ejection of unsuitable or injurious materials—all this being accomplished, in a reflex manner, through the working of a very complex series of neuro-muscular operations, very faintly controllable by voluntary effort, and, hence, generally successful in their working and in their ultimate object of freeing the gastro-intestinal tube from hostile influences and agents.

The occurrence of the sense of sickness, in its less pronounced degrees, may be, and is often, rationally appreciated and used by civilised man as a criterion of the fitness of what should constitute his "food and drink"; in savage man and the lower animals, however, we often find that their daily regimen in both food and drink is regulated

by a strict adherence to inherited and early experience, which would do credit to the most advanced elaborators of dietetic tables and scales and the firmest adherents to prescribed methods of living—"Once bitten, twice shy" thus proving successful in their rule of life.

The *vis medicatrix natureæ*, utilising the incidence of the sensation of sickness automatically, debars the further supply of alimentary substances, until the effects of the occurrence on which its existence was due have been removed and the *status quo ante* restored, and proceeds gently and gradually to renew the process of alimentation, by first allowing the use of only the most digestible materials in diluted form and small quantity. Art, therefore, whenever it is called upon to interfere in the supplementing of nature's work, if it is to be successful, must carefully copy nature's methods and adopt nature's plans of operation.

It would thus seem that the "forcing" of medicine, or anything else, into an unwilling stomach may not always be justified, nor be successful in the accomplishment of the object of its use, if the excitement of that safeguard—sickness—be its most prominent result and its continual attendant. In such cases the "cure may be really worse than the disease," and the trusting of them a little more to nature may be not only justifiable, but highly beneficial and even curatively successful, besides certainly being more humane to the patient, and, what is not to be despised, agreeable to the "interested onlooker." After professional acquiescence in, it may take a long time to educate lay public opinion into the necessity of recognising, and acting on the truth of, these observations; it will, however, we are convinced, be accomplished as the required scientific knowledge, which is now the possession of the few, becomes the possession, by early and everyday education, of the many.

Although the sensation of sickness is a very recognisable sensation, the scientific realisation and description of its various phenomena become the more difficult as we attempt to focus our indefinite knowledge in an attempt to obtain a clear view of it, and, to some extent, to appreciate its real and true meaning, and, if possible, to

deduce from its teaching some indications for the guidance of those who seek to minister to its relief or to effect its removal.

Being, as we have said, in most cases a physiological expression by the local nervature, epigastric, of a presence of a disturbing influence or influences, generally material, in the stomach, we must look upon the sensation of sickness as a *call* to both the voluntary and involuntary local machinery, nervous and muscular, to "work in unison" for the expulsion or removal of the peccant influence or influences, and to maintain that local feeling of comfort which should at all times prevail in well-disciplined digestive systems and during physiologically sound gastro-hepatic work and operations.

Should the offending influence on which the sensation of sickness is dependent be sufficiently powerful to rouse the gastric nervature into supernormal activity, the phenomena of *anti-peristalsis* may be at once initiated and the offending presence ejected without the interference of the systemic neuro-musculature; such an occurrence, however, in the conscious condition, cannot take place without arousing the latter and bringing into play the combined neuro-muscular machinery of both systems.

In degrees of the more pronounced sensation of sickness, the neuro-muscular storm thus initiated may persist for an indefinite period, to the great discomfort, and sometimes danger, of its subject—in such cases it becomes a matter of supreme importance to have recourse to whatever means will assist in stilling "the troubled waters" and securing the wonted physiological calm. In the severest forms of sickness, induced by improper or poisonous *ingesta*, the disturbance engendered may terminate in death from shock and collapse, or be prolonged into local and general pathological conditions of a temporary or permanent character, which may tax the highest intelligence and the best resources of art and science.

Besides these varieties of locally induced sensations of sickness, some of an entirely reflex and distal character take place when pathological conditions or profound functional disturbances ensue in various parts and organs throughout the system, such as in occlusion of the bowel,

in various cerebral troubles, and in many definite and indefinite, febrile, and other systemic conditions, where they are reflexly felt by the epigastric neuro-muscular structures, with the result that more or less grave and continued functional disturbance is the result. Symptomatically this occurrence is often of value in drawing attention to the presence of, it may be, hitherto unsuspected disease, and of the consequent necessity of special treatment being adopted as soon as its nature becomes unmasked and its true character apprehended.

In this last variety of the sensations of sickness, with, it may be, acute *anti-peristalsis*, the phenomena may occur so suddenly and unexpectedly—"like a bolt from the blue"—that a revelation, sometimes of a startling and grave character, is in store for its unfortunate subject, which may then be read as the second chapter in the history of some dangerous disease, which will, thereafter, prolong itself to the third and even fourth chapters, and then leave the patient invalid for life.

"Sick unto death" is a phrase in which it might at first sight seem that its framer was using the poetic license beyond the limits warranted by strict adherence to truth. This, however, we are convinced, is not so, as in these exceptional cases which prove the rule, the sensation of sickness is so persistent and overpowering, and so unattended by other disease, as literally to necessitate the use of the phrase. What is embraced in the symptoms of sickness and the disease "sick unto death" constitutes the largest proportion of physical human misery, the principal *raison d'être* of the medical profession, and a fulcrum by which the compassionate instincts of humanity are raised into helpful activity for the benefit of the race, as well as that of all the lower races of animated existence liable to such infirmities. The sensation of sickness, when physiologically analysed, is found to consist of the more or less violent excitation and dynamic disturbance and exhaustion of the gastric, and the associated sympathetic and systemic nervatures embraced within what might be called the sympathetico-systemic "head centre," where the functions of digestion begin and radiate from, and, consequently, where shock acts on lines more or less

parallel with those which obtain in the incidence of such influences in central nerve areas and in the brain itself. Thus, shock, traumatic or toxic, external or internal, may so profoundly affect and depress the epigastric nervature as to deplete it of nerve energy, and thereby paralyse the organs directly dependent for innervation upon it, as well as those, such as the cardio-pulmonary immediately, and others more remotely, related to it. The lethal effects of shock here are so immediate and profound, and the sensation of sickness is so short as not to be consciously realisable, therefore it can only be in cases of minor degree where the sensation of sickness is consciously appreciated by its subject—complete paralysis preventing, and partial paralysis allowing, appreciation in the respective instances, according to the degree of intensity of causation.

The sensation of sickness being a physiological manifestation of the incidence of nervine disturbance, whereby impressions are made on the local epigastric nervature for ordinary organic purposes, and on the sensorium for extraordinary or systemic purposes, we must regard it as a nervine function normally exercised for maintaining the life and health of the body, but capable of explosive displays or neural breakdowns incompatible with the maintenance of health or even the continuance of life.

The comparative unprotectedness of the epigastric neural structures lays them open to many traumatic interferences from which the central nerve structures are exempt, and hence to a wide range of morbid conditions of a transitory and more or less persistent type from which the central nervous system is almost entirely exempt on account of its anatomical position and remoteness from external contact and consequent liability to lethal impressions.

Sickness may be described as an exaggerated form of what is usually a sympathetic or sub-conscious sensation, intelligible, so to speak, only to the sympathetic nervature, and used as a guide by that system in its direction of the organic work of the body, and is continuous, on the one hand, with the absolutely unconscious sympathetic innervation, and with conscious systemic cerebration and innervation, on the other. In this respect it may be

classified with such sensations as those of hunger, thirst, and pain, and be regarded as possessed of a functional and material value as a regulative influence in the organic execution of the affairs of life and health, happiness, and misery.

EXTRACT V.

THE SYSTEMIC NERVOUS SYSTEM, IN ITS RELATION
TO THE INCIDENCE OF DISEASE GENERALLY, AND
THE MANNER OF EVOLUTION OF ITS VARIOUS
DISEASES.

THE systemic nervous system is, primarily, liable to attack by a very large number of diseases, and, secondarily, to affections invading or spreading to it from the so-called non-nervous structures and fluids with which it is interpenetrated and surrounded.

The primary affections may attack the cerebro-spinal lymph, the neural envelopes or peripheral non-nervine elements of that system, or they may, through and from these, invade and involve the true nerve elements which they contain, and in many cases these affections may involve the whole structural elements, nervine and non-nervine, of which the systemic nervous system is composed, the juxtaposition and continuity of these elements securing a universal involvement of the nervous system, and, in certain cases, secondary implication of the interpenetrating and neighbouring non-nervine elements of the affected organism.

Each of the diseases included in the long list of purely nervine diseases is characterised by an individuality, the outcome of the nature of the *materies morbi*, the neural element or elements attacked, and the sequence of the morbid changes involved in the pathological process. Thus, an attack of influenza may primarily involve the cerebro-spinal lymph, the totality of which it may zymotically affect, and, everything being favourable, may pass

out of it without "leaving a trace behind" to mark its passage, but, if not inducing secondary diseases of a more or less fatal character and persistent nature, which leave a wreckage, it may be of a permanent kind.

In like manner such diseases as the following primarily incubate in the cerebro-spinal lymph, and, secondarily, affect its surrounding, containing and contained, textures, viz. Variola, vaccinia, varicella, scarlatina, measles, cerebro-spinal meningitis, trypanosomiasis, rheumatic fever, eczema, a great proportion of the non-febrile cutaneous eruptive affections, at least those of an internal microbic origin, as well as many less definite or anomalous and ephemeral affections, which "come and go" comparatively unnoticed.

These may be looked upon as types of bacterial disease whose habitat is primarily the cerebro-spinal lymph. Another class, however, may find an entrance to the true nervine structures from this medium, of which we may enumerate such affections as plumbism, arsenical neuritis, alcoholic neuritis, and beri-beri, with those cases of chemico-physical origin whose manner and method of attack and spread are still enrap in great obscurity.

The meningeo-neurilemmar structures are liable to attack by their own specific ailments, as well as indirectly by those of their contained fluid, while in like manner the true nervine structures are affected by their own intrinsic diseases, as well as indirectly by those of their surrounding and enclosing fluid, and outer solid or organised envelopes.

The diseases, therefore, which affect the nervous system partake more or less of the pathological characters of these three elementary structural constituents, in varying proportions according to the nature of the *materies morbi*, its manner and method of attack, and the evolution of the morbid phenomena constituting the various diseased conditions. Thus one, two, or all three, may be implicated in the same disease, each of which may leave its pathological impression individually or conjointly in the features of the particular disease, and the sequence of its symptoms in its evolution as well as involution.

The nervous system may, from the foregoing remarks,

be regarded as peculiarly liable to infection by bacterial organisms and to entrance by certain inorganic substances, and to the subsequent manifestation of pathological phenomena, as these pathogenic presences or factors exercise their baneful influence along their specific lines, by writing, so to speak, their individual names and characters on the nervine and surrounding textures. Its intimate and structural relationship with every organic element of the body, and its exposure to invasion from outward or external, as well as internal, pathogenic agencies, render it peculiarly and constantly liable to attack, while both its material and dynamic work or functions cause it to exercise a powerful pathological influence on its non-nervine or containing structures.

An analysis of the vascular elements of the skin, we think, will reveal that the nervous system must be fundamentally concerned in every, or almost every, eruptive disease to which that structure is liable, as we have contended is the case in our study of the phenomena displayed in vaccinia and vaccination.

Constituting the proper fibro-cellulo-vascular substance of the *cutis vera*, we recognise the presence of three well-defined vascular systems, each of which, on account of its vascularity, takes part in the cutaneous circulatory phenomena in its individual capacity, as a vehicular agent in the economy of nutrition, excretion, or imbibition. These three vascular systems are respectively concerned in the circulation of the blood, hæmal lymph, and neural lymph, and are consequently engaged in their individual capacities in conveying the nutritive plasma to the *cutis vera*, the collection and return of the hæmal or resultant lymph from the nourished *cutis vera*, and the conveyance to and discharge of neural lymph, as well as effete proper nerve substance, from the surface of the skin in the form of vapour, sweat, and epidermic *débris*.

In the division of functional work here indicated, we see that the nervature of the skin alone, or almost alone, is responsible for the discharge of effete materials from the outer surface of the body, and, therefore, since all eruptions represent a discharge of substance from within the body, it must follow that the nerve vasculature must be

the discharging agent, responsible for the conveyance of the material from the place of its production within the body and its consignment to the proper delivery agencies within the outermost layers of the cuticular envelope of the body, inasmuch as the circulation of the blood is constantly onward and forward, round and round, without break in its physiological state, and inasmuch as the hæmal lymphatic circulation is from without inwards, and consequently away from the scene of eruption or excretion.

We thus eliminate from the category of eruptive factors, except in certain purpuric and other eruptions of a kindred character, where manifestly the blood circulation is primarily implicated, or where, at any rate, it contributes more or less of its corpuscular or hæmoglobin elements to the substance and pigmentation of the eruption. In *variola hæmorrhagica* we have contended that the blood circulation is secondarily invaded from the area of nervine eruption by the breaking down of the interstitial cutaneous elements and the commingling of the toxic and atoxic circulatory media, and consequent re-infection of the affected person by way of the blood circulation.

The substances erupted or thrown out of the system by the nervine excretory agencies must necessarily be modified by the nature of the *materies morbi*, on the one hand, and the particular nervine elements affected by the particular eruptive disease, on the other; thus a *herpes* may alone involve the cerebro-spinal lymph, and may begin and end with mere vesiculation at the points of exit of the tainted fluid, or an attack of hyperkeratosis in like manner may be characterised by the eruption or excretion of the true nervine elements, or the medullary and axis cylinder substances, which undergo encrustation and agglutinative changes in virtue of the coagulation of these substances on exposure to the air; in like manner also eruptions may vary in character in accordance with the nature of the material erupted, as to whether it is one or the other, or a compound of the two, and whether the eruption is lethal enough to disorganise the interstitial connective elements and surrounding cutaneous textures and vasculatures, in which latter case the eruption becomes

a wholesale and compound exfoliation or shedding of the entire external dermal and epidermal matrix.

All such morbid cutaneous phenomena, like all other morbid phenomena, must, therefore, be regarded as naturally determined by anatomical and histological conditions, and physiological hydrostatics and dynamics, so to speak, of a constant and consistent character, and hence requiring a therapeutic and other treatment based on such foundations and directed by a strictly scientific use of the laws deducible from them by pathologists and clinicians. Thus alone is it possible to place the almost entirely empirical fabric of dermatological therapeutics on a sound basis, where its practical bearings can be directed on lines capable of leading it into the haven of something akin to, if not entirely accordant with, exact science.

All that has been stated above applies to the sensory neural aspect and to the afferent, peripheral, or cutaneous terminal nervature; we, therefore, to complete this study, have still to dispose of the efferent or motor nervature, and the *nervi communicantes* to the sympathetic.

The efferent or motor aspect of the systemic nervous system has an equal or equivalent terminal distribution throughout the voluntary musculature with the afferent in its distribution to the skin, and is affected on the same lines as determine the incidence of the morbid affections of the latter, the difference in or between the two categories of affections—viz. the sensory and motor—being due to their different anatomical and histological terminal structural conditions. The principal difference, therefore, being due to the fact that the sensory nervature sheds itself finally *from* the periphery of the body, while the motor nervature sheds itself *into* the voluntary musculature, and, by histological continuity along the tendons and their sheaths, into the periosteal structures, the joints, the proper osseous matrix of the skeleton, the medullary substance of its hollow bones, and the systemic lymphatic spaces generally of the cancellous osseous tissues.

This absolutely different manner of disposal of residual efferent nerve plasma, in its continual nutritional distribution to the musculature and skeleton, entails a correspondingly different character and incidence in the

occurrence of the diseases to which the motor nervature and musculo-osseous structures are liable; besides, it introduces into the non-nervous structures, with which these latter are anatomically related, the secondary products of nervine diseases, which, in turn, constitute a pathogenic array of the most formidable order, and one, the prophylaxis of which must be sought for on all occasions, while the far-reaching process of morbid causation is still in embryo.

As types of efferent or motor nerve disease, we may allude to rheumatism and myopathy—the first, it may be, positively involving the whole neuro-musculo-osseous economy, the latter passively leading to negative pathological results and complete atrophy of a part or of the whole of the voluntary musculature.

Typical rheumatism, acute, subacute, and chronic, covers a very large clinical area, and no doubt in its causation may and must be due to a variety of pathogenic influences; suffice it, however, here to say that in many cases it is of undoubted microbic origin, in which cases the microbe effects an entrance into the incubatory medium of the cerebro-spinal lymph, where it multiplies, and finally invades the motor intermeningeo-neurilemmar spaces, along which it finds its way into the histologically continuous intra-sarcolemmar spaces, where the lethal effects of its presence at once become manifest in the functional disability of the implicated musculature, the generation of local sub-inflammatory phenomena, and more or less pronounced pyrexia—these phenomena being due to the presence of the microbe, with its *trail* or *train* of toxin, formic acid, etc., amid structural surroundings of a highly organised and functionated character. Should the zymosis end here by retrogression and peripheral excretion of the tainted cerebro-spinal lymph, convalescence may quickly follow, but if progress of the microbe be uninterrupted, the invasion, piecemeal, of the whole musculo-skeletal structures inevitably follows, in which case the disease presence affects in turn the whole lymph vasculature, neural and hæmal, with their contained fluids, and secondarily the blood itself, with the whole non-neural textures to which it is distributed—thus we see what is at first a

local nerve bacterial invasion progress along the lines of least resistance within the body, until the whole has been literally *leavened* by the fell bacterial organisms. The sequence, therefore, of the evolution of the symptomatology of acute rheumatism may thus be traced and read along the lines here indicated, as the stages of invasion and occupancy are accomplished, until the entire corporeal commonwealth is overrun and subdued, when we see the "conquering host" victorious, waiting the *vis medicatrix natureæ*, it may be, with its allies, science and art, once more to assert itself, and clear the affected domain of its foreign occupants and obnoxious toxic impedimenta. It might here be remarked that, in the most typical cases of acute rheumatism, the *materies morbi* is most probably telluric in origin, and that it effects an entrance into the lymph spaces surrounding the nervous system by aërial convection and contact with the escaping perspiration and transpiration, and zymotic genetic progress or zymosis thereafter, along the layers of that fluid, as they flow out of the cerebro-spinal cavity into the inner recesses of the central nervous system. Microbes, of the character here indicated, may be supposed to *abound* more or less everywhere on the earth's surface at all times, and to be constantly on the alert for a suitable "breeding place"; it, therefore, but requires to be presented to be accepted and utilised. Insect plagues are more or less the constant companions of man and animals; it is, therefore, not to be wondered at that these insect plagues are accompanied, and preyed upon, by smaller insect plagues, and so on *ad infinitum*, or until the absolutely smallest living organism closes the *biological scene*. In this light we have not far to seek for the reason of the evolution of formic acid in this insect and bacterial struggle.

It is most interesting, besides instructive, to trace the "waxing and waning" of the toxic and antitoxic struggle, embraced in an attack of, and recovery from, acute rheumatism, and to mark the occurrence of what are called complications—cardiac and others—as the disease runs its course along the anatomical and histological lines traversed by the ordinary physiological media in the course of their meeting the daily healthy requirements of the human

organism. Thus rheumatic invasion may occur in some cases of the disease, generally or locally, along the sudoriferous channels *from the outer world* in a very brief period of time, after which, when zymosis of the cerebro-spinal lymph has been more or less completely effected, the phenomena of local or general neuro-muscular involvement, joint affection, and visceral disease begin to evolve themselves, as the *materies morbi* spreads along the lines of least resistance into the physiologically sound areas of texture and organ. The peculiar liability of the heart to the incidence of rheumatic affection thus becomes at once apparent, when we consider that the principal source of its innervation is the pneumogastric nerve, a nerve anatomically well, indeed ideally, suited to receive and convey the toxic agent from the cerebro-spinal cavity, or incubating chamber, to its muscular, epithelial, and endothelial terminally connected textures, the common and synchronous presence of certain bacterial organisms in the central nervous system and the organs and textures innervated by it, generally and locally, thus receiving an easy, as well as a scientific, explanation.

The phenomena of *metastasis*, which are peculiarly liable to be experienced in rheumatism, are also explicable by the forward or backward movements of the microbe-laden cerebro-spinal lymph, as they are determined by intrinsic and extrinsic local or general systemic influences, acting by physiological hydrostatics and dynamics along the most patent available inter-spaces and vasculatures. Thus a regurgitative movement of infected cerebro-spinal fluid may take place from a part or the whole of the voluntary musculature into the cerebro-spinal cavity, when the central nervous system may be so profoundly narcotised as soon to be affected by unconsciousness and coma, or it may happen, in non-fatal cases, where the sensory nervine outlets are available for the work of excretion of the toxic lymph, that a clearance of the diseased area is effected by profuse *diaphoresis*, it may be, aided by artificial neutralisation of the prevailing toxis, and timely assistance to the narcotised and failing nervature.

Myopathy is a nervine affection of what may be called

a negative character, *i.e.* an affection arising out of a failure in the supply of nerve protoplasm to some or all of the voluntary muscles, and a consequent atrophy of these structures; this failure, of course, may arise primarily in the neuronal or cell economy of a part or the whole of the motor areas, in obliteration of the axonal processes of the various neurons from which the neuro-sarcous elements are derived, in a breakdown of the end-plate structures of the motor nervature involved, or in the inability of the affected musculature to take advantage of the proffered neural protoplasm—but from whatever of these causes the affection proceeds, or arises, the result is the same, sarcous atrophy or myopathy.

The *nervi communicantes*, proceeding from the central nervous system, to join and to supplement, or reinforce, the sympathetic system, seem to establish or set up a “buffer” or mixed system of innervation, partaking of the characters of both systems, and, therefore, subject to invasion from diseased conditions or *materies morbi* from both, which diseased conditions are necessarily coloured or conditioned, so to speak, by the proportion in time, intensity, and extent of the prevalence of the disease, and whether it is contributed by the one or the other system in a greater or lesser proportion. This ganglionic or mixed system of nervine structures, being enterable from both the systemic and sympathetic nervatures proper, is, therefore, subject to diseases commencing in either or both the neural or hæmal elements, and may free itself from them by elimination of their diseased products, through either or both systems, along their respective excretory vasculatures, and through the exits provided for the completion of that function—hence, therapeutic assistance can be directed along one or both or on mixed lines, according to the character of the particular morbid condition and the indications afforded. In this *debatable* field of innervation, moreover, will be found the favourite *locale* for the origin of much of the neoplastic structural new growth to be met with throughout the human organism. In this field unite the neural and hæmal tissue elements; here blend the formative energies of two systems of innervation, or, it may be, two divisional areas of one innervation, which,

conjointly, take part locally in the manipulation of both nutritive pabulum and effete or excrementitious materials; here, in short, are provided both the material and dynamic conditions and formative materials for the production, figuratively speaking, of a "kirk or a mill," and it will, therefore, depend on the nature of the blending of the materials, and the play of the mixed formative energies, what formative results may be attained under the modifying influences of the systemic hygiene and the operation of the *vis medicatrix naturæ*.

EXTRACT VI. A.

ON THE INCIDENCE AND DEVELOPMENT OF CYSTIC GROWTHS, TUMOURS, AND NEOPLASMS, AS RELATED TO ARRESTED AND IMPEDED CIRCULATION AND EXCRETION.

As a general principle in the initiation, and incidence, of cystic tumours we would recognise the occurrence of stasis within the vascular media engaged in circulating the various fluids of those structures, or parts, of the body in which they occur, the consequent accumulation of those fluids within the *lumina* of their vessels, the also consequent ballooning of these vessels, the inspissation of their contained fluids, the quasi-organisation of the resultant *residua*, their pseudo-material histological amalgamation or blending with the surrounding textures, and the continued or further progress of the pathological processes thus established along the lines of tissue strata of least resistance, and of greatest plasmic supply and re-formative and mal-formative energy.

While this generalisation applies to cystic tumours generally, it applies with perhaps greatest force to the incidence of those tumours which are found related to the excretory mechanisms of the cerebro-spinal fluid, and of gland ducts generally ; thus a "definite range" of tumours, cystic and others, range themselves at, and around, the great as well as the small neural lymph emunctories and gland exits generally, claiming as their initial cause the arrestment of lymph circulating matter or fluid excretion, and the establishment of consequent pathological changes, which culminate in the production of new structural arrangements, tumours composed of retained effete

materials, and ultimately of foreign bodies. All ducts are peculiarly liable to such occurrences, but the same principle also applies to the initiation and incidence of many tumours in tissues and organs, apart from ducts, and in such cases it will be found, on histological and anatomical analysis, that the pathological changes involved arise from circulatory stasis in one, more, or all of the circulations of the affected parts, *i.e.* in any of the three circulations, the blood, the lymph, or the proper neural substance, such as may be seen, for instance, in aneurysm, *localised* œdema and neuroma, in each of which the arrest of circulation, or stasis, respectively, of the blood, the lymph, or the neural medullary substance constitutes the starting point of the pathological changes involved. In advanced cases of any of these diseases, stasis of one or other of these circulations leads to stasis of another, until frequently a general stasis of all ensues, with complete arrestment and gangrene. Small arrestive causes may, therefore, in time produce wholesale pathological arrestive effects, and so are liable to be overlooked in the final assignment of responsibility in the ante- and post-mortem summing up. Flowing out of stasis in structures where the vascular walls are to any degree permeable by the arrested circulatory materials, or where those walls rupture and permit wholesale escape of their contents, thickening, consolidation, and pseudo-organisation ensue in the inter-vascular and inter-histological spaces, and a general matting or tumour essence is the result, which may overwhelm and modify both the original structural features of the implicated parts, as well as any preceding pathological conditions effected by the earlier stages of endo- and peri-vascular morbid change. Stasis of circulation in vasculatures when collateral channels are easily reached and utilised by the circulatory agencies is, therefore, less liable to occur than in those vasculatures in which the circulatory channels do not anastomose, so that the systemic nervine circulations are peculiarly liable to suffer from the effects of stasis, inasmuch as each neuronal unit of circulation is bounded by its individual unbranching, encircling structures, and hence is incapable of overcoming stasis of its contents, save in one of two directions, *viz.* forwards or backwards, and

backward movement being prevented by the nodes of Ranvier, the arrested circulating material, if not moved forward, must collect and balloon the *lumina* of the neural channels involved, and hence cause such pathological phenomena as neuroma, which we have elsewhere contended is due to arrest, accumulation, inspissation, and pseudo-organisation of the white substance of Schwann.

While we thus claim stasis of neural circulation as one of its specific series of vascular channels, arrest of the forward and backward movement of the substance known by the above name, with accompanying inspissation, sub-organisation, and localisation of the accumulating mass as a type of cystic tumour of neural origin, we would claim that the operation of kindred circulatory conditions, material and dynamic, and the action of like pathological factors, must result in the evolution of kindred morbid states, organic and functional. The phenomena, physiological and pathological, due to vascular circulatory stasis must depend in character to a very great extent on whether the arrested material is potentially formative and nutritive, or has lost its nutritive components and qualities and is on the downgrade of vital change, or become actually effete; thus the character of the tumour or new growth, and the physiologico-pathological *régime* set up by the circulatory stasis will necessarily be determined by the amount of vital change already undergone by the arrested material, and the nature of the histological elements amid which the arrest has taken place, as to whether they formatively lend themselves, so to speak, to further vital change, physiological or pathological, or at once break down from material inability or dynamic exhaustion, and cease further to maintain the continuity of vital change. Circulatory stasis may be complete or partial, and, therefore, may lead to very different pathological results, ranging from complete destruction and disappearance, or wholesale accumulation of the circulatory materials, and their formative re-arrangement amid the surrounding tissue elements, to the slightest mechanical interference with the process of organic change and functional activity or vital capacity: it may also be local or general, and produce effects from the most minute and transitory to the most general and persistent. Cir-

culatory stasis may thus be said under such circumstances to initiate the process of the formation of new growths and strange tissue formations by the suspension of the normal process of physiological growth and the substitution of an abnormal or pathological growth, in virtue of the retained material and unexhausted formative energies being re-directed along abnormal lines, and determined as to result by the survival of the strongest formative energies and the most abundant formative materials as factors in the morbid processes set up. Tumours thus initiated and determined, if detected before they become invaded by the elements of malignancy, are amenable to treatment, as clinical records abundantly prove; it, therefore, behoves the science of the subject to assist in every way possible rightly to direct the application of the art of the subject.

The quality of malignancy, so often acquired by such pathological developments, may be said to be determined and precipitated by environment and pre-disposition, and may, by anticipative preparation of the threatened or susceptible subject, be averted or prevented by the elimination of exciting causes, whether these be material or dynamic, structural, bacterial, or chemical. Malignancy being a quality superadded to an already pathologically acquired and determined mode of growth, it follows that the absolute removal of such pathological structural elements will prevent the occurrence of malignancy, besides it will follow that thus is obtained a systemic condition suitable for the maintenance of an absolutely hygienic physiological *régime* around and in the pathological area, which will ensure immunity from future malignant attack and occupancy, and enable the subject to live out life to its legitimate close, all other physiological requirements being present. As stasis of circulation so often initiates and determines the development of pathological conditions, it must follow that in all such cases the reasonable and logical procedure, curative and ameliorative, to be adopted must be chosen with a view to meet the clinical necessities created by such causation. In short, to make clear and patent the devious obstructed circulatory ways is what is indicated, and how, and by what means, this end is to be achieved must be determined by the character and

extent of the pathological changes already effected, the ability of the subject to "respond" to the application of the necessary means, medicinal or surgical, and the range of "choice of means" available in each particular case. Thus in stasis, or overcomable obstruction, of alimentary circulation of opposed renal and vesical outflow of hindered pulmonary expectoration and cutaneous excretion the therapeutic means to be chosen are aperients, diuretics, expectorants, and diaphoretics respectively, classes of remedies first determined and set aside for regular use by the progenitors of Æsculapius and Hippocrates, many of which still continue to afford an almost unimpaired satisfaction to the latest exponents of scientific medicine.

Stasis of blood, lymph, and neural circulation within definite portions of their individual vasculatures, individually and combined, represents a much more complex problem, or series of problems, in pathologico-biological physics (statics and dynamics), and requires the use of a much larger series of medicinal agencies, as well as (it may be) assistance from whatever mechanical and materio-dynamic means which can be brought to bear in their clinical solution. Massage and other mechanical contrivances for the breaking down of intra- and extra-vascular inspissated and pseudo-organised arrested material, the promotion of renewed circulation, proper or direct and collateral, and the maintenance of the regained physiological *régime* by whatever can conduce to its permanency, are all here indicated. But if, unhappily, pathological changes have so affected the original vasculatures as to render their renewed functional activity impossible, then the character of the means to adopt to meet the clinical requirements becomes still more modified and problematical, until a limit is reached, when the "relief of symptoms" is all that can be achieved or even attempted by the most heroic treatment.

All which but proves, pathologically and clinically, the truth of the *physiological* finding: *circulatio circulationum omnia circulatio*, and that, without it, vitality, local as well as general, is impossible, physiologically and pathologically alike.

Within the apparently almost homogeneous structures

of the body we must, therefore, find, as a result of the universality of circulation, that the occurrence of stasis, or arrest of the continuously moving materials of which they are composed and by which they are inter-penetrated, is the starting point of structural change, and that the new formative procedure so initiated is finally dependent on the survival of the fittest amongst the struggling physiological and pathological factors, material and dynamic, the new growth or neoplasm so begotten affecting the health and the length of life of its host, in accordance with its specific character as to anatomical position and relationship to innocence or malignancy, and to the resisting powers of that host.

Circulatory stasis, or arrest, from the pathological point of view, may be regarded as proceeding primarily from a change in the physical consistence of the material circulating, due, it may be, to the effect of material or dynamic causes, or the occurrence of obstructive conditions in the circulating vasculature or tissue inter-spaces, through which the phenomena of nutrition are effected and the stages of formative activity determined and regulated, morphologically and functionally, and both physiologically and pathologically.

A body, mobile in mass and in molecule, and continually changing under the influence of vital and other energies its physical and chemical constituents in certain vitally determined directions, must necessarily be subject to the disturbing influences, material and dynamic, flowing out of its subjectivity to the laws of matter and energy, and, consequently, must be liable to the modifying influence of every change, material and dynamic, which impresses it, and as these changes are innumerable, and to be "met with at every turn," a special prohibitive and rectifying force is self-produced in every organism, by which the disastrous effects of these changes are neutralised, called the *vis medicatrix nature*.

This power it is which renders the continuance of life possible to the extent that it is, and which, under pathological conditions, enables the affected organism to throw them off and to renew the *status quo ante*, or the reign of physiological law and order; a study, therefore, of this power, and the manners and methods of its beneficent

procedure, becomes a matter of paramount necessity if we would seek to aid it in its continual attempts at curing disease and healing the injuries to which humanity is subject.

We would, therefore, hazard a brief contribution to its study as it seems to manifest itself in the removal of circulatory stasis, and the pathological effects due to it. Thus, in simple stasis of the blood circulation, a simple appeal to the vaso-motor nervature may be sufficient to effect its removal, by altering the *lumina* of the affected vessels, in lymphatic stasis the *vis medicatrix* may be exerted both *a fronte* and *a tergo*, while in neural stasis it may operate variously, but especially *a tergo*, according to which of the nervine circulations is the seat of stasis. If the stasis, however, be more than simple, and if consolidation and pseudo-organisation have ensued in the elements intra- and extra-vascular, the *vis medicatrix* proceeds to break down or disintegrate, to move on, and to cause absorption of arrested and effused material, to unlock the closed vasculatures and to re-start the arrested circulation by means of molecular disturbance and movement, cell activity, leucocytic and phagocytic, lymphogenesis and vascular absorption, hæmal and lymphatic, the clearing of the intra-vascular channels and the restoration of the circulatory activities of the implicated vasculatures, hæmal, lymphatic, and neural. All which procedures indicate that if we are to render scientific and practical assistance in the process of cure, we must seek for inspiration and guidance by an appreciation of what nature has got to do in it, and how she is doing her work.

For example, if she is breaking down adhesions and obstructions, we must assist her mechanically and otherwise to do it, if she is trying to remove *débris*, we must help her surgically and medically so far as we can, and if she is engaged in the work of regeneration and repair, then we must remove conditions inimical to her procedure and supply others which will conduce to a successful issue to her beneficent efforts. If there be perforation, rupture, effusion, or exudation, superadded to, or consequent on, stasis, then art and science may both be brought to bear in the securing of a favourable issue.

The symptomatology of circulatory stasis must vary

according to the structural character of the part or parts affected, the vasculatures implicated, and the degree and extent of the pathological changes effected; but in most are displayed, to some degree, the classic or Celsian tumour or swelling, and, it may be, *dolor*, or pain, with a varying number of other subjective signs determined by the mechanical and other effects of the pathological changes produced, locally and generally. The character and amount of the swelling varies indefinitely, usually within certain structural visceral limits, but is always the most pathognomonic symptom, as it has been the one which has given rise to the generic name of tumour. Pain is also a very variable quantity, as observed in the origin and progress of tumours, and is evoked very often by merely mechanical causes, such as pressure on and stretching of nerve structures, or by direct implication of these in the matrix of the tumour, with stasis of the nervine circulations, complete or partial. The character of the pain is somewhat tell-tale, however, and sometimes very plainly reveals what structures are implicated directly in the pathological process, and what parts are indirectly or reflexly involved in the neural nexus amid *pain* "storms"; the sympathetic nervature from this point of view yielding information, more especially from distant *internal parts*, of the most valuable character to the diagnostician. Moreover, pains emanating distinctly from the systemic nervous system are usually strangely contrasted to those of the purely sympathetic or the mixed or dual class, and proclaim themselves, as a rule, within the matrix of the cutaneous envelope of the body, being referred to or realised at some portion or portions of that structure by the sensorium. Besides, it is found that a *series of sensations*, varying from a desire to sneeze, through the many degrees of pruritus to acute pain, are found to locate themselves with the precision of cause and effect at and around the areas engaged in the function of cerebro-spinal lymph excretion, *i.e.* in the Schneiderian mucosa, in the pharyngeal mucosa, in the peri- and endo-anal structures, and at the orifices of the individual and grouped sweat glands, or in reality wherever that fluid is eliminated from the body.

Stases, therefore, of all degrees in the vasculatures and circulatory inter-spaces, from the largest to the most minute known to anatomy and histology, are the causes of pathological conditions ranging from definite structural new formations or neoplasms to the most minute and ephemeral arrestive circulatory phenomena.

The occurrence of circulatory stasis, strictly speaking, must apply to, and can only take place, where circulation exists, *i.e.* usually along definite lines or in the vasculatures and tissue inter-spaces, in other words, in the canals, ducts, vessels, and inter-communicating channels, where the alimentary, the hæmal, the lymph, and the neural materials are conveyed to their respective destinations; it must, at the same time, be recognised that the cells, to which these vasculatures convey their contained materials, and from which they again receive them, must of necessity suffer in some degree from the incidence of the same biological statics and dynamics in their reception, intra-cellular disposal, and return of these materials. It must, therefore, follow that cell circulatory stasis must also be regarded as a causative influence in the incidence of those diseases due to the arrest of movement of the materials concerned in the vital processes of metabolism and physiological hygiene. A cell or a group of cells may thus be the centre or the point from which many of the diseases referred to are to be traced, and, consequently, may, if discoverable, be made the stepping stones to the obtainment of indications for successful treatment.

Circulatory stasis, therefore, however minute or limited, if associated with perturbed formative physiological activity, may lead by pathological continuity to the production of new growths and strange forms of tissue evolution, both innocent and malignant, without, in the first instance, the presence of other than normal conditions and physiological influences, these latter changing by degrees into pathological by regular and continuous formative sequence—the same physiological materio-dynamic expenditure, as dispensed by pathological means, ultimately leading to the production of foreign and alien results.

EXTRACT VI. B.

ON DISEASED CONDITIONS, ARISING FROM MECHANICAL INTERFERENCE WITH THE INTEGRITY OF THE INTER-MENINGEAL AND INTRA-CEREBRO-SPINAL SPACES.

IN the normal condition of these inter- and intra-spaces a continuity of *lumen* is maintained, by which the gross quantity of cerebro-spinal fluid is secured and maintained in proportion suitable for the internal support and external protection of the central nervous structures, and for keeping open a means whereby its circulation is secured from end to end of the brain and cord; and that the quantity of fluid can be increased and diminished indicates the existence of means of escape and of entrance to the canal; but as we have elsewhere described these means, we merely recall that a choice of exits is provided, whereby local and general intra-pressure can be lessened and also increased, according to the exigencies of intra- and extra-cerebro-spinal hydrostatics.

In certain pathological conditions, these facilities for the equalisation of intra-cerebro-spinal pressure become non-operative, and such untoward diseases arise in consequence as acephalism, hydro-cephalism—the former during foetal life, the latter also then, but more especially in early post-natal life—*hydro-myelia* and *syringo-myelia*—the last-mentioned usually in adult or advanced life.

Acephalism usually arises from preceding hydrocephalic conditions, rupture of the surrounding, or cortical, and non-nervine cephalic structures, and escape of contents, with shrinkage of the brain substance, but does not necessarily interfere with the growth of the body;

hydro-cephalism results from non-escape and consequent accumulation, or from over-production, of cerebro-spinal fluid, with consequent cortico-cerebral ballooning and over-development of the cranium to meet the increased skeletal requirements of the condition.

To a certain extent *hydro-myelia* may be said to consist of like increase of fluid in the central canal of the cord, and to represent a mechanical distension of its *lumen*, with mechanical interference with its nutrition and functional powers, which may ultimately assume proportions incompatible with the maintenance of life; it is also conceivable that it may precede and initiate the condition known as *syringo-myelia*, in which case the over-distended central canal limiting structures finally give way, and allow the surrounding neuroglial elements of the cord to be inundated with the imprisoned cerebro-spinal fluid, and to be thereby disintegrated and finally washed out of it, reducing it to the condition of a hollow tube, bereft of the nutritive plasma whereby the spinal neurons are enabled to live, and of the physical supports to which they have been accustomed to attach themselves, until they perish from inanition and mechanical disturbance.

In cases of *syringo-myelia* not preceded by *hydro-myelia*, we may infer that the endothelial lining of the central canal suffers a solution of continuity from some intrusive cause and fails to resist the insinuation of the cerebro-spinal fluid, with the attendant vital and mechanical changes, due to admixture of a more or less toxic medium with the neuronal pabulum, and the incidence of nervine changes, due to the destructive progress of the disease created, in accordance with local neuronal implication, until the spinal cord, at and below the seat of attack, becomes more or less completely hollow and functionless, and the structures innervated thereby become degenerated and, in many cases, entirely removed.

Of course, for such occurrences there must be an array of original and acquired etiological factors of a formidable order, both predisposing and exciting, the determination of the manner of whose working can only be dimly guessed at, but a knowledge of which, if not utilitarian, should be scientifically interesting and very informative,

and a means of assisting "elimination" in symptomatically allied morbid entities in the processes of diagnosis and treatment.

Thus, from the point, or points, at which the cerebro-spinal fluid effects an entrance into the matrix of the neuroglia of the cord, a process of softening and disintegration of its amorphous elements, followed by a breakdown of the neuroglial reticular framework of supporting and innervating texture takes place, leaving the local neurons unprovided with nutritive pabulum, and bereft of mechanical support for their cell bodies and attached dendritic and axonal processes, in which condition they collapse and disappear, causing the paralysis and degeneration of their peripheral or histologically continuous neuro-musculature, and, to some extent, affecting the related sympathetically innervated structures. Its symptomatology, therefore, must vary according to the rate of incidence of the destructive effects of the neuroglial breakdown on the local neuronal structures, and can thus be made to measure the progress that is being made in the syringo-myelic process.

Moreover, the destruction of the neuronal textures is usually realised by the myopathic degeneration and disappearance of the sarcous elements of the dependent musculature, with, frequently, the appearance of whitlows or cold abscesses, which represent in such circumstances the passive accumulations of the resultant muscular *débris*, and the final stage of neuro-muscular paralytic breakdown and sarcous degeneration.

These accumulations of neuro-muscular *débris* usually take place on the outer surface of the bones, to all appearance from a too consistent condition to pass through it, on account of the lymphatic vasculature being overwhelmed with, and unable to absorb and pass on for excretion, so much semi-solid waste material, and to the non-connection of that material with any other vasculature capable of effecting the formidable work of its removal; hence, it must either remain pseudo-encapsulated or effect its escape by the aid of ulceration or *necrosis* of the overlying tissues. The condition must, therefore, be regarded as one of complete and melancholy hopelessness.

EXTRACT VII.

THE INCIDENCE OF SKIN AFFECTIONS, ERUPTIVE AS WELL AS DESTRUCTIVE, AND MAL-NUTRITIVE, DETERMINED BY THE DISTRIBUTION OF THE CUTANEOUS NERVATURE.

THAT the exanthemata, febrile and non-febrile, are nervine in origin, with very few exceptions, we are convinced there can be no doubt, and that many of the non-exanthematous diseases, involving the structural elements of the skin, are nervine, we also think there is ample evidence to prove; thus such diseases as perforating ulcer and rodent, or cancerous, ulcer of the skin, *leucoderma* and *scleroderma*, exactly coincide with certain areas of sensory nerve distribution, and certain points where the cuticular or afferent nerve trunks debouch on the under surface of the skin, to traverse the thickness of the dermal layers and areas, and, therefore, where nerve energy and nerve protoplasm are circulating with a greater combined intensity than at the remote terminal arborisations, where dissipation of both energy and protoplasm are more easily and safely effected, amid the general terminal and surrounding structures, or in non-fulminating proportions. The two first-named ulcerative processes belong to the former category; while the two latter, which may be said to implicate the cutaneous textures in a non-disintegrative way, may be regarded as affecting the peripheral expansion of the involved nerve trunks, and producing alterations in pigmentation and terminal histological arrangement only. The anatomical and histological distribution of the cutaneous nervature renders the occurrence of these somewhat

local diseases orderly in character, and does away with the apparent element of chance or accident as a determinant factor, making the operation of like causes, under like circumstances, to be followed by like results, and introducing into the work of diagnosis, prognosis, and treatment a method of exactitude which has not hitherto been conspicuous, but which may be pregnant with great possibilities when the subject comes to be studied in proper detail, and becomes fully systematised. In studying in only slight detail the manner and method of the pathological evolution of the two first of these disease entities, viz. rodent and cancerous ulcer, we have been struck with the thought that the processes involve the operation of both material and dynamic factors in a more definite way than can usually be discovered in pathological processes generally, and that, in the two alike, the disintegrative, or dynamic factor, predominates over the material, thereby determining the incidence of abnormally *active whole tissue disintegration*, as distinguished from the normal or physiological disintegration. We have elsewhere argued that this pathological or abnormal tissue waste is due to the escape into the extra-systemic neural textures of nerve energy, with the resultant blighting and final destruction of these textures, and the involved and systemic neural textures themselves, when they become exposed to the traumatic and neurolytic influence of the escaping nerve force. If this be so, as we have little doubt it is, then we have also reason to believe that the nerve energy is being discharged from within, and, therefore, must reach the scene of its destructive work along the afferent channels or sensory nerve trunks, or by "reverse currents"—this latter circumstance explaining the destructive effects of the lethal discharge of nerve force *through a receiving or sensory* instead of *a delivering or motor terminal nervature*. It is thus a self-destructive influence, exercised by the involved nervature on itself and its surrounding and neighbouring non-nervous structures, during the prevalence of which the destroyed and disintegrating tissue elements may become a prey to bio-chemical change, bacterial invasion, and pathogenic influence of other kinds, the morbid process supplying materio-dynamic fac-

tors ideally adapted for invasion of neighbouring sound textures and the propagation and perpetuation of disease. Nerve influences, emanating from the systemic nervous system, are thus destructive to that system itself, and irresistible in their disintegrative effects on the sympathetic nerve areas, which everywhere surround and support it, by the intensity and continuance of their neurolytic powers. A way, therefore, must be sought to prevent this nerve force escape or leakage, to redirect it aright, and to erect barriers to prevent the recurrence of its escape. Into the therapeutic bearings of the subject, however, it is yet premature to enter; we, therefore, content ourselves with reiterating that a very large number of diseases, which are still looked upon as emanating from hæmal quarters, are none other than nervine in origin and progress, and that they require to be studied anew in the light of neural pathology.

Altered pigmentation, a principal feature in the two last-named of the group of diseases mentioned above, viz. *leucoderma* and *scleroderma*, we elsewhere traced to an origin in the central nerve structures of brain, cord, and ganglia, in the nerve cells of which all physiological colour phenomena of skin, hair, and cutaneous appendages generally are determined and effected, where the pattern is designed, and the material and energy provided by which the design is peripherally carried out. Thus the nerve cells elaborate the neuroplasm, which, when circulated to the peripheral nerve terminals and shed into the dermic texture, produce, in conjunction with the modifying influences of the environment, the pattern originally determined by the trophic hierarchy of the united nerve commonwealth, and accomplished by dynamic influences emanating from the same quarter. *Leucoderma* seems to depend on the central failure of the elements, material or dynamic, or material and dynamic, of pigmentation, and represents a condition of central negation or peripheral neural incapability of trophically dealing with the physiological necessities of the situation. *Scleroderma* involves a greater or lesser departure from the standard of normal pigmentation, combined with what seems very like a pathologically aggravated discharge or shedding of the neural elements

of lymph and plasm, or cerebro-spinal medullary and axis cylinder substances, into the areas embraced within the spheres of attack, plus the modifying influences of the pathogenic factors which may happen to come on "the scene of action" to modify the course of events and determine final results.

The lines of junction of the "spheres of influence" of the two nervous systems, the systemic and sympathetic respectively, seem to afford a more or less debatable area, along which there is at times a possibility for leakage of intra-nerve elements, material and dynamic, and where the unwonted and unrestrained play of nerve energy on non-inhibited structures leads to their neurolysis and to interstitial distinctive changes, whereby the definitive elements of both nervatures and their material belongings are reduced to pathological waste, to be removed by systemic hygiene or to become a prey to pathogenic vagabondage, by which they are finally disposed of, or remain a more or less permanent menace to the health of the surrounding physiologically sound structures.

The pain associated with these ailments, the solutions of tissue continuity involved in their progress, the shorter or longer continuance of the diseased condition, and the ultimate results, locally and generally, of the morbid processes, are one and all meted out by the leaking nervature, while the intensity of the intercalated and dependent, secondary and concomitant, destructive tissue phenomena conform to the local conditions imposed by the anatomical and histological relationships of the affected parts, or areas, and the individual resisting powers of their subjects.

Viewing as a whole the *rôle* of the nervous system in its widest sense in the incidence of disease generally, it would not be too much to say that it has more or less to do with every morbid process entitled to be called a disease, either of structure or function, and that without the dynamic influences exercised by that system in every physiological process, and by continuity in every pathological departure from physiological standards of action, disease itself, and premature death, would disappear, and leave the race to run its life-course free from the limitations imposed by its present vulnerable conditions and its con-

stant exposure to pathogenic agencies from within and from without.

In other words, the nervous system, being synonymous with life and responsible for the conversion of dead or inorganic matter into living protoplasm or bioplasm, and the fashioning and moulding of that bioplasm into the various tissues and organs of a composite human body, continues to maintain the vitality of that body, to guard it against the influences of morbidity, and, where unsuccessful in its battles with these, it continues the use of its best endeavours to neutralise the effects of every morbid influence, which has attained a temporary ascendancy by opposing it with its utmost physiological vigour, until it perishes in the attempt or comes out the victor.

EXTRACT VIII.

ON THE EXANTHEMATA, AND HOW THEY ARE RELATED TO THE FOREGOING VIEWS.

THE exanthemata constitute an order of diseases of a conspicuous and very important character, and have from the very earliest period of scientific, as well as folk, medicine, given rise to the greatest interest—the eruptive symptoms with which they are accompanied, and the febrile disturbance to which they generally give rise, alike claiming the attention of the patient, his friends, and his medical attendant.

Their nature, genesis, and after effects have been keenly observed and discussed, and classifications made according to, sometimes the intensity of the fever and sometimes the appearance and character of the eruptions, the length of time of their endurance, and the many other features by which they are known.

According to the most modern teaching they are regarded as all but entirely bacterial in origin, and the view is all but universally held that the zymotic or microbic poison on which their production depends, incubates or grows in, and is finally thrown out of, the blood by eruption—each eruption differing from another according to the behaviour of its specific *virus*. In this process of eruptive excretion it is taken for granted that the capillary blood circulatory mechanism *somehow* effects the expulsion of the zymotic organisms, and leaves on the various surfaces, cutaneous and membranous, an impress according to their varying nature and character. This we confess our inability to see in, we may say, a large

proportion of the eruptive diseases, inasmuch as the type of the eruption seems not to depend on the surface distribution of the blood capillary circulation, but on that of some other surface textural element—what then can that be? In our opinion, it can only be the nerve terminal arborisations, their distribution determining the position, shape, and duration of the eruption, or rash. This occurrence would and could, of course, only be the pathological outcome of a previous invasion and *sepsis* of the cerebro-spinal lymph cavities, and the subsequent outflow along the nerve trunks and their terminal distributions of the resultant microbe-laden fluid—the primary infection taking place from the blood streams communicating with the brain and nervous system, or by direct transit into the cerebro-spinal lymph circulation *viâ* the neural lymph channels.

The process of eruption is attended by more or less profound disturbance of the peripheral or distal ends of the sensory nervature, with an appreciable subjective experience of motor involvement, in many cases followed sooner or later by a “sense of relief” and gradual defervescence.

In diseases in which the nerve terminal textures are simultaneously affected with the blood capillary circulatory vessels, as in hæmorrhagic variola, the prognosis is always grave, the apparent reason being the re-invasion and *sepsis* of the blood by a fresh culture, so to speak, undergoing excretion from the cerebro-spinal septic lymph spaces.

The presence in the cerebro-spinal lymph of a microbic organism undergoing the process of more or less rapid growth and decay, with the resultant accumulation of toxinal matter, explains much of the intellectual and nervous disturbance so frequently associated with exanthematous disease, and affords a clue by which its future course and conduct may be anticipated and its progress, to some extent, guided—thus the preliminary *flushing* of the excretory apparatus, most involved in the process of eruption, assists in determining and accomplishing it, as we observe when we succeed in setting up a free *diaphoresis*.

The phenomena constituting the early stages of the exanthematous diseases vary greatly in the degree of their intensity, their manner and sequence of manifestation, and the length of time occupied in their development and evolution, the period of incubation, as it is called, occupying the time stretching from the date of infection to that of eruption, and coinciding with the growth, reproduction, and expulsion of a particular microbic organism. The number of diseases now included in the class of exanthemata is very large; that number, however, we think, is likely to increase as we gain a more precise knowledge of the etiology and pathology of many of those diseases familiar to the dermatologist; moreover, many of the diseases, undoubtedly exanthematous at times, fail to manifest themselves in their usual eruptive character and manner, and thus elude inclusion in their proper category, hence the necessity for maintaining broad views in relation to classification, and the consequent therapeutic and hygienic action indicated therein.

EXTRACT IX.

THE RELATIONSHIPS OF THE INCIDENCE OF ORGANIC DISEASE TO THE DISTRIBUTION OF THE SYSTEMIC NERVOUS SYSTEM.

WE have already traced the incidence and manner of manifestation of exanthematous and skin disease generally to the manner of the terminal distribution of the systemic nervature in relation to the other structural elements of the skin, and have satisfied ourselves that it is almost all-important therein, and we have *now* become satisfied that the incidence and distribution of many affections of the voluntary musculature, as well as of much organic disease throughout the viscera, but more especially of the tissues belonging to these viscera that are to any extent innervated by the systemic nervature, are similarly determined.

Thus the muscular system generally, owing to its intimate materio-dynamic relationships with the central nervature, is necessarily dependent for the origin and progress of the main part of the disease to which it is liable, to interferences with the processes of neuro-muscular nutrition and neuro-muscular innervation, varying from the extreme of the complete negation of myopathy to the extreme of muscular hypertrophy in incidence, and from the affection of single muscles to the wholesale affection of the entire musculature.

We mean to allude here more especially to the incidence of organic disease of the heart and its dependence on interferences with the neuro-muscular and central connections of the brain, cord, pneumogastric nerves, and heart.

In this connection we have already traced the bacterial relationships of various septic conditions of the cerebro-spinal lymph, and the simultaneous or immediately subsequent appearance of similar pericardial or endocardial bacterial involvement, in which alone the element of the cerebro-spinal lymph is primarily involved, and which, by the continuity of its presence along the nerve trunks, secures the spread of the disease, from the cerebro-spinal cavity to the cardiac cavities and structures—covering, lining, and interstitial.

The incidence of disease of the muscular structure of the heart in like manner may be traced to materio-dynamic interferences with the nutrition of its fibres and their consequent innervation, by mechanical, chemical, or bacterial causes owning a central nervine origin, and acting along histological lines of continuity *viâ* the pneumogastric nerve trunks, stretching from the cerebro-spinal structures to the dependent cardiac musculature; thus atrophy, hypertrophy, fatty degeneration, and other associated and consequent heart conditions owe their origin and incidence alike to interferences with the distribution of neuro-muscular plasma, and the consequent lapse or perversion of neuro-dynamic influence or energy, with the subsequent evolution of disease entities, according to the particular etiological combination of disease factors.

Of course the heart, being beholden for its innervation and nutrition to both nervatures, can be sustained in functional wholeness and comparative health when failure threatens from either side, and will only yield when both sources fail; we must, therefore, in estimating the probable etiology and pathology of any disease of the muscular structure of the heart, allow for this organic duplex nutrition and innervation, so as, if possible, to adjust our unfortunately usually only ameliorative treatment with the greatest scientific precision. The various diseased conditions named above may be due primarily to non-over, or perverted, production of neuro-muscular plasma by the central neuronal elements, to faulty neural conveyance from the scene of production to the scene of delivery, or to imperfect powers of assimilation of the receiving organic or muscular structures, in whole or in part, and

to subsequent mal- or non-assimilation and complete structural and functional breakdown.

We thus see that the central nervous system determines the incidence and particular local manifestations of a wide range of disease, spreading over both aspects of distribution, sensory or cutaneous, and motor or muscular, and that the full recognition of this etiological principle, as a diagnostic assistance, should always be taken advantage of, as well as its use in affording indications of treatment.

Moreover, many other allied diseases owe their origin to the spread from the muscular terminations or attachments to the bones of morbid materials and agencies, which have already done their best and their worst during their neuro-muscular transit, such as periostitis, ostitis, abscesses, acute and cold, joint disease, perversion, and destruction of skeletal developments, *et hoc genus omne*—all of which circumstances are inseparable from the great laws of neuro-cutaneous and neuro-musculo-osseous evolution and nutrition, and the origin in the great cerebro-spinal cavity, and its contents, of a host of etiological factors, which, let loose on the dependent structural elements, progress and eventuate on the lines of histological continuity and materio-dynamic affinities, with the common end of leaving in their track the history of structural impairment and functional curtailment to mark the various forms of morbid evolution proceeding from this little suspected region of “cause and effect.”

EXTRACT X.

ON THE NAKED-EYE DETECTION OF THE PERIPHERAL DISTRIBUTION OF THE SENSORY NERVATURE, AND ITS CLINICAL IMPORTANCE.

IT must be conceded here that the naked eye is often baffled in tracing the peripheral distribution of the cutaneous nerve terminals in many individuals, as well as in many parts of those individuals in whom in certain areas it is conspicuous—thus, in many infants, but particularly in the healthy and “thriving,” we can easily see, in the “dappling” of their skin, a more or less obvious differentiation of the neural and hæmal structural elements, the former, or neural, being represented “in bulk” in the pale; the latter, or hæmal, in the pink, spots composing the dappling, both, however, dovetailing and blending to constitute that variegated “ivory” or “pearly” appearance so often characterising this condition of the infantile skin. As age advances through youth, adolescence, and decline the relative disposition of the two principal vascular elements of the skin undergoes considerable change, “waxing and waning” and fluctuating somewhat rhythmically and regularly with the changing phases of life and altering environment. At one stage of life, and under the combined influences of certain environments and internal conditions, the neural element may be most in evidence, while at another the hæmal element may be in like manner most conspicuous.

Paleness of surface, in normal conditions, may be said to mark the presence of the neural vasculature locally as well as generally whenever present in conspicuous pro-

portion, and, when locally observed in *thin skinned* individuals, the paleness may often be seen to be confined to one or more terminal arborisations, to a group of associated peripheral nerve expansions, or to the specially distributed terminal nervature of the skin generally. Thus, on the more exposed surfaces of those who show this anatomical peculiarity, each nerve terminal displays its final histological *breaking up* in the form of single, dual, triple, or multiple, circular, oval, or irregular, but distinctly outlined, ivory coloured, glistening or faintly transparent, ring-like shapes showing in slight relief above the prevailing more *rouge* hæmal vasculature. *At first* this *surface marking* has to be carefully looked for, even in a *good specimen*, but when *once seen*, and when the eyes have been familiarised "to the sight," there is very little difficulty in detecting, even in the *worst specimen*, traces of this manner of the terminal distribution of the sensory nerves and blood vasculature respectively. That the power to observe the manner of the terminal distribution of the sensory nervature of the skin can aid us in diagnosing a neural from a hæmal eruption goes without saying, as the most elementary scrutiny, by the initiated, of the cutaneous disposal of its details, will show whether the eruptive display conforms most to the outlines of the neural terminals or to the more indefinite capillary elements of the blood vasculature, or whether it involves both.

As we have said before, we are convinced, from our analysis of the eruptive phenomena displayed by the exanthematous fevers and the non-febrile eruptive disorders generally, including many forms of neuritis and dermatitis, that differentiating the neural from the hæmal varieties will enable us to dictate a treatment at once more scientific, and likely to be successful, than that only based, at the best, on the *sifted empiricism* "of the ages": moreover, justified by this analysis, we claim once more that a much larger proportion than is usually supposed of the eruptive diseases will be found to have been incubated in, and to have secondarily invaded, the so-called non-nervous structures of the body from the cerebro-spinal cavity, and that, therefore, it will be found that their

eruptive displays have been moulded on the structural lines of the cutaneous or peripheral nervature—anatomical necessities, therefore, determine their manner and method of evolution and development, as they must be acknowledged to do in every definite diseased condition.

The terminal distribution of the peripheral sensory nervature being thus generally more or less traceable, lends itself to the more or less graphic illustration of the "condition of things" within the central nervous system, and publishes, for the information of those able to translate the messages, what is transpiring in these cryptic regions, and what response, if any, to return.

The naked-eye features of the skin generally, and those relating to the sensory nerve terminals particularly, as we have remarked, are continually undergoing change as age advances, each phase of life being characterised by its own particular features; thus its creasing or wrinkling, its smoothness or roughness, its own pigmentation and that of its appendages, with many other less prominent, are rhythmically responding to the plastic and colouring or de-colouring touch of the "hand of time," and "telling the tale of life," whether it may be smooth and joyous, rough and careworn, or wild and tumultuous.

The truth of these observations must be tested by the study of the living subject, however, because post-mortem changes frequently obliterate those which have been the work of a lifetime, thus smoothing out the grosser markings of time, throwing an air of peace and rest over countenances which have long been strange to them, and leaving, it may be, a uniform pallor alone to mark, or mask, the history of the individual.

The deeper and unseen relationships of the peripheral nerve terminals, to the well-defined and anatomically traced nerve trunks and fibres, have an important bearing on the surface disposition of the terminal nerve markings, inasmuch as every such marking, when it has become the scene of eruptive phenomena, will, on being traced back to its parent nerve, reveal the path by which the neural discharge has been effected, and give a clue to the discovery of its true etiology and nature. The cutaneous sensory nerve terminals seem to be disposed on and in the surface

of the skin, and the sympathetic nerve terminals in the lining membranes, very much in the same manner as the leaves of a tree—say a sycamore—are disposed on its terminal branches, which, when looked at from the outside or from above, show an almost complete continuity of leaf surface distribution and arrangement, giving to the tree an appearance of solidarity, which is only appreciated at its true value when subjected to scrutiny from underneath or within—then it is realised that the disposition of the individual leaves is such as completely to “slate” the trunk and its branches, the natural seasonal leaf shedding, revealing the same truth negatively. On pursuing the comparison, we become aware that at certain points of the leafy envelope of this sycamore a group of leaves shows a disposition to wither, change colour, and are finally shed, leaving a mark more or less evident amid the prevailing green, which may become a permanent scar should the leaves not be renewed. Very similar phenomena are observed in the disposition of the sensory nerve terminals of the skin, as they lie closely tessellated in its neuro-hæmal layer when attacked by eruptive and destructive morbid forces and *materies morbi* from within the central nervous system, or, if the eruptive displays involve the lining membranes of the body cavities, the same may be said of the sympathetic nervous system.

The phenomena of diversity of appreciation of sensory stimuli by different areas of the skin and by different points within any one area, in view of the comparative light thrown on the subject by such observations as these, would seem explicable by the varying degrees of intensity with which the various component parts of the nerve terminal expansions are reachable by the stimuli; thus the outer or peripheral surface of the neural tubules, composing the terminal arborisations, must be reached, and respond more quickly and readily than those surfaces representing the sides and under aspects of the same tubules, and hence the explanation of the apparent contradictoriness of the results obtained by experimental stimulation of these sensory nerve terminals, and the unsatisfactoriness of the conclusions which have been based on the results.

As proving that the peripheral or sensory terminal nervature must necessarily be the most superficial element of the true skin, we may point out that the sense of touch is resident in the most acute degree at the parts of the *cutis vera* nearest the surface, and, therefore, that it is the first vasculature met with in the usual manner of performing vaccination, where it is best not to "draw blood," and to avoid the hæmal vasculature; hence the nerve terminals usually lie above or outside of the capillary vessels of the skin, except in the red or more deeply tinged areas referred to in describing the more conspicuous cutaneous naked-eye features for the detection of the peripheral distribution of the sensory nervature.

EXTRACT XI.

A COMPARISON OF SOME OF THE DISEASES INCIDENTAL TO THE AFFERENT AND EFFERENT NERVATURES RESPECTIVELY, BASED ON THEIR PHYSIOLOGY AS BEFORE DESCRIBED, SO AS TO SHOW SOME OF THEIR COMMON CHARACTERISTICS AND DISSIMILARITIES.

THE afferent and efferent, or the sensory and motor nervatures or nerve fibrils, are histologically alike, in that they are both axonal processes of nerve cells, that embryonically they are projected into, become amalgamated with, and innervate the skin and voluntary musculature, respectively, and that they grow *from* the nerve cells *towards* the textures, which they innervate, and *not* from the textures towards the nerve cells, of which they form the axonal processes, the possibility of this latter occurrence being absolutely precluded from the non-existence at the periphery of either nervature of a neuro-genetic cell mechanism, and because a cell process can only *grow from* a cell. They are alike, also, in that, besides being merely axonal processes connecting nerve cells with sensory and motor agencies respectively, they convey, along with nerve energy, material pabulum for the growth and maintenance of these agencies in skin and muscle elements respectively, by capillary circulation along the fibrillary *lumina*, so to speak, of the axis cylinder and medullary containing membranes or tubes; the dual protoplasmic elements of the axis cylinder and medullary substances thus constituting the material pabulum, on which the processes of growth and maintenance of much of the muscle and skin

textures proper depend. Thus far the characteristics of the two systems of innervation, sensory and motor (*i.e.* so far as their histological development and structure are concerned), are entirely parallel; at this point in their comparison, however, there ensues a distinction, which amounts to an absolute difference, because nerve stimuli are transmitted from without inwards to the cell by the one, and from within outwards to the muscles by the other. It cannot be said, therefore, that nerve stimuli are always transmitted in the line of growth of the transmitting fibre only, but according to the direction of incidence of the functional transmission or circulation of nerve impulse or energy. An exception, however, to this latter rule is claimed to the extent that, in certain physiological as well as pathological conditions, a nerve fibre can and does transmit a duplex current, *i.e.* an afferent fibre can be made the vehicle of transmitting an efferent impulse, as in *herpes zoster*, and an efferent fibre can be made the vehicle of transmitting an afferent impulse, as it may be conceived to do in connection with the phenomenon of the "sixth" or "muscular sense."

In contending for the truth of these assumptions, it is necessary to reiterate that a nerve fibre, instead of being a solid and homogeneous texture, is composed of two keratinous tubes, through which run, or are circulated, the medullary and axis cylinder substances, these substances being the products respectively of the cell and its nucleus, from which they are poured into the *lumina* of their respective tubules and circulated to their remotest terminals, where they are disposed of as skin ingredients and sarcous tissue elements. Instead, thus, of the nerve fibre being a stationary non-mobile strand of neural substance, histologically attached by its two extremities to nerve cell and innervated texture, it is composed of two telescoped tubes, an outer and an inner, transmitting neuroglial substance, known as medullary and axis cylinder substances, from brain, cord, or ganglia, to the limits of the systemically innervated tissues, peripherally and centrally, of the entire organism.

Being, if this be true, active agents in the distribution of neural tissue pabulum, as well as the transmitters of

nerve impulse, these fibres, therefore, become the most important vehicular agents in the economy of nutrition of skin and muscle, especially in the so-called trophic work and oversight of certain nerve centres, which physiology persists in assigning to some hitherto ill-defined nervine areas, in conjunction with the distributive agency of the blood circulation and subsequent metabolism; and, consequently, interference with this nutritive work in the way of increase, diminution, or perversion, becomes a pathological factor of the most vital importance. Thus increase of the peripheral or afferent nerve terminal exfoliation, excretion, or shedding, is followed by hypertrophy of the cutis and cuticular textures, while increased motor excretion is in like manner followed by hypertrophic changes in the sarcous elements of the voluntary muscular textures; in like manner, also, decrease in the afferent nerve fibre pabulum leads to the production of "glossy skin" or dermal atrophy, while decrease in the efferent nerve fibre pabulum leads to the production of myopathy or muscular atrophy, the determining cause in both cases being abnormal supply of nervine pabulum or inefficient metabolism on the part of the affected structures.

In conjunction with these pathological factors is often associated a pathological condition of the cerebro-spinal lymph circulation, whereby diseased conditions of the above order are modified according to its extent and intensity, and so such conditions as neuritis and myositis, local and general, become evolved, and pursue a course, it may be, at first simple, but gradually becoming more complex as it involves associated non-systemic nervous textures.

EXTRACT XII.

ON NEURAL EXCRETION, AS THE DETERMINING FACTOR IN FASHIONING THE CHARACTER AND PATTERN OF SKIN ERUPTIONS, AND ON RODENT ULCER, CANCER, AND DISTURBED MATERIO-DYNAMIC BALANCE.

IN alluding to the causation and incidence of the exanthemata, we advanced the opinion that they represented neural excretion consequent on incubation of the microbic *virii* or organisms in the cerebro-spinal lymph, and were to be regarded as primarily diseases implicating the neural rather than the hæmal system. On the continuation of our studies along this line, we have become convinced that these views apply as well to very many of the more slowly progressing cutaneous affections manifesting themselves by eruption, or in other more or less conspicuous alteration of the cutaneous textures and surface, and owing their production to such very various morbid agencies as metallic, chemical, and bacterial *virii*, but eventuating in common in excretion through nervine channels in the great external area of final disposal of effete and noxious residual nervine materials. The cutaneous eruptions here alluded to usually conform to the configuration of the local terminal peripheral nervature, appearing in discrete or confluent proportions according to whether one or more terminal arborisations are involved in the work of excretion, and whether one or more of the constituent neural fibral elements of the implicated arborisations are shedding their residual contents, and in what proportions these elements are represented in the

rash, and consequently responsible for shaping its specific features and determining its local incidence and character. Thus a simple miniature dermatitis, with only the slightest surrounding hyperæmia, may be all that is visible in arsenical or alcoholic neural elimination, or the most acute and destructive changes may mark its rapid progress over larger areas, a papular thickening, a vesicular elevation, or a pustular invasion, may mark the points of excretion of a bacterial organism, a bulbous accumulation of neural lymph may represent arrested perspiration and subcutaneous accumulation, a crusted and piled-up heap of escaped medullary substance may be recognised in the rash known as *pemphigus*, and the more sebaceous spots of acne and the comedones of xanthelasma as admixtures of the whole exuvial and excrementitious fibro-neural elements. When we add this large class of the more slowly progressing eliminative ailments noticeable on, through, or over the skin to the exanthemata proper, and when we bring into the same category many of the diseases of the olfactory apparatus, the glosso-pharyngeal area, and the anal orifice of the intestinal canal, besides, it is conceivable, a considerable proportion of the diseases attacking the visceral parenchyma and limiting membranes within the body, we must become aware of the great importance of neural circulation and excretion in the incidence and evolution of the morbid entities to be met with in the human body, and of the consequent necessity there is for a continual recognition of that fact in the everyday work of diagnosis, prognosis, and treatment, both on account of its inherent, immediate, and utilitarian value, and its purely scientific bearings on the progress of medicine and surgery locally and generally.

Moreover, the incidence of cutaneous tuberculous affections, such as rodent ulcer, and even cancer itself, seem to be to a great extent determined by neural distribution and excretion, and the consequent effects of tainted neural materials amid the textural elements undergoing malignant change, hypertrophic growth, and degenerative removal, in all which morbid phenomena it is warrantable to suppose, and even to contend, that a subtle and destructive poison is being distilled, and, it may be, a dynamic leakage

taking place, from the central nervous system into the textures involved by the local nervature ; this being so, we shall in such cases have to look for their causation away back in the central regions and lymph caverns of the systemic nervous system, where, it may be, traces will be found of the presence of a bacterial organism or other *materies morbi*, which had found its way thither, and finally been expelled along the intra-neurilemmar channels of the locally involved nervature of the diseased textures and areas.

The character, therefore, of the specific morbid elements or effects locally discoverable in any particular instance of these affections, at least of those whose origin is not absolutely local, must to a great extent conform to the nature of the specific and determining cause, which has been at work in the distant central nervous system, moulding and evolving the particular or specific *virus*, and the character of its pathogenic influence on the structures involved locally must be likewise so determined—it may thus well be that the various schools of pathology now engaged in research on this subject may find a justification for their respective beliefs in this matter ; as according to the manner and method of their diverse procedure in arriving at them, so necessarily will they be ; hence mutual respect and forbearance will be required to enable each and all to have their particular views passed through the crucible of final determining search and criticism.

These statements relate to the incidence of disease in the areas innervated by the afferent or sensory nervature, and, therefore, to the peripheral or external aspect of the body, a similar, but necessarily modified, morbid incidence must characterise the motor or efferent nervature, when, amid the functionally active elements of the entire voluntary musculature, the toxic or disease-producing elements of the central nervature are liable to be deposited by their “end plate” fibril distribution. The diseases thus caused are no less numerous and important than those which emanate from the sensory aspect of the nervous system, and, generally speaking, profoundly differ from them, inasmuch as the textures involved in the respective categories of sensory and motor are fundamentally dif-

ferent ; thus the diseases affecting the tissues in which the sensory nervature ends spread themselves by histological continuity along and amongst the elements of these tissues free from overlying mechanical hindrance, while those involving the voluntary musculature are necessarily moulded by surrounding structural limitations, direct and indirect, and conform more or less exactly to the topography of that musculature and its textural environments. To make this plain, it may be sufficient here to refer to two classes of disease, affecting respectively the sensory and the motor areas of the systemic nervous system, with the textures to which they are distributed, viz. the exanthemata and the "*morbi rheumatici.*" These two classes of ailments are both typically illustrative of morbid agencies, hatched in the remote intricacies of the central nervous system, and finding an exit for their resultant toxic *débris* along the channels of exit and least resistance into their attached and innervated textures and organs, cutaneous and muscular—in both, although the results are so different, the manner of their evolution is the same. Kindred agencies, working along different lines, producing different effects, in accordance with the operation of the same laws, on different structural elements. It becomes conceivable here that the grouping of diseases generally, and their classification, may be determined on simpler and more scientific lines than those in use hitherto, and that valuable indications for the application of curative and ameliorative means may become more readily and rationally available.

Another group of diseases of very large proportions is embraced in this classification, in virtue of its nervine origin, and becomes conformable to the same laws of nervine distribution and evolution, viz. the nervine affections of the viscera generally ; in these, however, the influences derivable from association with the sympathetic nervature exercise a modifying influence on their incidence ; nevertheless, it is essential to bear in mind that the central nervous system is the *fons et origo* of these maladies, and requires to be appealed to in any practical measures that may be adopted for their removal or relief. This group of diseases may be typified by the affections known as the sequelæ of many of the affections of the

systemic nervous system, such, for instance, as heart complications in rheumatic fever, and pneumonia in influenza, where the specific neural *virus* travels along the pneumogastric nerve trunks into the parenchyma and proper structural elements of lungs and heart respectively, after incubation, in the lymph spaces of the cerebro-spinal cavity. Other viscera, innervated by the solar plexus, coeliac axis, and other sympathetic ganglia, conform to the same laws in relation to the incidence of those diseases which spread to them from the systemic nervous system, and serve as channels through which morbid or toxic agencies find an exit from the sympathetic system, on the same principle which characterises the excretion of an exanthematous *virus* or chemical poison from the cutaneous surface of the body.

From all which we may infer that these varieties of disease processes and phenomena associated with neural excretion are the active *curative agencies* or means exercised by the *vis medicatrix naturæ* for the maintenance of the health of its subjects, and that, generally speaking, all that science and art are called upon to do is to "put no obstacles in the way," and, if possible, to "lend a helping hand" in the work which the natural history of the particular disease in question usually more or less clearly indicates.

Before departing from the subjects of neural terminal distribution and excretion as the determining factors in fashioning the character and pattern of skin eruption, and affecting the incidence of diseases belonging to the sensory, motor, and sympathetic terminal nerve distributions, we would call attention to the possible, and, we think, probable, occurrence of an order of diseases, due not to the action of neural material poisons on the structures to which the nerve terminal fibres are conveyed, but to the modifying and, it may be, destroying influence of intensified, perverted, or alien nerve energy finding an exit through these terminal nervatures into the histologically related, if not continuous, non-nervous or sympathetically innervated textures. The leakage of nerve energy in small or large amounts into or out of sensory and motor and sympathetico-systemic nerve terminals is an occur-

rence felt and seen in the experience of every observer, in such affections as *herpes zoster*, epilepsy, and certain forms of gastralgia, together with many other forms of neuralgia, of particular nerve trunks or fibres, where absolutely no material change can be traced in the structures implicated, but where, of necessity, there must be the passage of nerve energy, with its implied molecular disturbance of the proper nerve and related substances. This disturbance, as we have already said, consists often, if not always, of a *reverse current* of nerve energy, *i.e.* the passage of an efferent current along an afferent nerve trunk or fibre, and, it may be, the passage of an afferent current along an efferent nerve trunk or fibre. The tracing of such nervine phenomena, amid the fibral intricacies of the sympathetico-systemic nervature, may be possible, but is transcendently difficult; suffice it to say, therefore, that the two forms of nerve energy, afferent and efferent, being different in genesis and manner of conservation, must be different in their influence on the various nerve elements concerned in their conveyance and distribution, the two being in a sense comparable to negative and positive in the kindred domain of electrical phenomena. *Herpes zoster*, for instance, according to this view, consists in efferent discharge of nerve energy through an afferent nerve trunk and terminal fibres into structures not designed to discharge, but to receive, hence the neuritis; while epilepsy consists in the discharge of nerve energy, efferently, it may be, of the whole of both cortical and deep-seated "nerve centres," cerebral and spinal, hence wholesale and inco-ordinated character of the muscle spasm and the lapse of consciousness which characterise such seizures. The phenomena characterising the mixed sympathetico-systemic pains and pure neuralgias are of less evident order in causation and sequence, but, nevertheless, traceable to some extent on these lines; their careful study will, therefore, we are convinced, repay the expenditure of whatever attention may be given to this department of the subject in a more intelligent "grasp of the situation" and an increased power to deal with it practically.

The lethal discharge of nerve energy from peripheral nerve endings, more especially on the sensory or afferent

aspect of the systemic nervous system, seems to us to fall, or to operate with the most deadly effect, on the textures innervated by the sympathetic system, amid which the systemic terminal nervature is distributed, destroying, it may be, their vitality, and leading to solutions of their continuity, in proportion to the continuance and intensity of the discharge. These solutions of continuity may vary in extent from the merely molecular and minute to the somatic and general, and may be sudden or prolonged in regard to the time occupied in their production, and temporary or permanent in their destructive results, according to the completeness of the textural destruction effected. Thus a *herpes zoster* may be of such a slight and ephemeral character as scarcely to be noticeable, or so severe as completely to incapacitate its subject, entail great suffering, and the destruction of more or less of the skin and subcutaneous tissues involved in the herpetic process. The destruction here indicated is "on all fours" with that effected by "rodent ulceration" wherever existent, and seems to us to depend on molecular or somatic death of the involved tissue elements by the lethal discharge of nerve energy from the peripheral extremities of the systemic afferent nervature into the sympathetically as well as the neighbouring systemically innervated tissues; hence the microscopic appearances of the resultant tissue *débris* must depend on the nature and texture of the tissue undergoing destruction, and the character of the particular microbic organism which may have gained access to the scene of destruction, and whose function for the time being may be that of scavenger and innocent assister in the performance of organic hygiene, phagocytosis not being here necessary, the removal of molecular *débris*, the result of neurolysis, being the pressing desideratum, and the *raison d'être* of their presence.

Viewed from this point, "rodent ulceration" is usually confined to a particular nerve or nerve fibre terminal arborisation, and manifests itself, as its histological position necessitates, in the involved arborisation, thence spreading, it may be, horizontally or laterally to neighbouring arborisations of the same nerve trunk, branch, or fibre, and perpendicularly, or at right angles, along the

receding and decaying nervine and other structures in the line of its destructive progress, regardless of obstruction, however resistant, until it reaches the dividing line, or nervine "watershed," where its progress ends, or continues, into the central nerve centres, where it may terminate in the death of its subject, or be reflected along some neighbouring or histologically continuous nerve structure on the same side, or, it may be, by symmetrical extension on the opposite side, to continue its rodent progress, and reduce the citadel of life to complete capitulation by continued devastation of its vital defences. Thus sometimes, after years, it may be, of molecular "sapping" and "mining" or neurolytic activity, the strongest and healthiest body inevitably crumbles, and finally perishes, from the attacks of its own forces, delivered against its own defences with inexorable precision and sustained determination; an occurrence only comparable to that of lethal and fatal systemic autotoxis and devitalisation, to be met with in certain conditions of vitality and body hygiene. Applying this method of etiological analysis to the explanation of the origin and progress of cancer or malignant disease proper, we are struck with its applicability and the manner in which it can be made to *clear up* many of the obscure problems involved in mastering its pathology and genesis; thus, whether cancer in any particular instance is to be regarded as a disease of external or internal origin, of microbic descent or dependent on the pre-existence of tumour germs, we see it deliver its malignant attacks along lines often, if not generally, marked out and differentiated by nerve distribution, indicating that in such instances it has obtained an entrance into the cerebro-spinal cavity, and delivers its attacks along lines secured by nerve distribution on the areas and structures involved; whence it follows that the *materies morbi* may circulate along the inter-neurilemmar spaces in the cerebro-spinal lymph, or along the true nervine elements, the medullary or axis cylinder substances, as a material *virus*, into the substance of the involved tissues or organs, or that the cause of the attack may be due to discharge of nervine energy on or amongst the molecular elements of the affected tissues,

in which latter case the cause may be called *dynamic*, and *not material*.

In this way we shall realise that the several observations and conclusions of those engaged in the work of research in this obscure department of pathological investigation are entitled to the greatest respect, inasmuch as each and all engaged in making them have been giving a true picture of their impressions and conceptions of what they have seen, and have each and all described an actual instance or instances of the many characters which cancerous disease assumes, according to the nature of the structure or structures chosen or attacked by it. The recondite theories which in these modern times have been advanced in explanation of its etiology and genesis, as well as its progress, will to some extent, we hope, be beneficially influenced by information obtainable along somewhat different lines, lines which, we claim, flow from the belief that the physiology of a structure, or of the whole organism, is the main determining influence in the shaping of its pathology in each and every diseased condition; altered structure, leading to altered function, in unbroken and graduated continuity, from the benign to the malign, from the ephemeral to the persistent, and from the slight to the fatal. The earliest possible pathological moment, with what it displays of pathological change in structure and function, must, therefore, be laid hold of, in order that the true etiological factors may be apprehended, their lethal work prevented, and effectual barriers raised against their further progress. In this way, we may hope, by a union of the physiological and pathological forces scouring this field of research, and the consequent strength derivable from united action in a common work, to obtain a clue to the discovery of what cancer, as a morbid entity, really is, as a means of accomplishing its prevention or effecting its cure. It seems to us that here both time and effort are being to some extent dissipated in a comparatively futile attempt to obtain a knowledge of the cause or causes of this most destructive disease, amid the structural ruins left by its agent or agents, *after* the work of destruction has been accomplished, and the real culprit, or culpable agency, had disappeared from the scene; viewed thus,

it would appear that what is discovered of the etiology of the disease is not its real cause or essence, but the remains of some of its weapons of offence, bacterial developments, embryonic survivals, and others, amid the surroundings of pathological débris and debased function.

Underlying and determining the fell work of cancer, as well as rodent ulcer, we are deeply impressed with the idea that *primarily altered and disturbed dynamic equilibrium* is operative in bringing about the material pre-pathological or preparatory conditions necessary for the operation of the specific etiological factors, whatever they be, and whenever they "assume the aggressive"; without this preparatory, disturbed and altered, dynamism, local or general, we are strongly of opinion that no mal-formative or pathologically organic departure can take place in any tissue or organ, and that no disease process can be permitted to exist, so long as the physiological condition of the organism, locally and generally, is maintained. The conditions of tissue or organ, known as physiological and pathological respectively, insensibly merge into each other, and which, being taken as axiomatic, it follows that in our investigation of diseased conditions such as cancer, we must be prepared, along the *debatable lines of structural union*, to turn over, first to one side and then to the other, the structures involved, and to view them alternately as physiological and pathological entities, in order that we may arrive at scientifically justifiable, if not absolutely correct, conclusions. It is an interesting but somewhat disconcerting deduction to make from the theory of distorted and altered dynamism, as a disease factor, that man—as well as all living organisms—bears daily about with him the elements of his own destruction, the letting loose of which leads to the production of disease, and its continuance to death. Man is thus heir to two methods of self-destruction, viz. autotoxis and auto- or neuro-cution, to coin a term, depending on conditions, flowing respectively from his material and dynamic component parts in both their independent and related aspects and bearings. The physiological working of vital energy on organic plasma results, in the state known as health, in normal growth and tissue sustenance, while the patho-

logical working of vital energy on organic plasma results, in the state known as disease, in waste, decline, or atrophy, or in increase or hypertrophy, according to the formative proportions of the pathogenic elements of growth, both dynamic and material, or by the perversion of these elements of growth into a condition known as heterogenesis, in which come to be displayed, in one form or another, organic structures of greater or lesser malignancy, according to the position and character of the structural elements involved, and the length of time to which the diseased process has extended. By the degree of normal inter-action on each other of the formative elements of vital energy and organic raw material, a normal or healthy tissue is involved, while the want of that normal inter-action results in the evolution of an abnormal or unhealthy tissue, in proportion to the character and duration of the abnormal condition, which may be either atrophic, hypertrophic, or heterogenetic and malignant, and may consist in, or arise from, want or superabundance, or the perversion of either or both elements—the dynamic or the material.

The heterogenetic or malignant, therefore, emanates from the normal tissue elements, on conditions entirely dependent on the formative elements, plus the influence of altered metabolism, due to the departure from normal inter-action of these elements—the physiological giving place to the pathological, along lines defined by histology and anatomy, and, therefore, necessarily conformable to existent morphology in each and every instance.

The human body *par excellence*, composed as it is of two distinct systems of dynamic and organic machinery, so to speak, actuated and operated by the sympathetic and systemic nervatures respectively separately and in conjunction, is liable to break-downs emanating from one or both of these systems; hence it becomes a scientific necessity to discover the “sequence of events” constituting the particular example of disease on which attention for the time being is being bestowed, in order to arrive at definite and correct conclusions, on which to found a treatment by which it may be possible to rectify the faulty working of these organic machineries, so far as it is possible to do it,

by the adoption of scientific means, intrinsic as well as extrinsic, medical as well as surgical.

The neuro-organic dual control here indicated, although an element of safety for the preservation of life in its daily occurring and recurring exigencies, may be conceivably an element of danger, as, for instance, where the lethal influence of systemic neuro-dynamic outflow, along unaccustomed paths or in unaccustomed quantity, may destroy the integrity of the textures invaded, whether they belong to that system, or whether, as most likely, they belong to the other partner, the sympathetic; thus epilepsy, from its very intensity, may absolutely destroy life almost at once, and thus rodent ulcer may destroy molecularly or piecemeal the combined or dual structures, both diseases being self-centred, if not self-initiated. Much the same may be said of cancer, with the addition that, instead of destruction and immediate dissolution and outcasting of texture, it keeps in pathological being and textural continuity the various structures and organs attacked by it, their final dissolution being thereby delayed until the physiological barriers opposing it are absolutely broken down and levelled, as a mass of pathological *débris*, amid a scene of dynamic confusion and chaos—an example of the morbid siege and ultimate reduction of the human citadel, by one of its fellest enemies, of the most tragic and complete description known to medical science, and surely deserving of the utmost efforts of philanthropy and sympathetic humanity to mitigate and, if possible, remove.

Under such circumstances it behoves us to keep fast hold of first principles as guides along the dark and unilluminated way open to the pioneers of research in this “dark continent,” where lurk the felt, but unseen, and malignant foes of humanity, and if these first principles are but rush-lights in a darkness intense as midnight, it further behoves us to replenish the supply from whatever source is available. We, therefore, feel warranted in producing what we think may become one of these, and offering it for use, so far as it will go, and so long as it will last, in order that the work of exploration may be even fractionally assisted. This rush-light of first

principle is the recognition of the fact that there can only be in malignant disease, as in all disease, the collision or friction of two factors, the material and dynamic, and a resultant pre-pathological disturbance of, and disparity in, the working of physiological organic statics and dynamics, which may, or may not, lead to a sustained pathological working of certain structures and organs, and to the establishment of fully evolved malignancy. The recognition, therefore, of the circumstances constituting this premonitory disturbance, disparity, and friction in the material and dynamic working of the human organism, is the great end to be aimed at primarily by research, as the prevention, and not the cure of the disease, will then only have to be dealt with, while the way to remedial success may simultaneously be brought into clearer view, if not practical realisation.

From all which it follows as axiomatic that, if the physiological material and dynamic balance in the working of the human organism can be constantly maintained, no disease, innocent or malignant, can exist, and that, if unhappily that balance is but temporarily impaired or lost, it equally follows that disease is beginning, or has begun, and that the incidence of that disease will depend on the nature of the influence or influences by which the balance has been destroyed, while the later stages of the disease so commenced must be evolved by the vital condition of its subject, and the character of the accessory morbid influences and agencies, material and dynamic, active and passive, live and dead, which are then naturally *present at*, or subsequently *determined to*, "the scene of operations."

In the evolution of disease it must never be forgotten that the two usually co-operating agencies, dynamic and material, have for the time being ceased to work in harmony, with the result that the scene of their combined operations ceases to be characterised by functional and organic order and normal material disposition, and assumes an appearance of spasmodic effort, in-coördinate and purposeless, as to function and destruction of material or structural integrity; we will thus, on coming critically to examine the "condition of things" brought about by this

morbid occurrence, be necessarily confronted with only the material remains of the catastrophe on which to expend our pathological acumen and to elicit the nature of the disease process—the dynamic factor in that process having disappeared, as the electric discharge does in the thunder-bolt, which is afterwards only known by the wreckage it leaves behind. Remembering this, it will necessarily be found that microscope and crucible have their limitations as instruments of discovery, and that they require to be strengthened, supplemented, and corrected by a ceaseless appeal to physiological aid and clinical support, in order that the factors of morbidity may be discovered and seen at work, their respective powers for evil appreciated, restrained, and neutralised, and their continuance prevented.

In accomplishing this, it will be perceived that the principal partner in the *combination of disease factors* must be the dynamic, which is at once the arranger and administrator of the vital business affairs, so to speak, in a work in which the capital of the sleeping partner becomes the subject of the firm's operations, and which, if prodigally used, in time will literally fail.

In this work outside influences, such as science, may, if called upon to indicate and supply, do something to prevent the inevitable collapse, which must overtake the working of all such firms by the adoption of means to correlate the working and conciliate the *amour propre* of the partners, so as to give a fresh start, and literally a "new lease of life" to the firm, which here signifies the restoration of a diseased body to a state of health. In accomplishing such a great work, our scientific efforts must be dominated by a strict adherence to indications, based on as true a knowledge of nature's ways as can be obtained from the strictest scrutiny and the use of not only the keenest observation and best directed experiment, but the most liberal application of "common sense." If it be found that the material, or sleeping partner, has suffered in what he has contributed to the firm's work, by shrinkage, or depreciation of capital, the restoration of that capital to its original proportions and quantity must be sought for by every legitimate means, and if the quest be successful,

good and well, but if, after every legitimate effort towards that end, it fails, then it behoves the directing partner no longer to attempt the impossible, on the principle of "putting new wine into old bottles," but to accept the inevitable and become accustomed to work in "reduced circumstances," which, in other words, means that a failing material capital must not be destroyed at the expense, or by means of, an artificially strengthened and accelerated dynamic expenditure.

We must, therefore, regard it as a sound principle not artificially to overstimulate a failing brain and nervous system by infusing into them alien dynamic influences, or over-increasing the crippled output and exercise of ordinary nerve energy, but rationally to slow down, husband, and regulate the currents of physical and nervine work, in accordance with the necessities of reduced organic ability, by courses of graduated mental massage, so to speak, and the dynamic influence of restricted nervine effort and modified cerebration—in other words, "spur not a done horse," but give him food and rest first, and exercise afterwards.

EXTRACT XIII. A.

ZYMOSES WITH REFERENCES TO PARASITISM, CONTAGION, AND INFECTION. ALSO ON ENGLISH AND ASIATIC CHOLERA, SO CALLED.

PARASITISM, contagion, infection,—what a combination of living pests is here grouped! Yea, it is sufficient to make the strongest thinking member of the human family shudder and shrink! Yet we get accustomed and callous, it may be, to our future avoidable, but now inevitable, companionships, and can bear critically to regard them as no doubt possessing some necessary, but at present undetected, *raison d'être*, which consequently it becomes our duty to discover and turn to proper utilitarian account.

Parasites, in gaining a human home, are usually implanted or swallowed in embryo, contagia attached, by adhesion to, and penetration of, the peripheral and inner surfaces of the body, and infections wafted into its interior in contaminated air, each mode of entrance originating an organic pathogenic agent possessed of *specific living qualities*, enabling it to live a life of dependence on its host, and to perpetuate its species, according to the laws of heredity and the battle of life.

In pursuing the subject, we shall mainly regard it from the point of view of the general subject of zymosis.

By this term, if it be permissible to use it, we mean that morbid etiological process, which is continually exhibited as a health disturbing and destroying factor throughout a large extent of the better understood morbid entities of

life generally, and in a constantly increasing number of the diseases affecting the human organism in particular, as they become better known in their nature and essence, as pathological research is brought to bear on them. The process implies that a more highly organised body may become tenanted by another body of a more lowly organised order, the latter multiplying itself and procreating its species at the expense of the former, thereby affecting its health, and sometimes even destroying its life.

The diseases thus affecting the human species are numerous, widespread in their incidence, and often most fatal in their consequences. They embrace a wide range of morbid conditions, febrile and non-febrile, local and general, and are due to the invasion of a part or the whole of the infected organism by a microbe or bacillus, which lives and multiplies according to its generic and individual character and nature, and whose incubation, growth, and continued presence or expulsion synchronise with certain conspicuous features and well-marked stages of the resultant zymotic condition. The natural history of many of these disease-producing organisms is now well known to science, and has given a name to a department of biology known as bacteriology, the future of which seems likely to be fraught with eminently beneficent results to the human race, and its immediate lower relatives, in the very possible and highly probable additions which are likely to accrue to preventive as well as curative medicine from the continuance of its progress along definite and scientifically dictated lines.

The first diseases to be understood, described, and classified as zymotic were the fevers, exanthematous and non-exanthematous, but others have constantly been added as bacteriological knowledge has increased and become more exact, until now they have become one of the largest groups of classified morbid conditions amongst the authentically proved and accepted category of human ailments. Moreover, besides the, what may be called, systemic constitutional or general zymotic diseases, a large class of local diseased conditions may be dominated local zymotic, as distinguished from the grosser parasitic, or non-zymotic, ailments, as respective types or illustrative

examples of which we might adduce erysipelas and scabies.

The primary or immediate effects of zymosis consist of those resulting from the foreign organic or microbic invasion, and its destructive and disorganising influence on the living textures, the vital properties of which become impaired and perverted, the secondary effects being those due to the continued presence in the affected textures of the bodies attacked, of the toxins, to which the growth of the zymotic or microbic agencies give rise.

The zymotic germs or organisms may attack their human hosts in many ways and along numerous paths, in fact, along every inlet to and outlet from their bodies; they may thus be air-borne, water-borne, or hidden within the articles of food and drink consumed, or they may enter by every chink in the external covering and protective envelopes of the body, as well as through the linings of its hollow viscera; but however the invasion be effected, and whether by foraging scouts or a whole army corps of the "locust brood," the overrunning and occupation of the invaded structural territories become the final result.

A few of the main lines of zymotic invasion and attack may be enumerated and considered in more or less detail, and first, we, following our last paragraph, would refer to the air-borne microbes, which effect their entrance by way of the respiratory organs—and by the respiratory organs we mean the whole mucosa lining these organs, from the nasal passages and accessory pneumatic cavities of the face and head, to the minutest pulmonary vesicular spaces. In the extent of assailable surface included in this area, there are abundant points where invasion can be accomplished with a minimum of difficulty, and we find that these points are taken advantage of by the bacterial invading forces; thus the nasal fossæ, with their communicating air spaces, offer an ideal surface to which air-borne spores can adhere, and, if not molested or removed, grow and develop, by continuity of medium and pabulum, along the olfactory inter-neurilemmar spaces into the inter-meningeal spaces of the cerebro-spinal cavity, and by the intra-olfactory passages into the associated lateral ventricles and other intra-cerebro-spinal spaces. Thus, also, the glosso-pharyngeal

mucosa affords a wide area for the growth of microbic organisms, and a ready means of reaching a channel of entrance to the cerebro-spinal cavity and third ventricle by the pituitary apparatus.

Thus, moreover, but not directly through the nervous system, does the laryngeal, tracheal, and pulmonary mucosa lend itself to the passage of hostile organisms into the blood circulation with which it is overspread and interpenetrated, and where, especially in the calm vesicular pulmonary recesses, in which rests the residual air, a fitting repository is found for the lurking and breeding of unsuspected lethal bacillary organisms, in "miliary" proportions, which are destined in the future to break their barriers, join their contingents, and overrun and annihilate their host.

From the above it will be seen that air-borne bacteria attack primarily the nervous system in the first two methods of invasion, and the blood in the third and last; it must, therefore, follow that the organic media first overrun must be the cerebro-spinal lymph and the blood respectively, and that the germinal pioneer broods incubate there, and thereafter traverse the invaded organism along the lines of least resistance, and finally effect an exit by eruption into neighbouring not yet invaded areas, or on to the limiting or "bounding" surfaces of the body, external and internal. The lines of invasion, the media of incubation and growth, and the means and places of exit of the peccant organisms, are, therefore, determined by anatomical structure, physiological affinities, and histological continuity of circulatory facilities—moreover, the characters of the resultant morbid phenomena are consequently moulded by the same genetic conditions, together with the differing zoological, botanical, and other features of the various bacteria. In this way the *viri* of such varying diseases as influenza, diphtheria, and tuberculosis effect an entrance into the systems of their victims, incubate, develop, and remain, or are thrown out, according to definite genetic conditions.

Water-borne bacterial organisms have a more limited "sphere of influence," but yet one sufficiently wide to enable them to effect dire injury on whole populations

where the indispensable element of water becomes contaminated and where its choice is limited. Drinking water thus becomes the principal representative of the media by which such organisms are conveyed within the bodies of their victims, and its most lethal microbic organism is the *comma-bacillus*, or cholera germ. The manner and methods of its attack have been described so fully that a great literature is now claimed by it, and yet it cannot be said that it is satisfactorily understood—thus its geographically determined varieties are sometimes not founded on generic differences of bacterial organisms, but on climatic and other influences affecting the growth, virulence, and septic qualities of, in all respects, identical organisms. We, therefore, sometimes find that a local outbreak of British cholera, or summer diarrhœa, is in no way distinguishable from Asiatic cholera in the fatality of its influence, the character of its *materies morbi*, and the symptoms to which it gives rise.

In illustration of the truth of this statement I would adduce the following personal experiences in which my own services as Medical Officer of Health were completed by those of Professor Klein, Bacteriologist, and Dr. Bulstrode, Inspector of the Local Government Board.

The findings of Professor Klein, after an examination of the excreta of the first and last cases, were to the effect that the bacillary organisms discovered were “indistinguishable from those of Asiatic cholera.”

This outbreak proves that the disease can be self-renewed in the same individual by the preservation of septic cultures from a patient's own excreta. Moreover, from this point of view we may be warranted in inferring that the *dried residue* of choleraic diarrhœa might be spread atmospherically, might remain dormant for a period, or until the required conditions of heat and moisture being renewed a re-growth is effected, by which the disease may again be spread.

This is the experience referred to which I take the liberty of quoting from my final report on the subject to the Local Government Board.

14th November, 1893.

To the

Secretary of the Local Government Board.

SIR,

IN continuation of my report of date October 4th, relative to an outbreak of "Choleraic Diarrhœa" at Low Moor, North Bierley, I have further to report, that the outbreak seems now to be at an end—no case having occurred since the death of Mrs. Law, Morley Carr, on the 9th of October.

Altogether, six cases of the disease occurred, and six deaths—the names of the victims being as follows:—Edmund Wood, aged 20 years; Mary Wood, about 42; John Wood, 42; Jane Stocks, 39; Mrs. Lockwood, and Betty Law, 71—the first three were son, mother, and father, the next two were sisters of Mary Wood, and the last was a neighbour, who assisted in nursing.

In arriving at a solution of the etiology of the outbreak, I have been unable to trace to any Asiatic source, or to contaminated water, milk, or food supply, neither have I been able to make out its connection with any preceding cases of the disease. I have, therefore, been led to believe that there has been something like "cause and effect" in the following circumstances: I am informed that Edmund Wood, the first to be affected, was the subject of "Chronic Diarrhœa," or what his friends called "consumption of the bowels," and that he sought relief for this in a "change of air" to Southport. On leaving he took with him (and this seems to be the point of origin) a quantity of napkins, or diapers, to prevent the accidental soiling of his clothes, or of the bedding in the lodgings to which he resorted.

These napkins, or diapers, when they became soiled, instead of being destroyed, were returned to the box from which they had been taken, and brought home with him on his return—meanwhile the contents of the box were no doubt the scene of the growth, or "culture" of organisms (*comma-bacillus*), which simply required a suitable soil in which to develop and perpetuate themselves, and this was supplied by the lad himself and his immediate relatives, whose office it was to wait upon him.

The opening of this box, thus, seems to have originated the outbreak, and appears to demonstrate that our own country can grow a "*materies morbi*" as lethal and destructive as any that can be bred in Asia.

I am, Sir,

Your obedient servant,

(Sd.) THOMAS LOGAN.

In view of such common characteristics, clinical, bacteriological, and general, we think we are warranted in insisting on the adoption of a classification and nosology which will more strictly accord with the requirements of science, and be less misleading in its bearings on the choice of the preventive and curative lines of treatment most likely to be successful in obviating the occurrence of epidemics of the disease and securing its extinction on its earliest appearance.

The retention of the terms Asiatic and British, as indicating two different diseases, is not warranted by fact, and can consequently not be continued without violating an essential necessity of all scientific progress, viz. truth. We would, therefore, urge that our nomenclature here requires overhauling and modification in order to bring it up to "the requirements of the times" in both a utilitarian and scientific respect.

Zymosis, besides typically delivering its attacks on these main lines, invades the human body by "sapping and mining" through every loophole or vulnerable point presented to the outer world, and many a disease owes its origin and development to the stealthy invasion of a single channel, or, it may be, a few lymphatic spaces and associated vessels, as, for instance, hydrophobia, where it attacks its victim through a single opening into the cutaneous tissues, through which its *virus* finally reaches the cerebro-spinal lymph cavity, either by way of the nerve vasculature directly, or by way of the lymph vasculature into the blood vasculature, or by way of the blood vasculature into the cerebro-spinal cavity and contained nerve structures indirectly. According, therefore, to which of these lines may be traversed singly or in combination by the *virus*, the time of the manifestation of specific symptoms is determined, and the time for prophylactic treatment regulated. Zymosis here seems to be effected by a comparatively limited and slowly progressive bacterial growth along definite anatomical and histological lines, neural, lymphatic, or hæmal, and to manifest itself in the production of the characteristic symptoms in consequently most irregular fashion and at most uncertain intervals, according to the length of distance traversed by the poison and the

extent of the initial tissue and vascular invasion. The fundamental necessity for the final delivery of the specific attack is that the cerebro-spinal lymph should be zymosed, so to speak, by the hydrophobic bacteria, and tainted by their toxins to such an extent that the encircled and interpenetrated neighbouring brain (but especially "the medulla"), cord, and nerves become literally saturated and intoxicated with the specific *virus*. On this occurrence nothing but the preparation of the subject of the microbic invasion for withstanding the attack and development of the terrific phenomena of this fell disease, by the renowned method of Pasteur, can offer any specific hope of averting its inevitably fatal termination. We, however, now have every reason to rejoice that science even here is offering such well-founded hopes for those unfortunate enough to contract such a *fearful* disease, and to the world generally that there is a possibility that it may in time "cease to be."

Zymosis may confine itself to a single structure, or series of structures, may begin and end there, or may, by continuity of the involved textures with neighbouring textures, continue its destructive course indefinitely, as, for instance, in certain lupoid affections and ulcerative processes as well as "fungating" surfaces. Zymosis may, moreover, begin and continue a local invasion along a single line into the blood or lymph streams proper, or by nervine channels into the cerebro-spinal lymph, thereafter effecting an exit along the same or other local lines without producing more than a minimum of constitutional disturbance or more than a local effect or an entirely local discomfort. Zymosis is, therefore, a process varying in the intensity of its effects from the most ephemeral and mild to the most prolonged and malignant, according to the media and textures invaded, and according to the character of the invading organism, as to rapidity of growth, reproduction, and spread, and the intensity of the virulence of action of its toxins on the structures and physiological processes involved.

The parasitic, contagious, and infectious agents now known to science represent a wide field of natural history, and comport themselves in their pathogenic work in a great variety of ways, and deliver their specific attacks on

almost every individual tissue and organ. Thus the parasites sometimes live in common with their hosts on the elements of the common food supply, while sometimes attaching themselves for sustenance to particular structures or organs, the contagious taking more or less general possession of the total liquids and solids of the body, and the infectious comporting themselves according to their local and general likes and dislikes; they thus attack among them, in general or in detail, the whole organic elements, either in organic mass, in structural division, or cellular unit, and hence, roughly, they are divisible into fully developed and differentiated organisms, cellular communities, or uni-cellular organisms, and organised particles capable of intra-cellular life and development, and so, individually, they are able to annihilate *en masse* or reduce in detail the strongest body and the most resistant structures, the last mentioned being able to effect the process of absolute disintegration of organised matter, plastic or solid.

Zymosis and sepsis are thus to a considerable extent identical in meaning, and signify, in preventive and curative medicine, an extent of area of ever rapidly increasing and widening proportions, but an area, nevertheless, which the rapidly progressive march of bacteriological knowledge and research are coping with in the most hopeful manner, and demonstrating that the trend of progress in medicine is ever towards prevention of disease, through the discovery of its causes, and the application of scientifically devised means of prohibition and neutralisation. Therefore, we feel warranted in holding the opinion that as thus much of the disease and suffering to which "human flesh is heir" is likely to be eliminated from its long category, and finally, barring accident, that there is, or will be, a chance given for man to live to the full extent of his attainable existence before yielding to the incidence of old age and final dissolution.

EXTRACT XIII. B.

ON SMALLPOX.

THIS is a disease of a typically contagious and infectious character, and as an example of the acute varieties of the exanthematous and zymotic diseases it might appropriately be appended to our general treatment of the subject of zymosis.

It will be noticed that it is both *contagious* and *infectious*, being able to effect an entrance to the bodies of its subjects through the media of the air they breathe, the liquids and solids they consume, and by direct *surface acquirement* through personal contact with the *materies morbi*.

The disease is so well known, and has been so much and so long in the public and professional eye, that any allusion to its clinical character and treatment will not be here necessary; we, therefore, merely venture to refer to a few of the aspects of the subject so far as they relate to the views we are promulgating; and, in doing so, it may best meet our requirements if we recapitulate the main features of a case with which we are familiar. The case is as follows:—J. D., a young commercial gentleman of splendid physique and athletic attainments, in the course of business was ushered into the room of a gentleman who had been but a short time unwell, but who, as it turned out, was at the time developing an attack of variola, and who, as is generally the case in severe confluent smallpox, was profoundly “poorly.” He talked for a short time with his affected host, and on bidding him good-day and leaving, he suddenly became aware of a

peculiar and, to him, very disagreeable odour, which seemed to emanate from the bed, which he had *not touched*, or from the gentleman himself, whom he had *not been near*. This odour continued to "haunt him" and to draw his attention to its probable source or cause, when he remembered he had seen the gentleman turn in bed at the time he felt it, and, in the movement, that the bed-clothes were tossed about, and he became satisfied that that must have originated it; meantime, while trying to forget the circumstances, he became aware of unusual feelings of discomfort, and "sickened" so as to be compelled "to take to his bed," learning, at the same time, that his friend on whom he had called had developed a severe attack of smallpox. For some time he continued "better and worse," but ultimately became the subject of a dangerous attack of the same disease, which also became confluent, and, after running a protracted course, subsided, leaving him deeply pitted, but otherwise absolutely well.

We now enquire, whence came the infection in this case? and we are satisfied that the answer should be, "from the gentleman on whom he called"; nevertheless, it may be best to advance our reasons for the belief, seeing that absolute certainty in such matters is impossible. And these reasons are the following: The subject of this record was, at the time of infection, in the best of health, and had not been, so far as he could discover, in the neighbourhood of the disease; he had not touched the body or the immediate belongings of his friend who was unwell, but he had breathed a "fetid air" which emanated from him, and which made in reality a deep impression on his *olfactory* mucosa, and here is the *fons et origo* of his attack of variola, the factors operating in some such way as this—the subject, from whom the infection emanated, had begun to throw off a brood of variolous microbes in the perspiration of his skin, which was on the eve of showing their presence by *unmistakable* eruption, and these had "taken wing," so to speak, in the vapourised or insensible transpiration, and, *floating in the atmosphere* confined under the bedclothing, waited their chances of freedom, which arrived at the time and by the means mentioned, when, "as luck would have it," a "new start

in life" immediately presented itself to the disengaged microbes, on which they were "not loth to seize," and in which they perpetuated with unabated vigour and renewed strength a further brood of young pathogenic organisms. These are the "main facts of the case," and, we think, there is little doubt but what they prove the whole sequence of cause and effect.

The nasal mucosa, being the main route by which the microbes reached the cerebro-spinal cavity, where they incubated and grew, in the medium of the cerebro-spinal fluid, renewing their journey into the outer world along the lines of least resistance, which were those of the inter-neurilemmar spaces, and finally succeeding in destroying beyond repair the tissues composing and surrounding the peripheral sensory "nerve endings," thus leaving both a continuous internal record in secured immunity from further attack and a legible external record, which not only variolous microbes, but the human species can read and "take note of."

EXTRACT XIV.

ON THE "*VIS MEDICATRIX NATURÆ*."

THIS phrase must be of considerable antiquity, and its origin would be of some interest to know, inasmuch as it points back to a time when the educated man had begun to differentiate between the various agencies responsible for the restoration to health of the diseased and maimed, and to a period in the history of medical science when the deeper aspects of biological processes and things generally were beginning to present themselves for solution and practical appraisement and application. It, moreover, indicates a growing belief in the minds of thinking men in the powers of nature, not only to cause disease, but to effect its removal, to produce the bane, and to provide the antidote.

Nature, in evolving living forms from inert matter, made each form perishable and ephemeral, embodying in it the co-working of the principles of life and death, both of which principles are absolutely essential in the great evolutionary processes of advancement of type of organisation, and the effacement of imperfect adaptation to altering environment.

In the process of organic evolution, the *vis medicatrix naturæ* may be regarded from two different standpoints, according to the two aspects from which we may study its operations throughout the broad field of *animated nature*, the one aspect being the origin and perpetuation of living forms, the other aspect being the limitation of individual living forms to more or less exactly defined periods of time and areas of space.

The origin and perpetuation of living forms may be regarded as the dynamic aspect of organic evolution, while the disappearance or cessation of living forms, as they make room for the appearance of others, may be regarded as the adynamic aspect of organic evolution. The two processes are complementary of each other, and must be regarded as equally necessary and essential in the great process of organic evolution as it unfolds itself in "the struggle of life" by the "survival of the fittest."

The "survival of the fittest" is the result of every organic struggle, whether it takes place in the evolution of the various individual forms of life or in the evolution of the members, organs, and structures of the individual organism within itself, and represents on all such occasions the occurrence of an exhausted or adynamic residuum of degenerate or "used up" organic units. This degenerate or used up residuum, which results from every such organic struggle, becomes a source of danger to the surviving organic units and individual organisms, if retained within or in close proximity to them or their living and functionally active structures; it, therefore, becomes a necessity that a machinery should exist by which all such residual material can be removed from the "scene of the struggle," to provide an unincumbered "field," if "no favour," for the continuation of this perpetual organic warfare.

Within the individual organism this machinery exists as, and is actuated by, the *vis medicatrix naturæ*, with the intent that the life of that organism may last to its utmost possible limit—the operation of that force, if unopposed, being just able to prolong it to that extent, so as to obviate the loss or waste of that organism before it has accomplished the work of which it is capable.

This machinery and power, although existing in every vital organism, cannot definitely be separated from its other vital machinery and powers, and subjected to such separate scrutiny and experimental testing as will enable us to make use of it definitely in the treatment of the many "ills to which human" and all "flesh is heir," nevertheless, we are warranted, and called upon, to make use of every fragment of inductive evidence we can obtain on the subject, and every fact which in any way can be said to be

deducible from the study of it, to enable us not to "run counter" in our attempts to aid the operation of the *vis medicatrix naturæ*, but to mould "our line of conduct" with an eye to combined action and co-operative influence with it. The *vis naturæ* having done its work absolutely well or physiologically correctly in vitalising and moulding into organic form the protoplasmic elements of the fecundated ovum, and in superintending the various stages of embryonic, fœtal, and pre-adult growth by the aid of the *vis medicatrix naturæ*, it lays the foundation of a future health which, if unassailed by morbid agencies, is calculated to last, in the human species, to "three score and ten years," and, according to the experience of every generation, to "four score," or even "the round century."

This result is frequently obtained by the unassisted operation of the combined *vis naturæ* and its constantly associated *vis medicatrix*, and may be regarded as the natural goal which all humanity is legitimately entitled to aim at gaining, by these agencies alone, but, if required from any cause or combination of causes opposed to it, then by the assistance of science and art.

The *vis naturæ*, as the fountain of organism or formative force, and the author of vitality, utilises almost all the known forces, combining and opposing them, and harnessing them to the machinery of life in the accomplishment of the great organic work of evolution. Should these forces suffice for the ends of life and health well and good, but should they not, then the *vis medicatrix* is called in to meet the difficulty and to arrange for bridging over the temporary *impossible* by the addition or substitution of other and perhaps exceptional modes of force. The organic *vis naturæ* being a compound of mechanical, chemical, and physiological modes of force, with that specific residuum of force or forces known as vital, requires for its "field of operations" a combination of organic units, material and dynamic, specifically adapted and mutually arranged so that their inter-dependence and co-operation will result in "life," "organism in action," or that which answers to any other definition of the phenomena called "vital," known to science. It operates by trituration of the solid materials of the food, admixture of these with

the juices of the mouth and fauces and fluids imbibed, mechanical agitation by intestinal peristalsis, and still further admixture, chemical action and reaction, with resulting changes of composition, physiological or vital, including those of metabolism or nutrition, and resolution or disintegration, secretion, and excretion.

When the sequence, mechanical, chemical, and physiological, of these factors and their work becomes faulty, the *vis naturæ* takes to its aid the *vis medicatrix*, in order to re-establish the *status quo ante* and maintain the conditions of health and continuity of life, hence we find, under such circumstances, that a change of alimentation is effected, a modified digestion is accomplished, an improved aëration is introduced, and that such improvements are wrought in the details of metabolism that physiologically perfect nutrition is once more in evidence in all its details, with its usual concomitants of health of body and soundness of mind.

In the performance of this work of aiding the *vis naturæ* to re-establish the condition of health, it is most interesting and highly instructive to notice the methods of procedure of the *vis medicatrix*, and the agencies it employs in its beneficent work. Thus, it may be noticed to appeal to merely mechanical force, as when it excites hyper-peristalsis or anti-peristalsis, as suits it best, to altered methods of the use of chemical force, to modified forms of the use of metabolic energy, and to a modification and redistribution of the secretory and excretory physiological forces, in order to meet special wants and necessities. Its methods of procedure are necessarily determined by the necessities of the individual occasion, and may require for their carrying out the single or combined use of one or more mechanical, chemical, or physiological agencies, such as increased muscular action of the intestine and blood vasculature, improved oxygenation, local or general, increased phagocytosis, toxicity and anti-toxicity of body fluids, with improved organic hygiene and the procurance of freedom of exit for all excretionary matter from the intestinal canal in its whole extent—lungs, kidneys, and skin. The *vis medicatrix*, having tried one agency, or set of agencies, and failed to procure the needed effect, tries another and

another until it does succeed or is finally baffled, leaving "no stone unturned" in its beneficent procedure, and only yielding to compulsion.

In this latter dilemma, if science and art come to its aid, it behoves, in the first instance, that the natural history of the "occurrence" in which it has been engaged should be as fully mastered as possible, in order that the proffered aid should come to its assistance in the way and by the method best adapted to help its always beneficent intentions and actions. In this way alone is it possible for the ameliorative, curative, or preventive measures dictated by science and applied by art to be made available for the assistance of the *vis medicatrix* in its supervision and maintenance of the health of the individual and the community, and for the attainment of that complete immunity from disease, which has been the dream of the sanitarian of every age, to be made a final reality over the whole surface of the globe.

It must also be borne in mind by the ardent student and the conscientious busy practitioner, that "credit must be given to whom credit is due," and, therefore, that the *vis medicatrix* should be credited with performing the major part of every operation and medical procedure having for its object the removal of disease and the restoration of health, and that it is the most arrogant and faulty conduct to assign to science and art the entire credit on the principle involved in merely *post hoc, ergo propter hoc*, reasoning on, and estimation of, facts.

Reasoning on, and estimating, the facts embraced in the study of any morbid entity and its elimination on these lines, we are persuaded that a much higher position will be given to the influence of the *vis medicatrix naturæ* than has hitherto been assigned to it, and that the interests of medicine and surgery will be best served by their devotees being saturated with a humble spirit of imitation and subserviency in all their efforts to enlarge the boundaries of their respective callings, both scientific and practical.

It would, therefore, many a time be better were the surgeon and physician to sit with "folded arms" as intelligently watching as he possibly can the progress of events than by *haphazard* to venture into "the arena," where a

closely-contested combat is being waged between the *vis medicatrix naturæ* and a very obscurely visible and subtle morbid foe, at a time of crisis, or when the palm of victory is on the point of being awarded, perchance, to the beneficent combatant, lest the tide of battle should be turned in favour of the malevolent combatant, and the efforts of the beneficent undone. Be that as it may, however, we firmly believe that, "given a fair field and no favour," the *vis medicatrix naturæ* will, in the great majority of its contests with disease, be found the vanquisher, and that it is alone in those cases where the position of the opposing forces can be *descried* that medical and surgical relief can be most successfully offered, and where the results, if good, can be claimed as well won victories, and added to the undoubted and properly conferred laurels of applied medicine and surgery.

We must, therefore, at all times ally ourselves with the *vis medicatrix naturæ*, seeking light and guidance from the arrangements made for the conduct of its engagements with the enemy disease, and the disposition of its forces, so as to be able to assist it where weak and liable to successful attack, and to guard it when and where possible from defeat. Doing this, and using aright our medical and surgical armamentaria, we may, and will, do *great things* in the limitation of mortality and the prevalence of disease, besides adding greatly to the sum of human happiness and longevity, or to the extent attainable under the present life conditions in their relationship to the competition and battle which must ever be waged, and, if possible, won, individually and communally.

A word of confession may also sometimes be made, and that is when we at first sight feel inclined to credit ourselves with the recovery of a certain patient, and begin to analyse it in all its details, we discover that the patient has recovered, not in virtue, but in spite of our best directed efforts. We, therefore, hold that, from whatever point we view the subject, we are fully entitled to mete out to the *vis medicatrix naturæ* the major share of the credit in the work of successful treatment of disease and amelioration of suffering: nevertheless, we are far from decrying or pooh-poohing the magnificent work done by,

and in the name of, scientific and practical medicine and surgery, but, on the contrary, claim that in these latter days both have advanced with "leaps and bounds," and bid fair, in the near future, to be the greatest influence for physical good that humanity has known.

In still further tracing the nature and mode of action of the *vis medicatrix naturæ*, we have been "impressed with the idea" that it, the *vis medicatrix*, is necessarily only a mode of force possessed by, or combined with, the *vis naturæ*, to be exercised in the supervision and accomplishment of organic hygiene and police, so to speak, and that it resides in, belongs to, and is operated by, the sympathetic nervous system; thus, should a stasis of forward or onward circulation, or a regurgitation of the circulated substances, take place anywhere throughout the organism, with a consequent admixture of the effete and fresh tissue pabulum, or a pathogenic crisis of any other character, take place, or should the organic continuity of any texture or organ be disturbed by traumatic or other agency, we observe sooner or later the play of medicatrix force on the pathological conditions, and sooner or later the restoration to physiological order of the disturbed organic elements—in other words, the natural cure of the pathological conditions so created. The systemic nervous system, under these circumstances, acts a completely neutral part, taking absolutely nothing to do with the problems of restoration to order of disturbed circulation, or with the repair of traumatic destruction. In many cases, in fact, the systemic nervous system is absolutely suspended from its work of conscious innervation by sleep or coma, leaving the sympathetic nervous system entirely alone to effect the organic operations required for the accomplishment of her never-ceasing functions of repairer and vitaliser of shattered and substituted tissue elements. In this work it, the *vis medicatrix naturæ* is engaged from first to last in every living form, sometimes, as in vegetable, and the lowest forms of animal, life, by a solitary nervous system, and sometimes, where associated with a systemic nervous system, aided by reason and intelligence.

EXTRACT XV.

ON THE HEALING OF WOUNDS BY "FIRST INTENTION," AND WHAT TAKES PLACE IN THE PROCESS OF CICATRISATION AND OSSEOUS UNION.

WOUNDS are of daily occurrence throughout both the vegetable and animal kingdoms, and are usually left to the management and oversight of the *vis medicatrix naturæ*, aided, it may be, sometimes, by the efforts, conscious or unconscious, of the subjects of them.

In arriving, therefore, at an understanding of the subject of the natural and unaided healing of wounds, it might be well if we could gain some definite ideas with regard to the manner of nature's procedure, and the instrumentalities or agencies she uses, so as, if possible, to become better able "to lend her a helping hand," without interfering with her plans, when called upon to do so.

We would, therefore, begin by asking, what constitutes a wound? A wound, according to our received teaching, is a "solution of continuity" of a texture or textures, usually the latter, inasmuch as, if it be "but a scratch," several textures must be involved in the traumatic occurrence, and, hence, we may describe a wound as *compound*, although it may be called *simple*.

The textures, or texture, wounded necessarily determine the character of the wound, or "solution of continuity," each texture showing a different manner of behaviour under the influence of traumatic violence, and making arrangements for the process of its healing on its own lines and according to its particular anatomical and histological structure. In every instance of wound, in whatsoever structure

or structures it may have occurred, the "solution of continuity," according to the distance separating its sides, the amount of interstitial injury, and the presence or absence of foreign matter in the wound, nature's plan seems to be to obtain in the shortest possible time the apposition of the severed textures, and this, when all is favourable, she does by "first intention," but if unable from any of the above or other unfavourable conditions to do so, she first removes these, and then proceeds to accomplish the process by second, third, or continued intentions.

When all the conditions for healing are present, she proceeds by obtaining, as nearly as possible, the exact apposition of the separated surfaces, and by renewing the continuity which has been dissolved by the traumatic influence by interpolating into the wound an organisable plasma or "mortar," so to speak, which develops into a bond of organic union, which more and more approximates the separated textures while it itself proportionately disappears. This organisable "mortar" or intra-traumatic plasma we would regard as largely the product of nervine exudation, sympathetic and systemic, because if sanguineous matter be exuded into a wound, it has to be removed or absorbed, minus, it may be, its organisable material, before the process of healing can go on, in the essential reparative matter or cicatricial elements, in which takes place the work of tissue reorganisation and restoration. Moreover, we are of opinion that the reorganising agency is none other than the sympathetic proper fibro-cellular texture immediately surrounding or entering into the traumatised area, and that it proceeds to the accomplishment of its benign work by sending out into the interpolated and enclosed or intra-traumatic plasma a series of proliferating cell organisms, which vivify and organise it, and by it readjust the separated and disorganised tissue elements—*spider cells* appearing in *reality*, and weaving into organised cicatricial tissue a medium of textural union so complete and lasting that its duration, with a few exceptions of pathological breakdown, is conterminous with the traumatee's life. This immediate union of traumatised textures may be taken as representative of healing by the *best*, if not absolutely the "first intention."

The other manners of healing, such as by granulation, may be generally classed as effected by a process of growth from the surface, or surfaces, of the traumatised area, or by what is called "second intention." Granulation may be described as a process of new growth, by which any loss of substance suffered by the traumatised parts is replaced by a cicatricial texture, usually of a lower type than the lost texture, but yet of such an order as to meet the functional requirements of the reunited parts, although, it may be, on a somewhat restricted scale. The process is effected by the reconstructive powers of the sympathetic nervature exercised in arranging and licking into organic form the exuded intra-traumatic plasma by a growth and proliferation of its cell elements with their uniting and anastomosing processes, and secondarily, by the interjection of vascular or blood-vessel agencies and the laying down of a fibrous groundwork of uniting tissue, with the concluding organic act in the regenerative developmental process of a more or less complete renewal of the cutaneous external enveloping texture.

On closely observing the character and histological elements of cicatricial tissue, it will become apparent that they are composed almost entirely of materials derived from the growth of the sympathetic nerve cellulo-fibrous reticulum into the intra-traumatic plasma by the proliferation of its cell elements and the anastomosis of the processes thrown out by the evolving cells. This description may be accepted as axiomatic when applied to the cicatricial results of healing by less than first intention, that is, by granulation, but as less axiomatic, or modified, when applied to those of healing by first intention, in which cases the sympathetic cicatricial elements are, to a more or less complete extent, inter-penetrated by the reunited systemic nerve and, it may be, neuro-muscular elements; functional as well as structural continuity being effected in the latter, while in the former, although structural continuity be effected, it is not followed by renewal of function, on account of the absence in the cicatrix of the systemic nerve elements and related musculature. The sympathetic nervature must, therefore, be recognised as the agent, material and dynamic, in the process of "healing of

wounds," and the production of cicatrisation in all cases of trauma, and should be allowed a "fair field," and as much "favour," as can be afforded, under the manifold conditions of its vital work, on the reunion, restoration of divided and more or less destroyed texture, and the new growth of substitutional tissue.

It may be remarked here that after excessive burns, where the systemic sensory nervature has been completely destroyed, and where, therefore, the new skin or scar tissue matrix is absolutely due to sympathetic materio-dynamic agency, the texture of that skin is irregular in outline, delicate and thin in histological character, sensitive to irritant influences, apt to contract and liable to suffer from ulcerative breakdown and keloid growth, all of which negative circumstances accentuate the importance of the presence of the peripheral systemic nervous system, as an external histological blend, for the sympathetic peripheral neuro-dermal elements to ally themselves with in all renewals of dermal tissue.

The restoration of function must be sought after in every case of trauma by the exact apposition, as far as possible, of the divided ends of the disunited textures, be they skin, nerve, muscle, or bone, organ or viscus, and the renewal of material and dynamic continuity: as far as possible, we say, because in the union of systemic nerve ends especially, there exist often insuperable difficulties, nevertheless, even then there seems a power inherent in or begotten of the materio-dynamic compact between the two nervous systems of passing nerve impulses across *neutral* barriers of cicatricial tissue laid down in the tracks of traumatism by the ever-watchful and inventive *vis medicatrix naturæ* through the materio-dynamic agencies of the sympathetic nervature, dovetailing, if not uniting, with those of the systemic nervature.

In the union of fractured long bones it has been observed that when the systemic nervature has suffered irreparable injury, it does not take place with the characteristic rapidity and completeness of unaffected innervation, and in some cases that it has not taken place at all. This observation is at first sight puzzling, but when we consider the physiology of the process of ossification in the

light of the preceding views, it becomes apparent that the "missing link" in the process of union is the absence of neuro-musculo-osseous plasma, due to the destruction of the systemic nervature of the fragments involved, the ossifying or earthy matter being wanting in the callus or material matrix of union supplied by the unassisted sympathetic nervature.

EXTRACT XVI.

ON METASTASIS.

METASTASIS is a term used to signify transposition or removal of disease from one region, organ, or structure to another. It has been in common use in medical literature for a long time, but its existence as a pathological occurrence has been objected to for various reasons, and it has been held by some to be an impossibility. Be that as it may, we persuade ourselves that it is a term of great convenience, and contains, in however limited a sense, a truth and relevancy of a remarkably cogent character when applied to the description of certain well-known characteristics of gout and rheumatism, for instance.

Thus, in the latter of these diseases in its most acute form, we have witnessed some of the most appalling occurrences which fall to the lot of the medical practitioner to observe, the most typical example of which is the sudden and complete cessation or disappearance of all local and general pain and distress, the immediate or subsequent and literally *intoxicated* belief of the patient in his entire recovery and safety from his late sufferings, and his confidence in the future of his case, culminating in the immediate or gradual development of intellectual paralysis, coma, and death; the whole of which occurrences succeed each other with the rapidity and in the manner of a lethal toxis from an over-dose of a powerful narcotic poison. How to account for these pathological occurrences we confess ourselves unable to discover on any other principle than that of metastasis or transference of the *materies morbi* of the rheumatic disease from the peripheral motor structures of

the body to the central neural textures of the nervous system, and, therefore, we hold that the whole series of such untoward events is due to, and determined by, the existence of circulatory channels and facilities along which the rheumatic *virus* and toxins are transferred from the one to the other of the involved areas. In other words, we hold that in such cases the *materies morbi* is in the meantime located in the external fibro-muscular developments of the body, whence it is usually eliminated by the lymphatics and other excretory provisions, but which, in such instances, have for the time being become occluded from some cause, and so have necessitated the escape of the rheumatic *materies morbi*, with its containing toxic culture and toxins, along the other lines of least resistance, which here are the intra-neurilemmar spaces of the proximal motor nervature connected with the involved musculature, into the cerebro-spinal cavity, where its neuro-cerebral toxic qualities are immediately, and with almost universally fatal effects, demonstrated.

In like manner the metastasis of gout is observed when an external manifestation of that disease gives place to, or is immediately followed by, an acute gastric attack, in which case the sequence of the metastatic events are retirement, or regurgitation, of the gouty *materies morbi* from its external seat, its invasion of the cerebro-spinal lymph cavity, and its ejection through the pneumogastric neurilemmar lymph inter-spaces into the gastric terminal extensions of these nerve trunks and related non-nervous structures.

Many other instances of metastasis might be mentioned, but these may suffice to prove that it is still necessary for us to retain the term as absolutely required to express and describe a pathological occurrence which is not uncommon, and which it would be difficult to define by any other term or combination of words.

EXTRACT XVII.

ON COUNTER-IRRITATION, OR ARTIFICIAL METASTASIS.

THE term counter-irritation is of considerable antiquity, but to whom we are indebted for its origination we have not as yet satisfactorily discovered, nor have we yet very clear ideas of its true nature and therapeutical application to the relief and cure of certain diseased conditions; nevertheless we think we are warranted in obtruding some of the views of which we have become possessed on the subject on the attention of those interested in such matters, in order that empiricism in its use should become tinctured somewhat more with scientific precision and warranty. What, then, is counter-irritation? Before answering this question, it seems right to ask, what is irritation? in order that we should more clearly understand the *rationale* of counter-irritation. Irritation then, as a scientific term, must be understood as applicable only to a condition of the nervous system, or part of the nervous system, which ends in eliciting or inducing involuntary contraction of muscular fibre in its motor aspect, or disagreeable sensation in its sensory aspect, and as dependent on the existence of an exciting or provocative agent or functional stimulus, which, if intense enough or long enough continued in its application, may produce disease of a local or even general character.

Irritation is thus a thing of nervine origin and essence, and, therefore, requiring for its relief or removal an appeal primarily to the nervous system. That the nervous system by direct or reflex agency can transfer the product of irritation, be it sensory or motor, from the actual seat

of irritation to a distant part, or distant parts, of its area, is a truth patent to every observer, and now generally acknowledged, and therefore, capable of being taken advantage of in dictating the line of treatment in certain diseased conditions, the origin of which is due to the existence of a removable irritant cause or stimulus. Hence we think we are consequently further warranted in concluding that the long since empirically established conclusion, that the application of a counter-irritant to a free and easily reachable or accessible surface or peripheral area, can determine, by the attraction of its superior and overmastering, albeit artificially induced nervine influence and persistence, the removal of naturally induced irritation to the scene of an artificially produced irritation, and, therefore, by counter-irritation, in which the latter must act on the former by the exercise of a preponderating and neutralising influence through the prevailing vital principle of *ubi stimulus ibi fluxus*, as regulating the circulation, or movement, of both vital energy and matter. Thus the use of the term counter-irritation is a defensible, as well as a most happy and intelligible, one, and one, nevertheless, which can claim a scientific permit, or authority, by reason of its completely *à propos* applicability to the circumstances and occurrences involved; moreover, the warrant for its therapeutic use is based on the fact that it is used by nature in carrying out many of the curative processes adopted by the *vis medicatrix* in removing pathological conditions and maintaining the even balance of health—it may be said, with equal truth, in both the bodies corporate and politic.

Who that has observed his own sub-conscious ways of feeling and realising sensory irritations, from the faintest degree of *psora* to the most intense degree of *neuralgia*, and of neutralising, or abating, their importunity and provocativeness by sub-conscious or reflex means? and who that has witnessed and analysed the apparently aimless and mostly reflex movements of the suffering infant, but has been struck with the manifold ways in which nature has endowed the sub- and un-conscious neuromuscular agencies to meet such oft-recurring nervine troubles? Thus the sensory inconvenience or irritation

is removed or neutralised by the application of peripheral counter-irritation in a degree of proportionate intensity, according to the manner and nature of the objectionable sensory experience, by gentle, or more or less vigorous, apposition, or contact of cutaneous surfaces and appendages with the irritated area. In the case of the adult irritable, this subconscious application of counter-irritation may, and does, often end in conscious realisation of the irritation, and the conscious and intelligent application of the means of counter-irritation.

Moreover, throughout the higher animal world, we may every day observe the more or less conscious and intelligent use of the principle of counter-irritation by the systemic nervous system possessed members in removing and neutralising the thousand and one irritations to which they are constantly exposed, and from which they so often suffer. Such phenomena may, therefore, be regarded as amongst the inherited, transmitted, or innate protective and beneficent qualifications for meeting the "ills of life," and baffling some of the many disturbing agencies to which it is continually exposed, and so of rendering its survival possible and, to some extent, enjoyable and desirable. The counter-irritant may vary in intensity of application from the faintest touch, contact, or impact, to the most violent, in proportion to the degree of intensity of the irritant to be removed or neutralised, and will be sub-consciously or consciously used, according to the degree of mental attention attracted to it, and the nature of the being affected. Thus the tickle may be neutralised or removed by a gentle touch or contact, or a more emphatic scratch, the fainter degrees of pain by more pronounced pressure and rubbing, the more severe degrees of pain by more severe application of these, and the absolutely intolerable varieties of pain by a frantic appeal to the involved nervation, overwhelming in its insistence and violence to the degree of self-destruction. The application, therefore, of artificial methods of utilising the principle of counter-irritation in the removal or modification of sensory nerve irritation is abundantly warranted, and will often justify its adoption as a mode of treatment in many of the ills to which human flesh is heir. The

use on empirical lines, à la "*similia similibus curantur*," of counter-irritation has brought into the medical armamentarium a series of agencies differing very much in character and manner of use, but possessing a common curative effect and quality; thus the emplastrum, the liniment, the unguent, the seton, and the cautery, *et hoc genus omne*, have been at one time or another in use by the older practitioners of medicine and surgery, and still have to be resorted to by the most modern generalists and specialists in their everyday practice; hence, we may conclude, that these facts warrant us in claiming the principle of counter-irritation as a "survival of the fittest" in the progress of empirical experience and research—a survival to which we hope present day scientific research, with its modes of mechanical and electrical percussion, its shampooing and massage, may be able to do full justice by placing it on a reasoned basis, and utilising, when indicated, its beneficial influences in the relief and cure of disease and suffering.

EXTRACT XVIII.

ON VACCINATION.

VACCINATION—the title of the following remarks—has, from familiarity, come to be mentioned by a somewhat large number of the lay population, and a very small number of the members of the medical profession of these Islands, with contempt, and the subject by them has obtained a sinister character, which necessitates its removal from the list of the “resources of civilisation.”

That it has been possible for this to occur in the country where, more than a century ago, the great and philanthropic Jenner *observed* and *formulated*, and where the strength of his convictions enabled him to form and sway a public opinion which initiated and established the greatest movement in the preservation of the public health of the world that had hitherto been witnessed, is one of the greatest enigmas of our time, and an occurrence which brings a “blush to the cheeks” of his countrymen, when they hear and see with what reverence his memory is cherished in every country of the globe which has entered on the race of hygienic advancement and the solution of the great problem of preserving the lives and health of its people.

As the explanation of this enigma becomes clearer, perhaps it will be found that its causes have been comparatively insignificant and quite removable, and that it behoves the nation which first demonstrated the nature and value of vaccination to cling to it and to vindicate its claims to retention on the statute book of the state

as the great corner-stone of the modern fabric of preventive medicine and beneficent legislation.

Vaccination, as its name implies, signifies the introduction into the system of a non-vaccinated person of a virus, the operation and influence of which, on that system, confers immunity from, or protection under, the invasion and attack of variola or smallpox. It is probable that we have already succeeded in isolating its specific bacillus, but we can scarcely as yet claim that we have identified it or established its claim to recognition as *the bacillus* of vaccinia.

In the *materies vaccinæ* are discovered several bacterial organisms, one or other, if not all, of which may play the part, or a part, as the case may be, in the production of the vaccine disease, and, hence, in the conferring of *immunity* or *protection* from the major disease variola, it, therefore, still behoves us to regard this question as *sub judice*.

Vaccination may be regarded as the type and herald of what is now called *serum therapy*, and as the foundation on which is being erected the modern beneficent institution of ameliorative and preventive medical principles and practice. Dr. Jenner may, therefore, be aptly named the "John the Baptist" of the great modern forward movement of militant and beneficent medicine alike, and to represent a "man crying in the wilderness" or amongst the arid but quickening places of medical thought and action of the eighteenth century, and, like his great prototype, it should be claimed for him that he "lived for the future," and that his name will be, or ought to be, retained as a living influence amongst the latest generations of mankind.

The pre-Jennerian or natural vaccination was effected by the entrance of the vaccine virus into abraded or open surfaces on the hands, or other exposed surfaces or parts of the persons, of dairymaids and others engaged in the milking of cows, and had done its work of protection against the lethal effects of smallpox or variola, no doubt, for generations. Of the protective value of this accidental occurrence nothing was known or dreamt, so far as we know, by the profession of medicine until the

observant mind of Jenner was attracted to the subject, and his inductive acumen was exercised on the problem, when lo! a means was devised by which the scourges of the most loathsome and mortal disease of the time were to be lightened and lessened almost to the vanishing point. His strength of faith in the correctness of his inductions led him to adopt the means which Nature had indicated and carried out in the dairymaids of his district, and he artificially followed her lead, introducing by the lancet the vaccine serum or lymph provided from its natural source, and afterwards from "arm to arm."

The good results of the procedure in conferring immunity against, or so far modifying the progress of, smallpox soon showed themselves, and he felt himself warranted in urging its adoption in place of "inoculation," which was then in favour. The subsequent experience of the ameliorative influences of the procedure won public confidence to such an extent that a measure enforcing its general adoption was added to the statute book.

The rationale of the process of vaccination is as yet somewhat obscure, and although a great deal has been thought, said, and written on the subject since the immortal Jenner's introduction of it, we can scarcely, with all the *comparative* light that has been shed on the problems involved in its elucidation, say *much* more of "light and leading" than he did. Nevertheless, and so much more in consequence of this, it behoves everyone who can add a "mite" of thought, experience, or deduction, to do so, trusting that aid, although infinitesimal may thus be afforded in the interesting and important work.

The vaccine *virus*, having been introduced into a susceptible child or individual through a sufficient "solution of continuity" of its surrounding skin, passes into its internal fluid-containing parts, and there *incubates*, producing meanwhile more or less febrile and general disturbance according, we may say, to the intensity of the action of the specific poison germs on the various impressible and responsive body constituents, and the range to which the multiplication of these germs attain and the degree of toxicity to which they may reach. The period of incubation passed, a more or less slow but definite

return to the *status quo ante* takes place, accompanied or preceded by the appearance at the point or points of entrance, but now of exit, of a more or less well-defined vesicular spot or spots, which indicate the exanthematous nature of the morbid process thus artificially produced.

In the imbibition of the *virus*, one, two, or all of these channels must have been used or entered in the process, viz. the hæmal lymph, the blood, or the nervine lymph circulatory channels. If the hæmal lymph channel had been the one used, then we would have expected that the solution of continuity of the vascular walls involved would have been made good or closed by the *vis medicatrix naturæ* before a process of regurgitation, were that possible, and exudation could have ensued after the processes of absorption and incubation had been run; in like manner and for like reasons the same may be said of the blood channels, besides, it might be mentioned that the walls of the hæmal lymph and blood capillary vessels are made up of organised structures which are eminently prone to heal, and, hence, would have prevented the occurrence of "eruptive" exudation. We are, therefore, reduced to the necessity of entertaining and maintaining the opinion that the vaccine *virus* enters the system by the nervine lymph circulation, that it invades and multiplies in the fluid with which that system is inter-penetrated and surrounded, and that, on the cessation of the morbid processes set up there, a small quantity of the tainted fluid or culture, as it might be called, is extravasated at the still open or thinned walls of the originally traumatised nerve terminals, which do not circulate further, but excrete their contents there.

Vaccinia, and consequently variola, are, therefore, diseases primarily of the nervous system, and it is through the impression made and left on that system by the artificial, or natural, effects of their respective *viri* that immunity or protection is conferred; but no doubt the secondary effects of these diseases are experienced throughout the whole organism, non-nervous as well as nervous.

Were it possible to analyse the changes wrought in the minute structure of the skin involved in the vaccine trauma and succeeding vesiculation, we are convinced that

the truth of the above assertions would be abundantly proved. Moreover, we are convinced that many of the exanthematous diseases, as well as skin eruptions generally, with the many anomalous "rashes" observed by the practitioner from time to time, are alike, primarily, diseases, or the outcome of diseases, of the nervous system. This may be said to hold good also of many of the diseases of the muscles and the various structures and viscera of the body, or, in fact, wherever nerve structures, motor, sensory, or sympathetic, are distributed. The key which thus opens to us a way into the intricacies and labyrinths of the nervine circulation is also, we venture to think, the key which shall open the door of the therapeutic situation in dealing with the whole family of the exanthematous diseases.

Eruption in its primary and simple varieties seems only, or principally, to occur by the natural sweat ducts or the rupture of the nerve terminal coverings and the escape of their contents, fluid and plastic, together with the subsequent subaërial changes which these latter are liable to undergo in the production of definite papules, vesicles, pustules, and crusts, as well as cuticular complications of a desquamatory and inflammatory character. Cases of variola, of a purely nervine variety and non-pustular, terminate well and without pitting, but purulent cases, or when the non-nervous elements of the skin are implicated, less satisfactorily, while cases of a hæmorrhagic description terminate almost universally fatally, all which may be regarded as pointing to the well-known methods of progress of the prevalent varieties and their natural history along nervine lines.

A vaccine or variolous vesicle may, therefore, be regarded as a limited or defined accumulation of tainted or specifically poisoned cerebro-spinal fluid, plus the more plastic contents or elements of the containing membranes respectively, of the medullary and axis cylinder substances, of the nerve terminals involved, together with the non-nervous texture of the parts outlying the vesicle, which, being almost entirely epidermic, do not necessarily touch the blood or lymph textures.

In the process of vesiculation in the eruptive stage of

vaccinia the neuro-keratine walls of the recently traumatised or abraded nerve terminals, we may assume, *give way* or rupture at the seat of trauma under the disruptive influence of the *vis a tergo* set up by, or due to, the retrogression of the tainted lymph or vaccine, and discharge it, with the effect that the neurilemmar sheaths of these terminals are disorganised or necrosed, so as to permit its intermixture with and possible destruction of more or less of the surrounding non-nervous texture, and afterwards of the formation of escharotic tissue from which the cerebro-spinal nerve elements are absent or sparsely present, and where only the trophic nerve elements are left to preside over the processes of nutrition and renewed development.

In this connection it might further be assumed that destruction, traumatism, and necrosis of the sensory terminal nerve arborisations *are not* followed by their renewal or re-growth in the substituted cicatricial tissues. The truth of this assumption is verifiable by testing the sensory condition of the vaccinal cicatrices and the "pits" resulting from smallpox. The depressed surfaces and "pits" seem, in fact, to be respectively due largely to the non-presence in them of the cerebro-spinal nerve elements consequent on their destruction during the continuance of the vaccinal and variolar lesions and to their imperfect, or non-renewal.

The manner of the performance of the operation of vaccination must be regarded as a matter of importance, and is a subject on which much diversity of opinion prevails. Since Jenner's introduction of it, it has been performed by all manner of persons, lay as well as professional, and at the present day we have living and smallpox-proof individuals amongst us who owe their immunity and protection to the services of one or all of these. In its performance, therefore, we may take it that its manner does not embody any great or insuperable difficulty. The introduction of the appropriate *virus* or lymph, destitute of any admixture with other *viri*, into the system of the unprotected is the desideratum, and this can be effected perfectly safely in mostly all of many manners affected by the initiated and other vaccinators,

provided the introduction of foreign disease-producing *viri* be avoided, and the specific *virus*, or *viri*, allowed a free and untrammelled opportunity of effecting the benign mission on which it is sent; this, therefore, necessitates the *guarded* use of bactericidal agents in case, perchance, they act too literally on the principle embraced in the old saying, "set a thief to catch a thief." In short, purity, simplicity, and the avoidance of unnecessary detail in the performance of an operation which was *first successfully performed by nature* would seem to dictate the *manner* of its performance.

A few more thoughts on the subject of vaccination have suggested themselves since the above study was closed, and, lest they should be forgotten, they had better be recorded here. The vaccine vesicles or "spots," as they are popularly called, as well as the vesicles of smallpox, are, we contend, nervine in origin and almost entirely nervine in the extent of tissue involved, and affect, secondarily only, the other tissues of the skin, as can be plainly seen on examination and analysis of the process of vesiculation. Thus the mature vesicles, when they may be said to have "reached their height," are semi-transparent, non-vascular, raised areas of cutaneous tissue loculated—and why? because they are determined by the disposition and arrangement of the terminal nervature—and filled with an unstained serum, containing the specific virus of the disease, which may be drawn off free from blood or left to undergo a process of inspissation and, finally, shedding, without, except in hæmorrhagic cases of smallpox, invading the blood circulatory structures or vasculature, the surrounding hyperæmic vesicular areolæ subsiding with the declension of the specific pathological neural changes, when the scabs or crusts are shed as the collective nervine necrosed elements of the affected areas, hence the scars left are found to be devoid of the ordinary peripheral nerve terminal extensions, these having been destroyed, and the skin consequently left to that extent anæsthetic.

In closely observing the sequence of the pathological events displayed in the evolution, maturation, and subsidence of the rash of vaccinia or variola, we are struck

with the very marked process of differentiation which manifests itself in the diseased areas in regard to the involvement of the nervine and non-nervine structures respectively ; thus, as the process of exudation or excretion of the specific serum and nerve plasma advances, the areolæ of hyperæmic cutis surrounding the areas of vesiculation widen and retire before the forming or growing vesicles until the stage of maturity of these is reached, when the fully formed vesicular units stand out clearly defined and quite anæmic amid a now scarcely visible but increasing halo of hyperæmia, which halo in turn widens, culminates, and finally subsides, leaving the involved nervine textures and contained inspissated specific serum and connective tissue to be detached and shed. This differentiation is effected through or by the eruptive material raising the cuticle from the underlying cutis and overflowing a more or less definite area of that tissue, where it ultimately "sets" or dries, and is thrown off.

The term eruption here, we think, is a very expressive one, as very exactly describing the final pathological phenomena occurring in the extravasation and exudation of exanthematous *materies morbi* generally, or at least when the peculiar habitat and incubating media are found within the nervous system. From the nerve terminals, distributed to the areas of eruption, the vesicular contents are thrown out by the sweat ducts of the nerve terminals through cracks or ruptures, and, in the case of artificial vaccinia, through unhealed traumatic channels in the neurilemmar walls, where they push aside or submerge the adjacent structural elements, leaving plateaux, cones, or elevations of erupted or "volcanic" material, so to speak, as monuments of subtextural or intra-neural pressure and morbid activity—the "vents" or passages by which or through which these acts of eruption are effected being the peri-neural lymph inter-spaces of the peripheral terminal nerve tissues. Secondary toxics of the blood and hæmal lymph is thus averted, save in the almost constantly fatal complications of hæmorrhagic variola, where the interposed limiting structures being broken down, and the circulation of the *materies morbi* being no longer confined within the neural lymph channels, overflows into

and invades the contents of the non-nervous surrounding areas, where secondary zymosis or auto-toxis results, and the most disastrous consequences ensue.

It might, moreover, be questioned whether many of the cases of exaggerated inflammatory and erysipelalous complications arising in the course of some cases of vaccination do not arise from the operation of the same causes, and, consequently, not from the introduction of extraneous morbid organisms or the non-avoidance or overlookment of preventable causes. In explanation of the shapes and manner of occurrence of the individual "spots" in vaccinia, varicella, and variola, as well as in many, if not all, of the exanthemata, we would offer the opinion that it is dependent entirely on the histological distribution of the cutaneous terminal nervature, which, being that of individual and associated groups of ultimate fibrils devoid of peripheral blending or anastomosis, lends itself to the occurrence of single and of grouped papules and vesicles, whereas, in the cases of hæmo-vascular eruptions, the manner of the eruption is general over the affected surfaces, as we might expect, where anastomosis occurs throughout the entire blood circulatory structures involved, and where capillary communication is universally present and actively operative. We are, therefore, called upon to observe further, that the diseases under discussion and the exanthemata generally must be primarily largely diseases of the sensory nervature, and of the cutaneous and other textures with which it is related. Their symptoms, however, point to general involvement of the affected organism, while the lasting impression of immunity left behind them is the legacy of an anti-toxinal influence of a temporary or permanent character, which we are warranted in referring to the existence of a universal sepsis, the leaving of a general impress, and the peripheral expulsion of the resultant spores, microbes, and toxins.

EXTRACT XIX.

ON THE PHYSIOLOGICAL ACTION OF TOBACCO IN THE VARIOUS METHODS OF ITS USE.

WE have already advanced—in a former study in connection with the pneumatic or air spaces of the face and head—that these spaces constitute what may be called the *lungs* of the head and face, inasmuch as an interchange of gases seems permitted by diffusion and chemical action or interchange through their thinly lined cavity walls, in which the blood capillaries are distributed in much the same manner as they are in the ultimate bronchial passages and pulmonary vesicles of the lungs.

The recognition of a provision *near* the great centre of life, the brain, of a supplementary means of keeping pure the blood circulating in its immediate vicinity and basal neighbourhood, and within its supporting structures, if not to a limited extent within the passages leading to and from itself, may be regarded as of great importance on account that these somewhat neglected spaces would consequently be brought within the circle of the more vital parts, and so have their condition as to soundness and patency more enquired into by those engaged in their clinical oversight, and their therapeutics, prophylactic and curative, placed on a more definite and scientific basis.

Flowing out of our study of this subject, the *rationale* of the physiological effects of one of the most all-pervading habits of modern life and times, viz. smoking, and inferentially all other ways of using tobacco, seems deducible or, at any rate, more apparent.

We have on many occasions asked devotees of the habit

for an explanation of its physiological effects on their minds and bodies, but have not hitherto been gratified to receive an answer which would satisfy non-smoking curiosity; in the dim light, therefore, of our inexperience, and what might, therefore, be called our unsuitability for the task, we would very cautiously venture to say that our own ideas, as above deduced, are somewhat as follows:

Tobacco, belonging as it does to a narcotico-sedative class of vegetable substances, charged, it may be, with essential oils and other elements of a diffusible nature, requires, *for its full enjoyment*, that it should be burned, vaporised, and diffused throughout the air passages of the head and body, including more especially the spaces under consideration, and absorbed by the structures lining these passages or spaces—the absorption being accomplished by direct diffusion of the gaseous part of the smoke, by liquefaction and osmosis of the more solid part of the smoke, and by the infiltration of the mucous lining of these passages and spaces, and the direct invasion of the underlying blood and lymphatic vessels and nerve terminals by what of the residuum has not been already disposed of.

The slow burning of the tobacco, effected by the many fashionable methods in use for accomplishing that process, lends itself to the correspondingly slow and gradual introduction of the nicotine and other volatile and absorbable constituents of the drug into the system of its votary, and so to the gentle and more or less complete saturation of those parts of the system amenable to its narcotic influences, and thus to the production of a more or less complete narcosis with the accompanying feelings of more or less full enjoyment of the effects, physical and mental.

Thus produced, the effects of tobacco are experienced over a wider area of the organism and with more intensity than can be possible in the cases of the snuffer or chewer of the article.

A somewhat fine drawn, if not quite exact, method of differentiating and estimating the height and depth, the length and breadth, of the possibilities of extracting the real and full enjoyment of the weed by the three classes of its uses may be possible as follows: The smoker may

be said to present his "burnt offering" to his brain and nervous system, his blood, his lungs, and his digestive organs; the snuffer his "pinch" mainly to his brain and nervous system; while the chewer of the coveted article presents his "plug," with the "benefit of the doubt," to his whole system.

EXTRACT XX.

ON METALLIC, OR ARSENIC, AND LEAD, ETC., POISONING, AS SEEN ALONG THE LINES DICTATED BY THE FOREGOING VIEWS.

WE think we see here the lines along which we can most successfully pursue our observations of this momentous problem if we are to arrive at a scientific explanation of the presence of arsenic and lead in such unusual but specific situations as the shafts of the hair and the extensor muscles of the fore-arms respectively.

The discovery of arsenic in the hair or other parts of a person who has imbibed it medicinally or otherwise through the walls of the alimentary canal, points to its absorption through these walls by the blood vessels or lacteals, its conveyance thence to the neuroglial matrix along with the nerve nutrient elements with which it is imbibed and conveyed to the nerve terminal areas by which the implicated hair and other parts are innervated, or to its exudation with the elements of the cerebro-spinal fluid from the *pia mater*, and its distribution by that circulation to the parts affected, or to its direct absorption or passage from the blood vessels supplying them. The first of these views we prefer to believe as being most in accordance with the teaching of the acknowledged affinity of nerve structures for arsenic and other inorganic poisons ; in which case the poisonous agents must first be supplied to the affected nerve structures, and thence, by histological continuity, to the hairs and other parts by being deposited from the blood of the *pia mater* in the neuroglial matrix or blastema.

This view holds good, of course, only in cases of the internal and, consequently, general poisonous effects by the substances in question, and not in such cases as “drop-wrist” in painters, where the local pathological condition is due to the cutaneous absorption of lead through the open sweat ducts, and its passage thence through the sweat glands proper along the inter-neurilemmar spaces of the sensory or peripheral nerve fibrils, terminating in the glands from which these ducts proceed to points high enough in the course of the common nerve trunk or trunks to enable it to pass up to and regurgitate or turn back into the inter-neurilemmar spaces of the accompanying motor nerve or nerves, along which it retrogrades or returns, or rather *passes forward*, into the sarcolemmar intra-spaces of the affected muscles, where its poisonous effects become apparent in the production of paralysis through its deleterious influence on their sarcous elements. Thus, moreover, we account for the confinement of the pathological characteristics of this disease—drop-wrist—within strictly defined and local limits, these changes being due to and consequent on the liquefaction of the lead by the sweat, it may be, its subsequent passage through the sweat glands, and thence along the peripheral or efferent nerve fibre inter-spaces and textures to the points in the common neurilemmar nerve sheaths, where the efferent or implicated motor nerve fibres leave, to be distributed to the paralysed muscles, and whence the poison finds its way into their intimate substance along the nerve terminal fibrils supplying them.

A local preference or affinity, we think, is thus demonstrated, due to progress, it may be, along the lines of least resistance between the invading mineral poison, the motor nerve fibres, and the sarcous elements of the affected muscles, as compared with the neutral influence exercised on the sensory nerve fibres and the local sensory phenomena. We think, moreover, that an analysis of the effects of general lead poisoning will demonstrate the same inference and lead to a similar conclusion as to the existence of the same affinity generally between lead and motor nerve textures, including cells, and fibres, and muscle elements.

EXTRACT XXI.

ON WHAT IS A "COLD" ?

THE disease or pathological condition called a "cold," "catching a cold," etc., is a clinical entity known popularly all over the world, but which has not received, we think, that critical notice from the profession to which its importance entitles it on its own account, if not on account of the part it plays—the very large and important part—in the causation of disease generally.

Adopting the name "cold," by which it is popularly known, in lieu of one based on a clear knowledge of its true scientific meaning and apprehension, and proceeding to analyse its pathological elements in the light of the views we have advanced in relation to "nervine circulation," etc., we shall try to make clear a subject which literally has been in everyone's mouth for, it may be, centuries, and which still passes current in our everyday literature and our daily converse.

To begin with the simplest example of what is called a "cold," or "catching a cold," let us choose the following as representing its most ephemeral and passing form or variety—for it can be studied and *felt* in endless grades of intensity and duration—and let us follow the sequence of events, one by one, in order to, or until we, grasp the meaning of the united whole or pathological entity.

Thus, a man, during the course or process of sleep, exposes a portion of his person, or has occasion to get out of bed, when a portion of his cutaneous surface becomes exposed to a *draught*. On awaking in the former

instance, and after retiring to bed in the latter, he is "taken with a desire to sneeze," and, yielding to the impulse, does so, with the effect or result that his nose "begins to run," and he finds himself the subject of a "cold in the head."

How is this? It is thuswise—the exposed cutaneous surface suffers a *chill*, the peripheral sensory nerve fibres, in association with the sympathetic ganglionic corporeal advance-guard, determine and cause the contraction of the muscular structures of the skin, producing, it may be, *cutis anserina*, when the local and cutaneous or peripheral nerve structures, with their surrounding sheaths and contained cerebro-spinal or nervine fluid, become in turn compressed, with the result that their fluid contents, their outward or cutaneous points of exit being thus closed, are pushed forwards or, if you like, backwards until more or less escapes into the cerebro-spinal cavity like railway "rolling stock pushed into a 'lie,'" which suddenly increasing the volume of the contents of these already sufficiently full intra-spinal and intra-cranial spaces and inter-spaces, the situation thus created is relieved by an overflow into the nasal cavities, *preceded by the required act of sneezing* or "open sesame" determined by the discharge of the necessary reflex motor impulses to the necessary muscular organisms.

A "cold"—a "simple cold" in this case—thus becomes the type of that class of diseases which have for their origin and cause the operation of a purely mechanico-nervous influence, and, therefore, into the consideration of which chemico-zymotic problems do not enter.

From thus following one by one the various occurrences in the "sequence of events" characterising and making up this pathological entity, and obtaining a clear insight into the causation and progress of the ailment, we are warranted, after searching for "indications for treatment" and "prescribing" on simple and purely scientific lines, in saying that, if our opinion were sought in this or such a case, "trust the operations of the *vis medicatrix naturæ*."

In pursuing our enquiries a little further in this twilight or dawning region of medical science, where the scene of the growth of modern descriptive medicine and pathology

just begins "to strike the view," we should further say, about the subject of "a severe cold," that some symptoms of it, such as the "feeling of pains and aches all over," seem to arise from the disturbance of innervation, due to violent and irregular distribution of the nervine or cerebro-spinal fluid, and to the consequent interference with, and impairment of, nerve force production and circulation, and that the feeling of "exhaustion of strength," which is experienced in the *more* severe cases, seems also to depend upon and be traceable to the same causes. Moreover, on such and other anomalous circumstances depend the many "indescribable" feelings and symptoms that are yet required to fill up the picture of a "*bad cold*."

At this stage, when the subject of the attack realises that *he has caught* a "bad cold," we, if consulted, perceive that disturbances of the blood circulation begin to play an important, but still secondary, part, and that the time is rapidly arriving when convalescence must declare itself, or further pathological changes of a more or less far-reaching description will follow; such, for instance, as characterise the progress of acute visceral disease, the consideration of which, so far as we can continue it, will follow more conveniently under proper clinical titles.

Nevertheless, we might consistently remark here that, if spontaneous cessation of the phenomena of "cold" has not taken place, then a simple appeal to diaphoresis or cutaneous excretion should be at once made in order to effect its arrest.

Diaphoresis, however induced, may be understood as a flushing—so far as the nervous system is concerned—of the peri-neural inter-spaces from their origin in the cerebro-spinal cavity to their termination in the peripheral terminal nerve structures, and of the ejection, of a portion at least, of the cerebro-spinal fluid with, it may be, a proportionate relief to "nerve tension," besides intracranial and intra-spinal pressure.

Should this process not be successful by ordinary and simple means, then it should be effected by an agent or agents, which will at once relieve this pressure and rectify chemical disturbances of the cerebro-spinal fluid or clear it of microbic organisms in the more intensely pathological

conditions, and then a great experimental work of research will have been performed in clinical medicine and some important problems solved in ameliorative and curative therapeutics.

EXTRACT XXII.

ON INFLAMMATION.

THE subject of inflammation has held the premier position in interest and in the everyday practical experience of the professors of the healing art since the days of Hippocrates. We, therefore, approach its discussion with mixed feelings, with one of great respect for those who have laid the scientific foundation for truly apprehending its character and nature, and another of strong desire to penetrate still farther into the secrets which lie at its foundation, and to place it, if possible, in a still more favourable position for being completely apprehended, and its clinical importance fully appreciated.

Its symptomatology, as given by Celsus, has not yet been materially departed from, being only supplemented by a few additions, as the progress of knowledge dictated. Its pathology, however, although of recent growth, has made great and notable progress, until now we can apprehend much of the true meaning and significance of the manifold processes involved in its initiation, progress and subsidence. Fortunately for us, we have been able to view by the aid of the microscope typical examples of it, and to study them in detail, in their elementary manner of evolution and involution, and have thereby become familiarised, as we have with few pathological problems or entities, with some of nature's ways of maiming and mending, of making ill and making well, and of working out the intimately related and continuous physiological and pathological processes constituting disease, which are so

much in evidence in the daily life of every organised creature and of every medical practitioner.

Engaged, as we have been, in the study of the nervous system in many of its less familiar aspects for many years, we have, when coming to consider the subject of inflammation in the light of the views of which we have become possessed, been much struck, in the perusal of its literature, with the absence as a factor in the production and evolution of the process of inflammation, of any but the merest inferential reference to the nervous system and the local nerve elements. This omission will, therefore, we think, warrant us in endeavouring to supply whatever information and data we can, in order to call attention to the circumstance, and, if possible, to broaden and deepen, and make more exact, the entire *rationale* of this complex foundation and far-reaching morbid phenomenon.

As a rule, we say we have noticed little or no importance attached to the influence of nervine factors in the production and course of inflammatory phenomena, and for this we can only, or mainly, suggest as a reason that the microscopic research to which it has been so searchingly and continuously subjected has failed to reveal the nervine influences at work in the regulation of the blood circulatory behaviour, so engrossingly interesting to the novice as well as the veteran observer.

It has thus, we think, been too much taken for granted that the visible phenomena comprise the whole phenomena of which this diseased process is made up, and hence the natural curiosity of the observer has been appeased, and the necessary still further research been prevented.

The behaviour of the blood vasculature and its contents has thus been most exhaustively observed, and the observations have been repeated and tested for every generation of physiologists and pathologists during many years, until we now take for granted that research in this field is no longer necessary, and are almost called upon to believe that the last word has been said on the subject.

The classical experiment on the web of the frog's foot demonstrates a succession of vascular vaso-motor and blood circulatory changes of a most apparent and consequential character, which have only to be seen to be

realised, and which afford a biological picture seemingly complete in *tout ensemble* and *minutiæ* of detail; but underlying all this, we contend that we have hitherto failed to recognise the chief factor in the origin, progress, and decline of the processes involved in the experiment. The stages of *circulatory acceleration*, *retardation*, *oscillation*, *stasis*, and *thrombosis* are preceded by what is usually described as a *momentary contraction* of the *local arterioles*, "a thing," or phenomenon, we are assured, that is "of *no known significance*" (the italics are ours) in connection with this series of events. This *thing* of "no known significance" we claim to be the *most significant* of the whole series of events comprising the experiment, inasmuch as it clearly (to us) indicates, if it does not show it microscopically, that the etiological irritant first appeals to, and is realised by, the nervous system—albeit both systemic and sympathetic—and that the nervous system throughout rules and regulates the evolution of the entire sequence of experimental events and results, and, by inference, those of all idiopathic inflammations as well.

This momentary contraction of the involved arterioles is the lethal or traumatic result of nerve irritation, or shock, however produced, and is followed by what is equivalent to a paralysis of the musculature controlling the *lumina* of these arterioles, in proportion to the intensity and duration of the influence of the irritant; if that irritant be mild and short in the manner and time of its application, or intense and prolonged, we should expect the respective results to be quite in accordance with the nature of their cause, and, therefore, that these results would afford an exact measurement of the intensity and duration of the inflammatory *sequelæ* and irritant causation.

Holding the opinion that every so-called non-nerve cell is controlled by sympathetic nerve influence, and that it is related to, and, in fact, continuous to some extent histologically with the processes of the true, or so-called proper, nerve cells, or, in other words, that it is in reality a true nerve cell, we have in all cases to deal with it in the inflammatory as well as all other diseased processes. We contend that, therefore, we have primarily and throughout to recognise the fact that we have at all such times to deal

with phenomena, largely or principally nervine in origin, and sequence, in the evolution and involution of physiological as well as pathological phenomena.

Thus the preliminary arteriolic contraction within the area of the experiment or disease is due to vaso-motor influence, emanating from the primary irritation or shock, acting through the controlling nervature of the blood vessel musculature concerned, while the succeeding dilatation, and consequent hyperæmia of the local vasculature, are due in turn to a *temporary paralysis* succeeding the violent contraction of the vessel walls, with a consequent temporary acceleration of movement of the now less opposed intruding blood streams. The subsequent phenomena of hæmal or circulatory retardation, oscillation, stasis, and, it may be, thrombosis are very much due to the altering hydrostatics of an increasingly viscous fluid, plus the modifying influence of the vital structures—necessarily nervine—involved, by which the further phenomena of exudation of more, or less, or all of the blood elements take place, and are followed by a subsequent series of modifying, destructive, absorptive, and cell proliferative processes, eventuating in the restoration, as nearly as possible, of the textural conditions existing in the pre-inflammatory state, and exhibiting one of the most complete and impressive pictures of the benignant working of the *vis medicatrix naturæ* in the spontaneous and successful treatment of a diseased condition.

Directing and accomplishing all these phenomena, etiological, pathological, and curative, is an unseen but potent vital agency, the sympathetico-nervine, the originally formative agency, and the nutritive medium in all organic vital processes, the sustainer of life and averter of death.

The vascular paralysis alluded to, as consequent on the hyper-contraction of the traumatised arterioles, produces, through the enlargement of the *lumina* of the vessels concerned, a collateral separation of the endothelial cells lining their walls, a consequent facility for leakage of the component parts of their hæmal contents, according to their respective mobility and fluidity, first, therefore, of the *liquor sanguinis*; second, of the white corpuscles; and third, in some cases only, of the red corpuscles. These

hæmal elements being already highly vitalised, and some of them highly organised, enter into new combinations and arrangements with the local organic elements, with which they find themselves in contact after their exudation, through the controlling influence and formative power of the sympathetic nervature, in virtue of which a continuity of the traumatised histological elements and a structural completeness of the affected parts is effected and maintained, thereby securing, as nearly as can be, the *status quo ante*.

We feel that it would be both instructive and interesting to follow, analyse, and describe, the succeeding stages in the process of evolution and involution involved in inflammation, but suffice it to say that this has already been over and over again most clearly and successfully accomplished, and that we *only here insist on the primary and essential instrumentality of nervine influence* in the incidence and course of all inflammatory as well as some, and, it may be, all other diseased conditions. We shall, therefore, in short and general terms, describe the succeeding stages in the *extra-vascular phenomena* of inflammation, and the re-attainment by the affected part, or parts, of the *status quo ante*, as a series of health and tissue restorative nervine operations, comprising the breaking down and rebuilding into permanent organic form of the extravasated materials, and the absorption and removal of the unused residuum, along with all the absolutely destroyed tissue elements resulting from the traumatic or morbid blood invasion of the tissue matrix. This manner of termination constitutes what may be called resolution by cellulitis, in which the peri-vascular cellular tissues, or what may be called sympathetic connective tissue cells, are the active agents in the conversion of the effused blood constituents into cicatricial tissue, or normal texture, by virtue of the all-controlling formative powers inherent in that part of the nervous system, through its self-contained ability to effect new growth and repair injured tissues by cell proliferation and connective fibre extension.

Should the inflammatory process here described terminate, instead of by resolution, in suppuration, ulceration, or gangrene, we but observe a continuation and accentua-

tion of the truly nervous manner of progress of the inflammatory phenomena. Thus in suppuration we find that the effused blood elements, along with the traumatised structural elements, of the invaded and inflamed textures are broken down, and developed by the process of suppuration into pus, in which form they are eliminated, through extension of the disintegrative and destructive, or necrotic, activity of the pus cells, through every overlying obstacle or texture, leaving the surviving or living tissues by cell proliferation and connective fibre process development, mainly of their connective tissue elements, to take up and complete the work of cicatrization and repair. Should suppuration end in ulceration, which is in reality a continuation of that process, or should the inflammatory process primarily end in ulceration, then we have demonstrated the extension by histological continuity of the piecemeal necrosis of the invaded and devitalised tissues surrounding the diseased or traumatised area by the continued extension of the suppurative process, and consequent textural disintegration and molecular decay, along connective fibre processes and their parent cells.

If the vital condition of the affected and neighbouring parts be low from any general or local cause, the untoward occurrence of gangrene, or somatic death of the affected tissues, may be witnessed on a smaller or larger scale, in proportion to the intensity and extent of the incidence of the exciting cause of the inflammation; in this occurrence absolute necrosis ensues, with or without the gradual extension of the processes of suppuration or ulceration, and under favourable circumstances for recovery the slough, or gangrenous tissue, is shed by the still vital and healthy neighbouring tissues, and the resulting structural hiatus made good by the substitution of fresh or cicatricial tissue, the result of new growth from the proliferation and expansion of the sympathetic nerve-ture, cellular and fibrous, and the overgrowth inwards of a new cuticular texture or epidermis, which becomes a good substitute for a true skin, though void of its distinctive organic textures and appendages.

Thus we perceive that the *reputedly morbid* phenomena of inflammation may be recognised as distinctly restorative

agencies, initiated and dominated by nervine influence, under the guidance of the *vis medicatrix naturæ*, and exercised on every individual occasion with an "eye to" the accomplishment of the best results by the removal of excitant causes, the neutralisation of the effects of injury and disorganisation, and the accommodation of the affected organism to the altered structural conditions and circumstances.

EXTRACT XXIII.

CEREBRO-SPINAL MENINGITIS.

CEREBRO-SPINAL MENINGITIS is another disease of the nervous system which may be considered with profit by the light of the foregoing views.

Sporadically or epidemically, simply or in connection with other diseases, such as pneumonia, it seems to be explicable to a larger and clearer extent than has been possible hitherto.

To begin with, it appears that we must regard this disease as almost universally microbic in origin, reserving, however, the possibility of the occurrence of non-microbic cases.

The disease being diagnosed to be cerebro-spinal meningitis, and consequently microbic, and it being believed to be due to the presence of a pneumococcus, diplococcus, or what may more truly be described in this case as a *neurococcus*, it behoves us to find out how it has come here, how it gives rise to the disease, why it is accompanied sometimes by certain diseases, such as pneumonia, and why it is followed by its peculiar *sequelæ* and frequently, or generally, fatal termination.

Aërial convection, it would seem to us, is the most likely method of its communication, most probably on the lines described as those followed in the dissemination of epidemic influenza; that is, the spores of the *neurococcus* are suspended in the atmosphere or other medium and find an entrance into the cerebro-spinal cavity through the nasal mucosa and the peri- and endo-neural canals of

the olfactory nerves, bulbs, and tracts, as well as through the glosso-pharyngeal pituitary tracts, and thence by continuity into the cerebro-spinal fluid, where they grow and flourish and perpetuate themselves, as in a prepared cultural medium, until the whole fluid becomes invaded, contaminated, and used up, so to speak, by the succeeding generations of this rapidly multiplying organism and its toxins.

During this process we may take it that the germination, growth, and decay of the *neurococcic* bacilli, and the accumulation of their consequent toxinal lymph elements, are effected at the expense and to the detriment of the proper lymph contents of the cerebro-spinal cavity, and that the toxins resulting from the manifold activity involved therein accumulate and attach themselves to the peripheral or meningeal surfaces of the cerebro-spinal cavity, or gravitate to or towards its most dependent parts, there setting up pathological changes or mechanically blocking more or less entirely the various intra-spaces and inter-spaces into which they are divided, and destroying the continuity and patency of their canals.

What, therefore, have hitherto been regarded as *exudates* must thus be looked upon as *deposits*, and the more or less turbid, muddy, or consistent character of the fluid withdrawn as a diagnostic expedient by lumbar puncture of the cord may be used to determine the greater or lesser degree of microbic development and decay undergone in the particular case and at the particular stage of the disease at which it has been withdrawn.

It may here be observed that the state of things above described may begin and end within the brain and cord and the meninges, terminating, in a small minority of cases, favourably, but, in the great majority of cases, fatally.

However the cases may terminate, whether fatally, as is their wont, or favourably, as it is just possible they may do, we see that, in the course of a great many cases, the pathological process extends itself in other directions, and that these other directions will be found to coincide with the direction or course of the greater and lesser nerve trunks.

Thus herpetic eruptions manifest themselves at the peripheral endings of some of the lesser nerve trunks on a level with the particular spinal area of the central nervous system involved, or a pneumonia will display itself on the invasion of the pneumogastric trunk, or an endocardial ulceration may appear, or a gastro-enteric catarrh may assert itself, each affording or providing outlets "*along the lines of least resistance,*" for the escape of the over-compressed and contaminated cerebro-spinal fluid, with its toxins and live disease germs.

We would, therefore, premise that if the course of individual cases of this disease be carefully analysed and studied from this point of view, it will be found that in almost every instance of complication the complication so called succeeds, or apparently only synchronises with, but does not precede; in other words, it will be found that the primary disease was, and is, the cerebro-spinal meningitis, all which is determined, we hold, by an *orderly sequence of pathological events.*

At the same time, in our process of analysis and study of individual cases, we must not lose sight of the *possibility* of the sequence of these pathological events being *reversed*, and of our finding that the *pneumococcus*—quite appropriately named in this case—of pneumonia found its way from the pulmonary terminal ends or endings of the pneumogastric nerves, or other nerves involved in particular cases, along the surrounding neurilemmar interspaces of these nerves into the cerebro-spinal cavity.

Thus we may conclude that in the absence of nasal, pharyngeal, cutaneous, or other discharges, overpressure, arising from the continually swelling contents of the cerebro-spinal cavity resulting from the rapid growth and accumulation of its pathological contents, must be relieved by a passage or passages being found for their evacuation, and thus, also, we find that the particular paths or nerve trunks alluded to afford the next easiest exits to the natural great cerebro-spinal lymph exits.

The pulmonary points of exit being, not on to a free surface externally, but into the texture of vital organs or the lining membrane or surface of partially closed or narrow tubes, we are forced to recognise that the difficulty

and dangers of evacuation of toxic material thus is very great, and that the proneness of the disease to a fatal termination is only too well founded or established. Nevertheless, it would seem that early surgical interference in the shape of lumbar puncture or otherwise affords a hope that we may be able to cope with a condition of things, now recognised as well nigh hopeless, if we be able to establish our diagnosis promptly, and are at liberty to use the appropriate measures before the cerebro-spinal fluid has reached the state of too great turbidity or too diminished fluidity to be withdrawn.

The above narrative at once suggests that the cause of cerebro-spinal meningitis is none other than the presence of the *neurococcus* in the congenial medium of the cerebro-spinal fluid, the growth and decay of this organism, and the consequent *intoxication*, so to speak, of the contents of the cerebro-spinal cavity, liquid and solid, with the result that the free surfaces of the involved meninges and neural elements proper become pathologically affected with the organism, its toxins, and residual products.

The meningeal inflammatory process, with its consequences, may thus be regarded as secondary, and, therefore, that the greater part of the solid admixture or turbidity producing constituents of the cerebro-spinal fluid may be credited to the primary microbic invasion, growth, and decay, with its resulting *deposition*, the remaining part *only* being due to an inflammatory *exudation* from the affected meninges and the deeper seated structures.

In this connection we are warranted in inferring that the great intra-cranial and intra-spinal lymph spaces, as represented by the ventricles and central canal, cannot fail to be also subsequently, if not simultaneously, invaded by the common microbic enemy, with the result that intra-spatial pressure and toxic action will be set up, together with the secondary inflammatory consequences alluded to, in the discussion of what we may call the *extra-spatial* form of the disease.

The same sequence of events may, therefore, be looked for in the latter—the intra-spatial—as were found to occur in the former—the extra-spatial—with the exception that

the difference in environment must, to a corresponding extent, affect the results.

We would here remark that the more or less plugged condition of the central canal may frequently have its origin in this morbid process, and that the occurrence of hydro-myelia and syringo-myelia may, in many cases, have indirectly to be attributed to it.

Moreover, the similarity of the consistence and substance of the *deposits* or *exudates* to be found in the intra-spinal spaces, and especially in the lower termination of the cerebro-spinal cavity in some cases of cerebro-spinal meningitis, and in the central canal in some cases of syringo-myelia, lends suspicion, to say the least of it, to the supposition that they owe their existence to an almost common cause, and are produced by similar conditions eventuating in obstruction of the central canal and rupture of its walls, with consequent invasion, obliteration, and dissipation of the proper or neuroglial substance of the cord.

EXTRACT XXIV.

NEURITIS.

NEURITIS, or nerve inflammation, is commonly regarded as a distinct disease of the nerves, and in systematic treatises on the practice of medicine is defined as such.

To this we would take exception, and would state broadly *that there is no such disease as neuritis*, and that, from the anatomical composition of the structures in question, its occurrence as a primary disease is impossible, inasmuch as the purely nerve structures, *i.e.* the axis cylinders and white substance of Schwann, with their containing sheaths, are devoid of blood vessels, and, consequently, cannot suffer primarily from the inflammatory process.

We, therefore, think that the term neuritis is applicable only, strictly speaking, to the secondary effects of the inflammatory process initiated, it may be, in and spreading from the outer envelopes of the nerve structures, and that it is, or can be, consequently only secondary; because purely nerve structures must be regarded when considered in relationship to diseases of the blood circulatory system, such as inflammation, in the light of being non-hæmvascular tissues, such as, for instance, the keratinous, as well as the proper nervine elements—hair, nail, epidermis, and epithelium.

Neuritis must, therefore, so far as the nerve substance is concerned, be looked upon as entirely a secondary morbid process or disease, and a change of the involved nerve substance, due to the existence of a previous disease, interfering in some way with its peri-neural sheaths and

textural relationships and soundness ; or, in other words, it is a disease of the envelopes or neurilemmar sheaths surrounding the sheath of the white substance of Schwann, and primarily involving the peri- and endo-neurium, the tissues representing and continuous with the membranes of the brain and spinal cord.

The sheath of the white substance of Schwann and the axilemma of the axis cylinder substance, being each composed of a non-vascular layer of neuro-keratine, are impervious to even the minutest capillary blood vessels, and are, hence, exempt from the initial changes involved in the inflammatory process, consequently we must repeat that we regard neuritis, so called, as a disease primarily of the non-nervous elements of the nerves or nervous system.

Its etiology must, therefore, be considered, primarily, in relation to the non-nervous enveloping and supporting structures of that system. As thus involving the non-nervous structures, it seems to us that we must look for its inception in the invasion of the intra-neurilemmar spaces by a *materies morbi* which finds its way from the cerebro-spinal cavity along the neurilemmar inter-spaces by the natural movement of excretion or outflow of the cerebro-spinal contained lymph ; this outflowing lymph, therefore, being contaminated by chemical or other admixture, or by the growth therein of bacterial organisms, may be regarded as the most usual and important cause of the *primary stage* of neuritis, and, consequently, as the *main* origin and cause of what is understood as *fully developed* neuritis.

The invasion by disease-producing agents of the intra-neurilemmar spaces of the nerves may also be accomplished by the process of imbibition of the toxic agents through the nerve terminals in the sweat glands wherever they may be distributed on exposed areas of the skin, while the manner of their transmission from these points to the structures for which they have an affinity, or between which and them there is a mutual affinity, is still a " moot point."

However introduced, and whatever the nature of the poison, be it chemical or bacterial, the result is the same,

viz. the irritation of the nervous structures involved, an increased blood supply to their surrounding non-nervous structures, the disturbance of the textural condition of these structures, as well as the neighbouring cellular and connective tissues, with the consequent and subsequent disturbance of the functional and textural integrity of the true nerve elements of the nerves involved.

The violence, the frequent repetition or the long continued incidence of these morbid phenomena determine the nature and extent of the attack and its probable termination.

Thus the attack of neuritis may be acute or chronic, local or general, and it may be characterised by all degrees of intensity between acute and chronic, and with a distribution varying between local and general, the general being usually recognised as polyneuritis, a condition of highly complicated disease, which is very often associated with the nerve phenomena of alcoholism, arsenicalism, etc., and other toxic conditions of the blood, and consequent disturbance of its circulation amid the proper nerve elements. Besides the instances of neuritis due to toxics of the cerebro-spinal lymph, and consequent irritation of the dermic structures and musculature into which or through which that toxic lymph is passed, we find that the purely nervine elements of the nervous system also become saturated with the toxic agent, in certain cases, with the effect that such affections as dermatitis and hyper-keratosis may arise on the afferent or sensory aspect of the systemic nervous system on the one hand, and disturbances of the nutrition and function of the voluntary musculature or afferent aspect on the other.

The forms of neuritis emanating from central nervine toxics may thus be divided into extrinsic and intrinsic in accordance with the order of involvement of the cerebro-spinal contents or elements, the fluid or lymph elements representing the former, and the proper nervine elements the latter.

EXTRACT XXV.

NEUROMA.

NEUROMA is a disease of the *proper nerve structures* as distinguished from the cerebro-spinal nerve adventitial sheaths, which can be more fully, more easily, and more intelligibly explained, than has been possible hitherto, by the application of the principles for the truth of which we have been contending.

Inasmuch as it stands pretty much outside the great subject of tumours, and is conditioned by laws emanating for the most part from within the nervous system, it occupies an exceptional position.

Thus a true neuroma is not due, primarily, to circumstances connected with the neural blood circulatory system proper, but to interference with one or other of those inner or nerve circulations, which in this case begins within one or many of the sheaths and contained columns of semi-consistent or semi-fluid substance, called the "white substance of Schwann," or the insulating covering of the axis cylinder, hence the results of inflammatory action are conspicuous by their absence, except when they may have been accidentally induced by mechanical irritation or pressure.

Neuromatous growths, or neuromata, must thus, primarily, be developed *within the nerve sheaths* or neurilemmæ, and conform to their environments by "growing" or *passively collecting* in the direction and along the course of these sheaths and the nerve trunk or trunks; thereby causing a bulging or *varicosity* of the sheath or sheaths involved, which may attain a size varying, roughly speak-

ing, according to the literature of the subject, from that of a plum-stone to an oval tumour, in some cases little less than a foot in longitudinal diameter (one was eleven by ten inches).

The contents of the tumour, which are comparatively homogeneous, may thus be regarded as the inspissated and quasi-organised *white substance of Schwann* collected into masses, due to the failure, on a large scale, of the nodes of Ranvier of the affected nerve fibres, and the yielding of the primitive or containing sheaths of that substance, together with that of the overlying layers of the endo- and peri-neurium.

The initiating and determining cause of the tumour may be a more or less temporary or persistent local stasis of the circulation of the white substance of Schwann within its containing sheath or sheaths, which becomes permanent, and ends in more or less local or general tumefaction at one or several different points throughout the whole or part of the involved nerve trunk or trunks.

The size of the tumour or neuromatous enlargement, we may take it, is determined by its shorter or longer continuance and its greater or lesser solidarity from the more or less complete exosmosis of the more fluid parts of its contained materials.

The unvarying character of the contents of the so-called growths or tumours may also be regarded as almost a proof that their formation has taken place within, and the materials of which they are composed have been drawn entirely from, the proper nerve structures or elements, and characteristically moulded by the peri-neurium, this view holding good in the solitary and multiple varieties of the disease alike.

The consistence of the contents of these tumours, it ought to be added, varies between that of a thin jelly and ordinary gristle; hence an analogy to the formation of gristle in joints and osseous development histologically.

The disease may be regarded in most cases, more especially of the multiple variety, as due to a constitutional predisposition or susceptibility, and the contemporary incidence and influence of exciting causes—the predisposition or susceptibility being or consisting of a too

yielding primitive sheath, an imperfect provision of the nodes of Ranvier, or a perhaps too fluid condition of the white substance of Schwann, either or all of which may suffice, along with an exciting cause, to initiate and continue the neuromatous growth by allowing passive accumulation of that substance within the peri-neurium of the implicated nerve trunks, in obedience to the influences of local anatomical conditions and histological environment. Thus, for instance, is determined that the long diameter of the tumour is universally parallel with the direction of the affected nerve, which circumstance is due to the escape and deposition of the tumour material along the lines of least resistance.

Neuroma is, therefore, *not* a "*new growth*" in the strict acceptation of the phrase, but an accumulation of the material being locally circulated through the interstices of the neural tubules in certain definite areas, where the operation of local conditions secures its conversion into definite nodules and larger masses. Generally speaking, these neuromatous nodules and masses may be regarded as due to stasis of the medullary circulation and substance alone, inasmuch as the axis cylinders of the involved nerve fibrils remain intact, and capable of transmitting nerve impulses; therefore, we have here to deal with, in the main, an arrest of medullary circulation and subsequent accumulation of that substance within the neurilemmar coverings of the affected nerve trunks, and, consequently, with the insulating media and the transmission phenomena of innervation, as they in turn become affected by these altered enviroing circumstances.

EXTRACT XXVI.

SCLEROSIS OF THE NERVOUS SYSTEM, OR SCLEROMA.

IN dealing with the subject of *neuroma* we assigned as its cause local over-accumulation or production of the intraneural or white substance of Schwann.

In relation to the pathological disposition of the white substance of Schwann within the neurilemmar coverings of the nerve trunks, it may be observed that *sclerosis* appears to us to be due to a condition the opposite of that of *neuroma*, *i.e.* the white substance of Schwann is conspicuous by its more or less complete absence, according to the stage attained by the particular case of the disease in which it is observed.

In other words, *neuroma* is the pathological increase and local accumulation or ballooning within the primitive and neurilemmar sheaths of the white substance of Schwann, and *sclerosis* is its decrease or disappearance—the sclerosed nerve tissue being reduced to the shrunken containing sheaths of both the white substance of Schwann, and, it may be, the axilemmæ of the axis cylinders (should the axis cylinders have also disappeared, which they usually have done in advanced cases) and the overlying peri- and endo-neurium.

The neuro-keratinous material, of which these two sheaths—the primitive or medullary and axilemmar or axis cylinder—are composed, being comparatively indestructible, yet elastic, yields to pressure from within, and expands indefinitely or to the vanishing point in the case of *neuroma*, while in the case of *sclerosis* it shrinks and hardens; hence the meaning of the term *sclerosis*, harden-

ing; the two conditions respectively representing, as it were, the positive and negative aspects of the intra-neural disposal of the white substance of Schwann, and generally, or at least in *sclerosis*, that of the axis cylinders.

These sclerosed sheathings, with the remains of their former contents altered by pathological changes, together with their encircling endo- and peri-neural coverings, comprise, therefore, the only vestigial remains left by the arrest of the intra-neural circulation, and constitute but the passive or inert structural survivals of once functionally active mechanisms and most highly endowed material organisms—dead, yet alive! They are dead so far as the systemic nervous system is concerned, from which their separation is permanent, but alive in virtue of their supply of sympathetic nerve energy and the retained power of the restricted nutrition and metabolism possessed in common by all so-called non-nervous or sympathetically innervated structures.

Sclerosis, moreover, befalls other structures, more especially of the muscular character, but also of the cellulo-fibrous varieties, and points to the incidence of involutionary change, comprising that of failing nutrition, lapse of function, and textural retrogression, with accompanying and consequent structural and functional failure and breakdown, such as is seen in premature senility, where the arterial structures are peculiarly liable to participate, and show that the initial stage of involution has begun, and that, generally speaking, it inexorably continues until the process is complete and the continuance of life impossible.

There are those who think that we should always look here for the earliest symptoms of *sclerosis*, and if means of preventing the threatening breakdown can be devised, the greatest chance of their doing good is secured at this stage, or before structural degenerative change has fairly set in, *i.e.* before neuro-muscular nutritive failure and shortage of neuro-muscular dynamic supply have become established realities.

In relation to incidence, this affection seems to fall entirely, as we have said, on structures innervated by the systemic nervous system, *i.e.* the musculo-osseous struc-

tures, as well as the muscular coatings of the blood vessels and other structures endowed with muscular elements. The explanation of this would seem to be that the involved muscular structures have been deprived of the nutritive plasma necessary for the maintenance of their sarcous tissue, the supply of which is due to their related nervatures, and that degeneration and removal of their existing sarcous elements takes place, resulting in the collapse and agglutination of the muscle fibre sheaths and the interstitial muscular substance.

Accompanying or following this process may take place the formation of a degenerate species of organisation, consisting, apparently, of the union of the formative elements on which the evolution of cartilaginous, osseous, or calcareous growths in physiological developments and pathological production are alike due.

As the notochord produced the vertebral column by intermixture of tissue plasma and earthy salts, as the skeleton was produced by leakage of cerebro-spinal fluid into the membranous or cartilaginous matrix at the skeletal points or centres of ossification, so have the leaking neuro-musculatures concerned initiated and continued the pathological processes of the conversion of sclerosis into ossific and, by continuation, into calcareous structures by an unbroken series of malformative changes.

This mal-formative procedure may be the outcome of specific predisposing and exciting causes constitutionally evolving themselves, or it may be due to traumatic and other influences rapidly or more slowly initiating and determining the phenomena in the seat of injured neuro-musculo-skeletal structures and associated non-systemic nerve tissue elements.

EXTRACT XXVII.

POLYMYOSITIS AND MYOSITIS.

POLYMYOSITIS, as described by Sir W. Gowers and others, seems to us to be secondary to, or to be in many cases a continuation of polyneuritis (motor), which in turn is often due to a rheumatic or allied condition, emanating, as in Sir W. Gowers' case in the *British Medical Journal* of date January 14, 1899, from repeated exposures to damp, repeated chills, want of nerve and muscle rest, and to the effects of living amid continuous insanitary influences.

The nightly chills to which the patient, whose case is described by Sir W. Gowers, was for a long period subject gave rise to nightly checks and stasis of the cutaneous exhalations and excretions, with corresponding increases of cerebro-spinal and intra-cerebro-spinal sepsis and pressure, and, consequent, backflows along the channels of least resistance, these channels being, in this case, along the continuations of the sub-dural and sub-arachnoid spaces, into the motor nerves generally, and by continuity through their fibrils and nerve terminal plates into the substance of the muscles to which they were supplied, and in whose substance they were finally distributed.

If we may be permitted to say it, the case was thus one of auto-toxis, due to the repeated invasion of the intra-neurilemmar spaces of the motor nerves, and subsequent inundation of the intra-sarcolemmar spaces of the muscles to which those nerves were distributed by a regurgitated cutaneous and, consequently, effete and noxious excretion, with accompanying inflammatory

changes in the non-muscular textural or interstitial elements.

We may here remark that the chemistry, as well as the bacteriology, of sweat, so far as known to us, do not seem to have been as yet exhaustively investigated, and that, therefore, to us, as holding the view that it (the sweat) may come from both a blood circulatory and a nerve circulatory source, it would appear to be of a consequently variable character, according to which of these sources contributed to the greater extent towards its production for the time being. Moreover, we think it will be found in such investigation work that a considerable exhalation of gaseous material must be reckoned with.

The stasis of sweat excretion or perspiration, if only local and of short duration, does not necessarily make itself felt pathologically, and, consequently, may pass unnoticed; but if, on the other hand, it be general and sustained, or often repeated, as in Sir W. Gowers' case, a vague feeling of "aches and pains" is experienced, which may result in *rheumatism*, more or less acute, *neuritis*, local or multiple, or *myositis*, local or general (*polymyositis*).

Rheumatism, acute, subacute, and chronic, has elsewhere been described, neuritis has also been referred to, it, therefore, now remains for us to explain further the causation and pathological changes observed in *myositis* and *polymyositis*.

Myositis, however, except for its localisation, being in no way different from *polymyositis*, it will suffice for us to confine our remarks to the latter disease.

The cause or causes of *polymyositis* have almost exclusively been attributed to and sought for in the blood supply of the muscles involved, that blood supply being supposed to introduce into the muscular substance or fibre a toxic material or agent, which initiates and perpetuates inflammatory changes sufficient to lead to the destruction and removal, or the disintegration and obliteration, of the muscular discs and fibres, or the sarcous texture proper, accompanied, it may be, by an *apparent* increase in the fibrous and connective tissue proper of the implicated muscles. Why do we say *apparent*? Because we believe

that what remains consists simply of the exact number of sarcolemmar sheaths representing the muscle fibres involved, minus their former sarcous or proper contents, and because we think that nature must not be here held responsible for the performance of redundant work in this evolution of pseudo-hypertrophy from the residual disorganised and amorphous sarcous materials, together with the non-sarcous muscle elements.

If these views are to be accepted as a "working theory," so to speak, it seems to us that a very large problem in what may be called pathological bio-chemistry, connected with the disease under discussion, awaits solution, and, it further seems to us, that if a simple and yet scientific method of escape can be provided whereby the necessity of finding the solution on the old lines can be averted and fruitless efforts and, it may be, precious time saved, it is desirable that it should be made available for the purpose.

We have, therefore, to state that, feeling our inability to find the solution of the problem referred to, as well as many kindred problems on what may be called the "old lines," we have felt ourselves compelled to renew or continue the task on new and, we think, or, in fact, are convinced, more promising lines, and, hence, we have been constrained to substitute a *nervine* theory, which seems to us shortly and simply to explain the nature and sequence of the pathological changes involved, and, to some extent, to indicate the methods or lines along which the treatment of the disease, therapeutic and otherwise, may most consistently and hopefully be conducted or directed.

Polymyositis thus regarded seems to us to be due to the invasion of the muscle sheaths primarily, at which stage it is not an inflammation, and, secondarily, of the individual muscle fibres, by a *virus* circulating along the intra-neurilemmar spaces from the cerebro-spinal cavity in which it has been incubated or produced, and from which it has passed along the lines of least resistance in such wise as this:

A chill or succession of chills having been experienced by the subject of the coming attack, a stasis or series of stases of the cutaneous excretion and exhalation are pro-

duced, whereby a damming back of them takes place, which damming back leads, of necessity, sooner or later to regurgitation of them into the cerebro-spinal cavity along the intra-lemmar spaces of the peripheral nerves, which, accordingly, and in proportion to their quantity, increases the intra-cranial pressure, and which, if not relieved by discharge from the nasal and pituitary channels anteriorly, or the peri- and endo-anal apertures posteriorly, or other channels, finds its way from that cavity along the lines of least resistance, which are the peri-neural inter-spaces surrounding the motor nerve trunks.

This having taken place, the cerebro-spinal fluid, which has now become charged with an effete, and, consequently, toxic sudorous material, is injected or run into the intramuscular textures, with the consequence that "rheumatic," and not necessarily "inflammatory," pains are produced, with more or less stiffening and, it may be, swelling, which, if repeated and continued, may finally result in complete loss of the power of contraction or contractility of the affected muscles, with destruction of their sarcous material or muscle discs—myopathy.

The pains, stiffening, and loss of contractile power, result from the disturbance of the motor nerve energy supply of the affected muscles, arising from the loss of response to the usual motor nerve stimuli, the disintegration and absorption of the sarcous and contractile substance of the proper muscle fibres, the final displacement of the sarcous elements, as well as sclerosis of the muscle fibres proper.

The *materies morbi* is thus, so to speak, "produced on the premises," and leads, consequently, to auto-toxis by, most likely, a series of chemicophysiological and pathological changes, due to its invasion of, and incorporation with, the muscle substance, and to associated inflammatory changes in the non-sarcous elements of the affected muscles—a secondary pathological process. Moreover, and we must reiterate the statement, it seems to us that the non-sarcous structures of the affected muscles are not *necessarily increased* in pseudo-muscular hypertrophy by hyperproliferation of their connective tissue cells, but that this matrix, after the removal of its accompanying and con-

tained sarcous material, only represents the empty sarcolemmar sheaths, with more or less remaining sarcous *débris* and interpolated materials from the motor nerve fibres, and, it may be, from the blood vasculature, through inflammatory exudation and through the deprivation or loss of lateral pressure on its component vessels, by the withdrawal of the true sarcous matter from the affected muscle fibres, and the consequent increase of local blood pressure from passive hyperæmia.

By continued pathological changes along these lines the sarcous elements may disappear altogether, leaving only more or less of the sclerosed sarcolemmar investments to represent the original muscular structure, which may be said to constitute the last stage of muscular atrophy or myopathy, these latter affections following on, so to speak, the asphyxiating influence of the inflammatory processes and altered neuro-muscular metabolism.

EXTRACT XXVIII.

MYOPATHY.¹

MUSCLE tissue, including the fibre or sarcous material and its interstitial or non-sarcous elements, represents a structure whose growth is due to nutritive materials supplied from two different sources, the physiological balancing of which represents the condition of proper tone and health of the muscular substance, and the disturbance of which produces such ailments as atrophy and hypertrophy of its dual structural elements. The nutritive materials are supplied from the nervine and hæmal circulations respectively, with both of which the affected muscles are structurally connected or continuous.

Muscle fibre, or the sarcous or fleshy part of muscle, is isolated and insulated from its interstitial and surrounding non-sarcous structural or connective elements, and, therefore, is cut off from direct hæmal nutritional relationship and cast upon nervine sources of supply, not only for functional impulse and tonus, but for the material renewal and structural nutrition of its fibro-sarcous elements, this being effected and the nutritive materials conveyed to it by an unbroken circulation through the motor nerve axons from their parent neurons or cells in the central nervous system, brain, cord, or ganglia. The medullary and axis cylinder substances respectively of these motor axons at their distal terminations, where they are exuded by the terminal nerve plates, represent the nutritive sources of supply of the manifold muscular

¹ *Vide* Sir W. E. Gowers' Lecture, *British Medical Journal*, July 12th, 1902.

developments of the voluntary musculature, and the muscle plate or terminal motor nervature, the nutritional medium or vehicle by which these sources of supply are made available for the material wants of that musculature, each of the muscle discs or sarcous units of which it is composed having conveyed to it, along with the necessary functional energy, the material elements on which it lives and by which it acts; the functional energy and activity and the material nutrition of the muscular system thus owing a common origin in and emanating alike from the inner recesses of the central nervous system, and exhibiting an indissoluble blending of functional intent and structural contrivance.

This intimate blending of the systemic motor nervature and voluntary musculature in structure and function is due to the persistence of an epi-blastic continuity of texture and a oneness and sameness of functional *rôle*, and represents an inter-dependence of an absolutely essential and unbroken nature for the complete realisation of voluntary and reflex mobile necessities between the nervous and muscular systems.

We may take it, also, that a like intimacy of union characterises the blending of the involuntary or sympathetic nervature with its related involuntary musculature in structure and function.

Moreover, we are, we think, further warranted in inferring that a like, or at least a kindred, blending subsists between the related, but in some respects independent, systemic and sympathetic nervous systems. We would remark still further that the central nervous system, with its related peripheral, motor, and sensory nervature, is united centrally, as between its two halves, by a somewhat like bond of union in structure and function.

A continuity of histological development and an inter-dependence of function, therefore, may be said to prevail throughout the entire nervous system, with its related voluntary and involuntary musculatures, by which is secured a reliable *tenure of the lease of life*, by the harmonious working of its varied but component parts along the lines of least resistance and consequent minimum expenditure of force, and the obviation of overlapping in

the spheres of production and results, intellectual and physical.

The interstitial substance or texture of the various muscles, on the contrary, derives its nutritional supplies directly from hæmal sources through the systemic blood vascular circulation of the mesoblastic area, with which it is inter-penetrated, and is, therefore, influenced by entirely different formative and nutritive conditions, in virtue of which, not sameness, but reciprocity, characterises the relationship with its enclosed and surrounding sarcous or fibro-muscular substance.

Muscular tissue may, therefore, be regarded as a compound of two structural elements owing their origin to two different formative and nutritional sources, viz. the *epi-blastic* and *meso-blastic*, and maintaining their structural individuality and distinctness, while collaborating in and contributing to the performance of a common function; hence the disturbance of the nutritional balance existing between the two may lead to unilateral or lop-sided trophic results, with consequent proportional functional disturbance, which may result in the abrogation of, or serious interference with, the performance of co-ordinated muscle functions, and, finally, to complete atrophic degeneration and myopathic obliteration of its entire sarcous structural elements.

Myopathy occurring thus would seem to be dependent upon a faulty motor "terminal plate" materio-dynamic distribution, as the remaining central motor nerve structures have usually not been found involved, resulting in the deprivation of the involved musculature of the nervine or sarcous nutriment, as well as nerve energy supplied to it by the central nervous system, or of that combination of matter and energy which is responsible for the maintenance of the true muscular fibre, as distinguished from the interstitial substance, which we have said is derived from hæmal sources. Myopathy, of what we may call the *first degree*, consists alone of atrophy, and degeneration of the muscular fibres, with occupation or overlapping of the vacated or shrunken intra-fibril spaces, by the yielding collateral interstitial element, which, being deprived of its accustomed lateral sarcous support, fills up the *vacua*,

and succeeds for a time in "maintaining the outward appearance or semblance of healthy muscle." Deprived, however, of its *raison d'être*, and no longer able to assume the functional rôle of true muscular tissue, this structural substitute succumbs in turn from inertia and disuse, leaving scarcely a trace behind, which constitutes the second and final stage or degree.

By thus regarding the sequence and nature of the pathological events which lead up to and are concerned in producing the diseased condition known as myopathy, and which constitute and characterise its two degrees, we persuade ourselves that we obtain a clearer insight into the "manner and method" of the working of the various factors responsible for its production, and alas! we also realise the limitations of the curative powers of therapeutic agencies and the futility of the most skilful efforts of manual and electrical assistance. Nevertheless, we perceive that however this diseased process is brought about, remedial measures, to be even to a limited degree successful, must be applied simultaneously with the commencement of the shutting off of the nervine nutrient protoplasm from the recipient muscular fibre discs, or before the involved muscular structures have undergone degenerative change beyond the hope of recovery, or while there is still the possibility of renewing the continuity of neuromuscular tone and contractility with full voluntary functional subserviency and potentiality.

In relationship to what is claimed for myopathy in connection with failure or non-degeneration of the more proximal, as well as distal, nerve elements connecting the affected musculature with the central nervous system, we would remark that that claim gives good ground for retaining a hope that it may still, after all, be possible to devise remedial measures, which will suffice to renew that material and functional connection of the divorced nervature and musculature which disease, histological accident, or failure has brought about, and that these measures are most likely to be discovered along the lines indicated by the local and general histological and physiological structural connections and continuities.

We would further remark, regarding the *general* subject

of muscular atrophy as compared with the *restricted* subject under discussion, myopathy, that the latter, from the *immediateness* of its cause—nerve terminal distribution—should be more amenable to treatment than the former, which is often due to *central* and *distant* structural changes altogether beyond the possible reach of the best devised remedial and even ameliorative measures.

It need scarcely be added that the occurrence of muscular failure in all its varieties is a concrete subject of a most far-reaching character, and one which, next to mental sanity, is of the greatest importance to the individual and to the world at large, inasmuch as the power of self-support of the individual and the united individual contributions to the coffers of the commonwealth are alike at stake, and affected by it, hence its interest becomes a matter of the greatest moment to the medical profession, as well as the administrators of the State. That muscular failure is usually, primarily, due to nerve failure, may be regarded as axiomatic, except in those rare cases where failure of muscular power is due to intrinsic failure of the purely muscular structure elements, apart from failure of any of the nervine structural elements with which the affected muscle textures are supplied. Hence, we must almost always be prepared to search for and to find, if haply we can, the cause of the muscular breakdown in some part of the nerve textures joining the affected musculature with its affiliated central nervature, *i.e.*, in either the parent nerve cell, its axonal process, or its terminal nerve-plate extension, as in the case of the disease under discussion, myopathy and muscular paralysis. In all forms of muscular failure, irrespective of the *locale* of the original breakdown, it is thus essential to recognise the universally underlying fact that that failure is primarily due, except in the rare cases of *intrinsic* muscle failure, to non-delivery of the nervine nutritional protoplasm from failure of the nervine vehicular agencies or nerve capillary circulatory *media* to supply the muscle discs of the implicated muscle fibrature. All this, therefore, is a matter entirely belonging to the economy of the nervine circulation, as connected with the nutritional phenomena involved in the growth and maintenance of the sarcous elements of muscular

tissue, and does not at all primarily belong, in the remotest degree, to the hæmal circulation or nutrition of the non-sarcous or interstitial elements or the non-contractile parts ; secondarily, however, follow pathological changes in these latter, dependent on the progress of pathological changes in the former, and as the closing phase of a long retrogressive or degenerative process, resulting in *annihilation* more or less complete, of the involved musculature.

EXTRACT XXIX.

ON THE CUTANEOUS CONDITION KNOWN AS "GLOSSY SKIN."

THIS condition of skin is observable in and constitutes a very conspicuous feature of many diseased conditions of that structure, but, at the same time, and in the same individual sometimes, it may be observed as a histologico-physiological feature due to and "marking time" in the process of evolution, or rather involution, of the structural changes or natural decadence, as displayed in the surface covering of the gradually ageing body.

In hemiplegia, paraplegia, and general sensory paralysis, as well as in cases of extreme senile decay, this condition of skin is seen gradually to develop itself until the glossiness completely overtakes and obliterates the ordinary or normal features and markings of the cutaneous surface textures and appendages.

It is dependent strictly and eminently on a *retrograde* and atrophic nutritional movement, having for its causes, amongst others, a failure of the cutaneous nervine plasma, due to scanty, or non-, production on the part of the neuronal secretory mechanism, and to nervine non-circulatory ability to transmit to the peripheral nervature the necessary nutritive material if, and when, it has been produced, or to the non-efficient supply of the requisite neuroglial elements by the blood or hæmal circulation to the central nerve plasma-producing machinery. The plasmic failure responsible for the genesis of pathological glossiness of skin is but an accentuation of the physiological glossiness of skin of extreme age, and represents in

unusually intense degree the working of those nutritional influences and processes which are daily at work from the cradle to the grave “writing down” the impressions of time on the human physique so plainly that “he who runs may read”—for are not the dappled skin of the chubby infant, the ruddiness of youth, the finished growth and nutritional completeness of adolescence, the nascent declinature and wrinkling of active workaday life, and the wholesale shrinkage of old age, but impressions left by fleeting time to mark the stages of the journey of life?

The cutaneous features and characteristics of these various stages of life are, to a great extent, produced by the varying peripheral disposal of the sensory or afferent neuronal plasma, consisting of the medullary and axis cylinder substances, and the surrounding neurilemmar lymph by the nervine circulatory media and forces, regulated by the altering conditions of vitality as determined by age and environment. Moreover, and as a matter of course, the appendages of the skin, comprising hair, nails, etc., have their tell-tale feature impressed upon them by time and determined by the operation of the same genetic, formative, and nutritional laws on the same, but variedly disposed, materials, together with the addition of altered pigmentation in the manifold stages and degrees of complexity between the “positive and negative.”

The atrophic changes displayed in “glossy skin,” in origin and character, are identical with the atrophic changes displayed in myopathic muscle, at any rate in the first stage, while in the second, or final, stage the respective atrophic changes are determined on the same lines, but modified by the somewhat different structural conditions existing between skin and muscle tissues. In like manner the atrophic cause must be sought for in faulty hæmo-neuroglial supplies, in breakdown of the neuronal structural developments of cell, nerve fibre, and terminal extensions, one or all of which may be found faulty in individual instances of the ailment, but one of which must have been primarily responsible for the induction of the pathological state and its consequences.

“Glossy skin” thus represents faulty dermal nutrition, due to nervine breakdown in one or other of the structural

elements responsible for the conveyance of nervine plasma from the central nervous system to the dermis, or the failure of the pial circulation to store the proper plasma in the matrix of the neuroglia within neuronal reach—generally or locally.

EXTRACT XXX.

ON KERATOSIS AND HYPERKERATOSIS.

THE first of these terms seems to us to be applicable to the definition of a natural process always in evidence on the general surface of the skin in greater or lesser degree, and consisting of the formation and exfoliation of horny or epidermal material, the term keratosis being, therefore, used to designate the physiological, while the latter, hyperkeratosis, in like manner applies to the pathological manifestations of the process.

Keratosis thus used signifies the ordinary proliferation and evolution of the epidermal cell elements, their cornification, so to speak, and their final exfoliation from the cutaneous surface as used up and functionless or withered structure. Hyperkeratosis, as thus used, signifies in like manner an exaggerated degree of the natural process of keratosis or the premature cessation of the final stage of exfoliation, by which the local or general accumulation of more or less of the keratosed material is allowed to take place on the epidermal surface, with the result that the involved cutaneous areas are said to be thickened or hyperkeratosed, or to present the pathological conditions known in so many morbid cutaneous processes and diseased states by such names as *lepra vulgaris*, *ichthyosis*, etc.

Keratosis, as a physiological occurrence, is represented by or consists of the conversion of the proliferating dermal into the fully developed epidermal cells, the gradual conversion of these into epidermal scales, and the final shedding of the scales by peripheral exfoliation in regular and uninterrupted structural succession, and, therefore,

constitutes a process of peripheral excretion—albeit mainly systemic nervine—of the exhausted and effete or dried-up protoplasm of the peripheral nerve terminals, admixed with a proportion of hæmal and sympathetic nervine excretory *débris*.

Keratosis being thus an excretional process, it is, therefore, liable to stasis, arrest, and accumulation, local and general, of the epidermal *exuvix* or excretory materials, with the result that a pathological disposal of these takes place on, within, or under the epidermis on lines determined by the consistency of the excretory materials and the histological character of the peripheral cutaneous elements, nervine and hæmal, amid which that material is arrested or deposited and keratosed, and ultimately hyperkeratosed by continuous accumulation and cornification.

A long list of skin diseases owes its genesis and existence to mal-excretion, or to epidermal retention or stasis, and pathological arrangement or organisation of the epidermal debris, which becomes cemented by the more fluid elements of that *débris*, together, it may be, by the more solid elements of the sweat, and is thereafter held by continual mechanico-structural continuity in histological union with the living textures.

The pathological juxtaposition, union, or fusion of retained excretional material, with physiologically active tissue, leads to the evolution of diseased conditions of great variety, each of which is determined by the operation of specific morbid influences, bacterial, chemical, mechanical, and others, and to combinations of these in different orders and intensities; all of which, operating in differing constitutional conditions and under powers of resistance of the most varied order, necessarily determine and secure the evolution of diseased entities in accordance with the laws of what may be denominated functional and structural *survival of the strongest*, but, unfortunately, *not of "the fittest."*

The generalisation here made applies to the evolution of diseased conditions generally, as well as to that department of dermatological morbidity embraced in the term hyperkeratosis with which we are now concerned.

The consistency of the excretory material on its

release from its histological attachments, and the part of the body from which the detachment is being effected in relation to facility or difficulty of shedding, necessarily afford the starting points and procure the conditions for the maintenance of hyperkeratosal evolution. It behoves us, therefore, to give warning that the process of keratosis must be prevented in all cases whenever a tendency is evinced towards hyperkeratosis, on the principle that "prevention is better than cure."

As illustration of the truth of this observation and the success of its practical application, we would give a short *résumé* of a case which lately came under our observation. The subject of the following clinical remarks was in advanced middle life, and had for years, during winter and spring, suffered from chapped hands and hyperkeratosis of the dorsal aspect of the carpal and metacarpal portions of thumb and forefinger of both hands. The condition of things, when first observed, consisted of a series of slight chaps over the dorsal aspect of the hands and fingers generally, with a dried and roughened feeling of the skin, and locally, over the region particularised as affected by hyperkeratosis, was a well-marked area on both hands, the right in particular, of irregularly but definitely raised epidermal *exuviae*, which to the finger gave the well-known sensation of "sand paper," and which looked to be determined in pattern by the peripheral terminal nervature. This exuvial epidermal upheaval was evidently determined by non-detachment of the external epidermal layers, and their continued adherence to the epidermal matrix, due mainly to the absence of the moisture of perspiration, determined by the repressive influence of the winter cold on the sudoriferous economy of the involved areas of the frequently exposed extremities. This state of things having occurred from year to year, and having as often disappeared, naturally gave rise to the idea that it was a seasonal phenomenon, and only required the use of preventive means to be entirely obviated, and if, unfortunately, by oversight allowed to develop, that the use of curative means indicated by the clinical condition were equally likely to be successful in removing it.

Thus the curative treatment in this case, which was most successful, consisted in the softening and removal of the hyperkeratosed epidermal *exuvix* by the local emollient and detaching influence of glycerinated skin lotion, assisted by simultaneous friction and the immediate removal of the softened epidermal impedimenta. This, together with the local protection of the affected parts after treatment and recourse to the same treatment when required, has resulted in the restoration to a perfectly healthy condition of the areas involved, and to a "much pleasanter condition" of the whole hands, in fact, equivalent to their summer or normal condition.

On analysing this pathological condition, if we be warranted in the use of the phrase, we become aware that it is entirely of mechanical origin, and that it requires for its cure and prevention means of a mechanical character; but who will say, if it be entirely neglected and allowed to evolve its undoubtedly pathological or pathogenic consequences, where it will or may end, and what actual disease or diseases it may initiate and foster? Verily we have here afforded the etiological foundation for the origin and progress of chemical, bacterial, and other ailments of the most varied and extensive order, and sometimes most repulsive and even fatal character—"desquamative dermatitis," "dermal tuberculosis," *et hoc genus omne*, and "leprosy," according to the prevailing bacterial life and local morbid environments.

EXTRACT XXXI.

ON HYPERKERATOSIS OF THE SKIN (*Continued*).

KERATOSIS being a physiological process of growth and devitalisation, and the last of the series undergone by the solid or organised textures of the skin, it must naturally follow that unless every step of that process follows the normal course or direction an interruption or stasis will be the result, or an altogether perverted course will be initiated and continued, it may be, to a pathological termination or hyperkeratosis. In other words, the shedding of the skin is the final stage of the katabolic activity of the natural vital growth or disposition of that portion of the organised plasma and resultant egesta which reach the periphery of the body, and necessarily, therefore, a vital hygienic function of the very greatest moment to the health of the body, and an occurrence, any interference with which must lead to pathogenesis, in proportion to the extent with which it interferes with the continuance of the physiological work of life and health.

Keratosis consists in the devitalisation, shrinkage, and detachment of epidermal cells as they become proliferated from the *cutis vera* and enter the stratum of overlying and protecting epidermis, and that proliferation is rendered possible only, or largely, by the presence in the proliferating dermic materials of a proper amount and proportion of solid and liquid or plastic elements in order to the maintenance of the succession of the cell outgrowth and the double function subserved by the skin of affording a containing and protecting wall to the body which it encloses, while allowing at the same time organised free-

dom for the external disposal of the effete and noxious matter resulting from devitalisation and detachment.

In the normal and healthy condition of the skin these processes are accomplished with absolute perfection, the cell proliferation and succession proceeding with vitally determined precision ; so soon, however, as the age of the individual or his environment, or both, leads to interference from within or from without with the regularity of this process, so soon will appear the first indications of the evolution of the phenomena of hyperkeratosis, it may be only in the form of thickening and hardening of the epidermis, with more or less consequent blunting of the involved afferent nervature ; the condition, however it may be, ultimately waxing in pronouncement until the consistence of "sand paper" has been reached, or great flakes and areas of accumulated epidermal *débris* mark the affected parts. Such processes do or can *only* occur where the skin is *liable* to be affected by changes in the environment of the body, as on the face and hands, or where the development of pathological changes in the vitality and texture of the skin elements have led to the occurrence of stasis or arrest of cutaneous transpiration, perspiration, or dermal cell proliferation and progression in one or all of the dermal and epidermal strata.

In the former or local the occurrence may hence be seasonal or climatic, in accordance with the existence and play of atmospheric change and condition, and the individual susceptibility to such influences and pathogenic incidence, while in the latter or general occurrence it may be developed at any or all times, or whenever and wherever the structural and functional conditions of the skin become affected by an internal pathogenic influence, localised in its power of action to a particular area, or spread over the general surface of the peripheral covering and the cutaneous excretory machinery of the body.

The substance, therefore, composing the hyperkeratosed epidermis represents an exaggerated degree of the physiologically produced epidermal elements, and may be due to defective shedding or aggravated production, which, once initiated, may become the host of organisms deleterious to the health, and, it may be, fatal to the life of

the body on which it forms, as, for example, in leprosy, where we contend that the prevention of hyperkeratosis will banish from the human family that long-dreaded and familiar scourge.

It is eminently here where want of *parallelism between structure and function* applies, and where the removal or detachment of devitalised and functionless materials becomes a matter of vital moment if the preservation of health is to be maintained, and where, if nature is unable alone to accomplish the work, she must be aided by art, medical as well as surgical.

“Cleanliness,” in the strictest sense and the completest form, externally and internally, “is next to Godliness,” and must, consequently, be the aim of everyone anxious to live out his or her days to their natural end, and to take out of this life all of comfort and happiness he or she possibly can. It, consequently, becomes the bounden duty of the individual and, therefore, of the State, so to educate public opinion that it will be strong enough to enforce the laws of public health, as well as to influence the character of the legislation necessary to this great end.

EXTRACT XXXII.

ON ATROPHY, HYPERTROPHY, AND DEGENERATION OF
MUSCLE AND SKIN TISSUES, FROM THE POINT OF
VIEW OF NEURO-MUSCULAR AND NEURO-DERMAL
NUTRITION AND INNERVATION.

CONTENDING, as we do, that nerve and muscle, and nerve and skin, are structurally and dynamically one in their neuro-systemic relationships, and that they are indissoluble in function as well as in histological continuity in physiological evolution and development and in sources of nutrition, we shall endeavour to apply these doctrines to the elucidation of the phenomena involved in the above conditions, and so prepare the way for, if possible, their more scientific and effective obviation and treatment.

The key to the situation thus created is what we should call the great *physiological law* that nerve and the true sarcous elements of muscle and the neuro-dermal elements of skin alike owe their nutrition to the neuroglia provided by the hæmal circulation in the brain cord and ganglia, where or from which the neurons primarily take up from the neurological matrix the pabulum on which they feed, as well as that on which all textures innervated and also nourished by them are supported, and to which they by growth or circulation convey it through their axons.

This key provides, we think, the means by which the etiology and evolution of the conditions known as atrophy, hypertrophy, and degeneration of muscular tissue and dermal texture respectively can best be realised and appraised, and indications provided both for preventive and curative treatment.

Thus, when it is fully understood and appreciated that every texture innervated by the systemic nervous system is likewise nourished by it, it will at once become obvious that any interference with either of these phenomena will of necessity be followed by altered innervation or nutrition, or both, of the textures involved, and will show the same, whether it be by deprivation, exaggeration, or perversion, of one or either, or both. It, therefore, follows from this that an entirely healthy condition of the factors engaged in systemic innervation and nutrition must of necessity be followed by an absolutely physiological fulfilment of these functions, while a disturbed or pathological condition of them will in like manner be followed by a pathological or imperfect manner of functional performance, which will manifest itself by the evolution of one or other of the structural states known as atrophy and hypertrophy, and, it may be, degeneration, which latter, however, may occur primarily or follow as a consequence of either atrophy or hypertrophy. Atrophy thus must follow neuro-plasmic failure in proportion to the completeness of the latter, and may vary in degree, consequently, according as the plasmic deprivation is partial or complete, therefore, the affected musculature and the implicated cutaneous areas will show by their trophic behaviour the extent of the neuro-plasmic failure, and so indicate to us whether the existent condition is partial and curable or complete and incurable. Moreover, it may be possible, by close observation of the incidence and sequence of the phenomena of atrophy, to determine to some extent whether they have originated in the affected muscular and dermal structures and areas or whether they have been initiated by central or connective changes, implicating the dendronal cell or axonal elements respectively, and thus, consequently, it may be possible for us to prescribe a remedial or ameliorative treatment on more scientific lines than those of the best directed empiricism.

Hypertrophy, like atrophy, follows the trophic disposal of neuro-plasm, but, unlike it, is due to its exaggerated distribution, circulation, and assimilation, which latter—the assimilation—being in excess of the spatial capabilities and requirements of the affected musculature and neuro-

dermal tissues respectively, manifests itself as structural exaggeration, but on and within the normal lines of natural histological arrangement and development. Thus the arm of the blacksmith and the whole muscular physique of the athlete undergo trophic increase exclusively along the naturally existent lines of histological continuity and developmental evolution of neuron and muscle fibre, determined by voluntarily increased neuro-dynamic discharge and insulated circulation of neuro-plasm or nerve matter and energy, whereby, by repetition, the constantly accentuated supply of neuro-muscular protoplasm becomes "piled up," as it were, in the muscle discs at the terminal extremities of the actively vehicular nervature, with the result that local or general hypertrophy is evolved in the "upper limb" of the former, and the fully developed "classic style" in the latter. Moreover, it may be claimed that the "horny handed" brotherhood of labour display on the same natural lines of evolutionary development the exaggerated dispatch and assimilation of neuro-dermal plasma, and its local "piling up" or storage, amid the dermal structure and appendages of their much exercised manual "organs" or extremities, all which shows once more the truth of the old aphorism, *ubi stimulus ibi fluxus*, and its applicability to the explanation of neuro-muscular and neuro-dermal circulatory and nutritional phenomena in their absolutely physiological condition; and foreshadows its corresponding applicability to the decipherment of related pathological phenomena; furthermore, we claim that underlying what we have here advanced are alone, or almost alone, the great principles of the neuro-plasmic material circulation and the neuro-dynamic or force regulation, or the formative disposal of neuro-dermal plasma in the normal or physiological aspect of the subject, the pathological aspect of it emerging by continuity from the physiological. Systemic musculo-dermic, as distinguished from sympathetic structural, textural, or organic degeneration, follows as a pathological phenomenon from a lapse or modification of the physiological control of the formative or organic impulses, and the consequently irregular plasmic dispositions of the neuro-muscular and neuro-dermic organic materials on the

part of the trophic machinery of the systemic nervous system or organism, and manifests itself in the production, by the substituted chemical and physical energies consequent on the lapse of neuro-dynamic or vital energy, of textural changes, called degenerative, or what may be regarded as analytic or dissolutive plasma or material dispositions, leading to atrophy and ultimate textural disappearance.

Degeneration may, therefore, present itself in all degrees of development and completeness according to the nature of the structures involved, the length of time since their trophic paralysis ensued, and the celerity of the chemical and physical changes undergone by the paralysed textures, besides what may be determined by the possible invasion and modification of the degenerating materials by bacterial organisms and *materies morbi* and their consequent conversion into pabulum fit for new organisation on pathological lines, and, it may be, for the evolution of definite morbid entities, some of which may have the most far-reaching influences on health and even life.

Degeneration, arising from neuro-plasmic and neuro-dynamic failure, may be regarded as a phenomenon of constant occurrence in the economy of nutrition generally in certain states of health and at certain stages of life in even its physiological condition, where the analytic forces begin to overtake and overwhelm the synthetic or formative forces, and to initiate changes which turn the healthy metabolism of the tissues to pathological purposes or uses, substituting by degrees a morbid for a healthy formative *régime*, which ultimately, it may be, completely asphyxiates normal growths and vital action. This applies equally to the trophic phenomena characterising the nutrition of both the systemically and sympathetically innervated structures and organs, and to tissue metabolism generally and particularly.

Degeneration, in the latter sense, is synonymous with the disintegration, which "waiteth" on and followeth integration in the process of nutrition, and becomes the lot of every particle of integrated material or tissue fabric, and, therefore, is physiological, while degeneration in the pathological sense consists of the premature devitalisation

and breaking up of tissue material into its simpler chemical and physical constituents, and, thereafter, into its ultimate inorganic elements.

Pathological degenerations may thus often precede atrophy of structure and organ, and afford the material and dynamic basis for the evolution of diseased entities and for their extension to the degree of ultimate complete usurpation of physiological dominion and vital supremacy in the material disposition and formative work of the affected organisms—it may, therefore, be regarded as a *prematurely aggressive ally* of the natural forces of involution which, at one time or another, assert themselves as the “natural span of life” lengthens out to its close and as the processes of innervation and nutrition, or the material and dynamic vital activities, fall into abeyance and ultimate cessation. Disease and death are, therefore, both indebted to degeneration for the accomplishment of much of their inevitable destructive work, and vital involution for the hurrying forward of its accomplishment of the duties of organic reduction and dismantlement.

EXTRACT XXXIII.

ON THE ORIGIN OF COLOUR OR PIGMENTATION IN THE VARIOUS TEXTURES.

THE occurrence of pigmentation or the deposition of colouring matter in the various textures of the body during the process of pathological changes in the course of disease *seems* to be dependent on the "chapter of accidents," and to be regulated by no law. Such, we are led to believe, is not the case, and, indeed, it would be contrary to all experience were we to look upon the phenomena displayed in the colour relicts of disease as representing nothing but the chaos of the battlefield, so to speak, in which the agents of disease have been struggling with those of health for the "mastery of the situation," and in which the alterations of colour may be recognised as so much wreckage.

Before referring to the subject in its pathological aspect, our explanatory efforts will be devoted to its physiological bearings, in order to make more clear the foundations on which we propose that the pathological superstructure and its clinical outcome of deduction and guidance should be built.

Physiologically, we think we are warranted in stating that all methods and varieties of animal colouration in living animal nature are due to the *initiative* and *selective agency* of the nervous system, by virtue of its manifold "tastes," and through the various *fashions* and *modes* of its working or operating throughout the whole of the animal kingdom, and, also, that nature operates by a pro-

cess allied to but, so far as yet known, without the agency of a nervous system, unless it be a rudimentary sympathetic, in determining and producing the magnificent array of colouration displayed throughout the vegetable kingdom.

The superficies of each animal is vitalised by the peripheral nerves, the texture of that superficies being determined and its colour resolved upon and fixed in settled perpetuity, so far as the individual animal is concerned, by the inherent determining and selective powers of the nervous system, reacted upon by the conditions of its environment, and the chemical and physical nature of the pabulum with which it is supplied, by the pervading and related hæmal vascular system and nutritional mechanism ; in other words, by the laws of *natural selection*, which here operate with great conspicuousness and continuity of purposive design—the colour of the deep-seated, as well as the superficial parts, must necessarily be determined and perpetuated by like agencies.

In the embryo are laid the foundations of the colour, shape, and general characteristics of the future organism, and the molecular arrangements, cellular development, and the manner of unfolding of its component parts, organs, and appendages foreshadowed and determined. In early and mature age are wrought out the designs formed in the embryo, while in old age we witness their modification, involution, and obliteration to meet the altered and altering circumstances of the individual organism and its environment.

Colour, being not a property of matter, but the outcome of its molecular arrangement, the causes of its changes and disappearance in the living body, must, therefore, be sought for amid the incessant activities and processes of vital synthesis and analysis of integration and disintegration, growth and decay, which repeat themselves in regular succession during the course of life. Continuity and regularity, in these conditions and processes, must be followed by sameness of result, and, consequently, sameness of colour, while discontinuity and irregularity must be followed by difference of result, and, consequently, difference of colour, which latter occurrence must be quite

consistent with physiological necessities, and, therefore, not necessarily a pathological condition or development.

The alteration in the colour of the hair, as the process of *ageing* advances, affords a good example of the physiological modification of the function of pigmentation, while the sudden blanching of the hair observed under the influence of great mental shock or emotion might be recognised as an example of the pathological variety of the alteration, although on strictly physiological lines.

Pigment, as observed physiologically in the human body, is detected in a large number of textures, both superficial and deep, and histologically it may be said to be almost consistently related to nerve textures—mainly terminal, both proximal and distal—as, for instance, in the skin, retina, Schneiderian mucosa, the otic muscular textures, and the smaller and larger pigmentary deposits to be found scattered up and down it. It may, therefore, be inferred that the nervous system, as has already been remarked, is mainly instrumental in its production and deposition, and that the play of nerve force on the material constituting the pigment under normal as well as abnormal biological conditions eventuates in a molecular transmutation or re-arrangement whereby the impression of colour is given and the pigmentation secured—the existence in some nerve cells of colouring matter and the occurrence of pigmentation in connection with the terminal ends of some nerve fibrils being thus accounted for by histological continuity.

As it is in the physiological state so it is in the pathological state, in which latter a morbid excitation or disturbance of the nerve terminal textures or a solution of continuity of nerve fibril investments takes place, whereby a leakage or escape of nerve substance and force is permitted into the surrounding structures, and there occurs the production of more or less pigmentation—“negative or positive,” fainter or more marked, according to the site, the structures involved in the lesion, and the continuation and intensity of the morbid processes involved.

Associated with the subject of pigmentation of the skin is that of the life-long modification or changing textural proportions due to evolution and involution of its external

layers. This modification, we have observed, is a life-long one, stretching from the earliest development of the embryonic "limiting membrane" and foetal skin to the most wrinkled old age, and determined by the circumstances of environment and the altering conditions of life and work. Thus the respective proportions in regard to fulness of development and complexity of textural arrangement of the nervine and blood circulatory *media* change "with the changing years."

EXTRACT XXXIV.

ON LEPROSY.

LEPROSY is a disease unique in the national and individual interest it has attracted all along the historical ages of the human race, its conspicuousness and esteemed infectivity securing for it the adoption of isolative and preventive measures more or less by all races in proportion to the intensity of its incidence in, and the degree of civilisation attained by, the particular race.

Many opinions have from time to time been advanced and held since its nature has been subjected to more or less expert consideration and analysis, but it cannot be said that any one of these has yet been generally recognised as absolutely believable and capable of leading to more than an empirical mode of meeting the hygienic and therapeutic necessities of the case; therefore, we feel that the advancement of another opinion will be quite consistent with the past history of this perennial subject.

Our opinion then, shortly stated, is this: We have in leprosy to deal with a disease primarily of arrested cutaneous exfoliation, transpiration, perspiration, and the consequent suspension of the other functional activities of that most important structure, the arrestment, beginning with temporary stasis of the eliminatory phenomena of the skin, continuing to increase by daily and yearly accumulation of effete dermal products, and culminating in the production of more or less *gross collections* of exfoliated but retained *débris* in the form of nodules, tubercles, and plaques, or pseudo-“armour plates,” which ultimately may, and sometimes do, undergo disintegra-

tion and removal, leaving the overspread and involved cutaneous and subcutaneous structures bereft of many of their histological elements, functional, material, active and passive, and, in short, in a state of "wreck and ruin" more or less complete, in accordance with the intensity and duration of the disease.

The process of arrestment of cutaneous elimination, and the consequent local or general formation of more or less gross collections of effete but unshed dermal materials, lay the foundation conditions and provide the required pabulum for the invasion and support of armies of bacterial organisms, which "batten and fatten" at the expense of their host, and *generally* succeed, with intercurrent allies, in completely undoing him, but not always, when mark the result! is it not a "living death"?

Underlying and lending itself to the production and evolution of these lethal events is one main structural peculiarity and histological arrangement of the elements comprising the skin, viz. the co-existence in it of three circulations, or rather systems of circulation, which are, respectively, sanguineous, lymphatic, and neural.

The first two may, we contend, be eliminated from the list of possible primary etiological factors of leprosy, so far as the principle of circulation and its arrestment is concerned, inasmuch as these are concerned in the circulation of fluids not likely to be primarily concerned in the initiation of such disease, although they may, and do, become secondarily involved by invasion and contiguity; moreover, they circulate their fluids mainly *from* the periphery, and consequently away from the scene of the disease, the exception being the pure arterial blood, which cannot be looked upon as conveying to the peripheral capillaries an effete and impure, and, therefore, excretional, product. That being so, we are left alone with the neural circulation, to find, if possible, in it what we are in search of, *i.e. the etiological factor*, which has in it a power and cogency sufficient to explain the initiation and sequence of the morbid events or phenomena characterising and constituting this long familiar, hideous, and fell disease, leprosy.

That the neural circulation or system of circulations is

a great histological and physiological reality, we have already attempted to make plain; therefore, it is not here necessary to re-describe it in detail, or to do more than claim for it that power and cogency, which we hold it possesses, to unlock the secret of the true nature and incidence of leprosy.

Thus the neural circulations one and all conduct to the neural periphery wherever situated, either internally or externally, and externally, of course, as in this case, they must necessarily end in the skin, to which they convey or circulate whatever of neural lymph may find its way along the inter-neurilemmar spaces, and whatever of plastic nervine substance is elaborated in and passed out of, or excreted by, the afferent or sensory neuronal commonwealth or sensory nerve cell community, whether situated in brain, spinal cord, or ganglia. The excrementitious matters here must, therefore, be neural lymph, in the form of sweat, and axonal process substances consisting of neuro-keratinous or containing membrane material, with the medullary and axis cylinder substances or nervine substance proper—truly, a series of devitalised and shedding materials abundantly and naturally able to take on agglutinative action, hardening and accumulative accretion, ideally adapted to the formative growth and prolonged cuticular adherence or dermal retention of leprous encrustations—the cemented and solidified equivalent of the total dermal *débris* of the surfaces involved.

That leprous skin developments are primarily due to such accumulations we deliberately believe, and that the bacterial or microbic organisms discovered in the accumulations and permeating the connected tissues are secondary we further believe; therefore, we are prepared to assert that without an initial stasis and more or less permanent arrestment of the neural circulations with local effete accumulations, we could not have leprosy nor the development of the leprous bacillus.

Such views necessitate the further belief that leprosy is essentially a disease primarily of the nervous system in relation to the non-patency and debarred function of its cutaneous, excretional, and exfoliative apparatus, and, therefore, that it is a disease of "dirt and uncleanness," with

super-added microbism, to be dealt with rigorously from the preventive point of view, the principles of which should almost at once and spontaneously be indicated or present themselves. That leprosy has been geographically limited in incidence, racially somewhat locally circumscribed in spread, and, as to individual cases, that they generally have been surrounded by somewhat questionable sanitary conditions, and, it may be, personal neglect of bodily cleanliness, with the continuous use of questionable articles of diet, as has been from time to time contended, give a warrant to the assumption that it is a disease absolutely capable of extinction by properly directed preventive measures and the education of public opinion as to the great possibilities underlying and flowing out of the continued and world-wide influence of the rigorous administration of the needful preventive and other measures.

We have claimed leprosy as a disease primarily of the nervous system, and we are quite aware that the claim is founded on nothing more or less than rank heterodoxy; nevertheless, we are prepared, we think and say, to demonstrate that, on anatomical, histological, pathological, and clinical grounds, we are warranted in making the claim and in rejecting the others, so far as we have been able to gather from available literature on the subject, as coming far shorter of the requirements necessitated than that which we now and here advance. The universally cutaneous sites chosen by the disease, the years long incubatory progress characterising it, the greater or lesser neural destruction wrought by its pathological incidence and influence, the consistence and composition of the leprous *exuvia*, the frequent symmetrical distribution of the morbid phenomena, and the correspondence in *locale* of the cutaneous involvements, with the anatomical distribution of the peripheral sensory nervature, all proclaim its nervine origin and incidence. These facts, in conjunction with the bacterial invasion of the resultant neurodermal exudations, give the key, therefore, in our opinion, to the true pathology of the affection, provide indications for a more hopeful treatment, preventive, curative, and ameliorative, than has hitherto been possible, and bring the disease into the category of affections of which

it is the bounden duty of the profession of medicine to undertake the treatment to satisfy its *amour propre*, as well as to reclaim from abject misery and hopelessness the unfortunate outcasts of, at the best, a barbarous and melancholy survival of ancient folk-medicine.

Pursuing the subject of the nervine origin of leprosy a little further, we are brought face to face with examples of undoubted neural circulatory stasis, accumulation of neural substance, lymphoid and plastic, in the *lumina* of the neurilemmar tubes, and the nerve tubes proper, with regurgitation along them and consequent enlargement, and sometimes varicosity of the implicated nerve trunks, occurrences which have hitherto ranked as nerve hypertrophy from neuritis and accompanying hyperplasia. At a glance we see that these cases of the disease, and kindred others, conform to the formative conditions and evolutionary requirements necessitated by nervine origin and progress, and that the whole sequence of morbid events constituting their clinical history and progress is determined by nervine conditions, plus, *ultimately* or later, the addition of bacterial influences, which to some extent modify the later and latest stages of the disease. The bacterial invasion cannot take place unless a suitable local culture medium is provided for the growth and increase of the organisms, and the continued maintenance of their malign brood, and this medium, we hold, is provided in the accumulating and unhygienic neuro-dermal *débris*; it follows, therefore, that the absence of this culture *medium* must be followed by bacterially negative results on every occasion, and that the universal non-supply of these *media* must inevitably be followed by the non-existence or extinction of the peccant organisms. We must assert, moreover, that the part of the nervous system primarily involved in the leprous process is the systemic, whose excretional exits on its afferent or sensory side are entirely on the skin, where the obstructing influences of external dirt and the accumulation of neuro-dermal impedimenta or *exuviae* ultimately effect the blockage of these exits, with the consequent damming back of the outflowing and outgrowing neural elements, and their piling up, so to speak, amid the wreckage of breaking

down and perishing dermal and sub-dermal tissues, and in some cases the regurgitant accumulations in, and the ultimate so-called pseudo-hypertrophy of, the involved nerve trunks.

Leprosy may, therefore, be defined as a disease primarily initiated by purely mechanical causes, evolved by the combination of these with bacterial influences, and closed by the devitalisation and disintegration of the tissues involved, ending, it may be, spontaneously in sorely maimed recovery, but generally in exhaustion and death—constituting altogether one of the most tragic and melancholy morbid spectacles to be met with in the whole range of human disease.

As thus defined, its evolution proceeds somewhat on the following lines, according to the geographical *locale* and climatic conditions in which it may happen to arise—being due, as we contend, to initial arrest of cuticular desquamation and retained dermal or peripheral excretional products, leprosy is evolved by accumulation of this epidermal *débris* on the functionally active and proliferating dermal tissues, where it undergoes a process of gradual thickening by continued accretion and cementing, which effectually prevents the process of normal desquamation and bars the exits of the sweat glands, and thus leads to greater and greater upheaval of the involved epidermis, and the damming back of the arrested sweat, with its consequent and compelled regurgitation along the neurilemmar interspaces of the implicated peripheral terminal nervature and nerve trunks, with, it may be, induced peri-neuritis and the development of pseudo-hypertrophy of the involved or connected nerve trunks. As this process proceeds, and where sufficient foothold, so to speak, is presented to the lurking *lepra bacillus* to effect an entrance on the scene, we see commenced the concluding stages of that long drawn-out morbid process and that physiologico-pathological conflict between the original and acquired phagocytic agents of the human organism represented by the host of leprosy in all its usually unmitigated hideousness and “long-suffering” endurance.

During this physiologico-pathological conflict, if the fortunes of war be on the side of the original and against

the acquired phagocytic hosts, the result, if the conflict has been long continued, is a scene of wreckage and spoliation of its subject almost as formidable as death itself, the immediately adjacent and the histologically continuous structures being usually left waste and desolate by the waxing and waning of battle and the continued cumbering of the battlefield by broken and useless impedimenta. Generally, however, the conflict becomes unequal, the acquired or invading gaining an overwhelming influence over the original or protecting phagocytic hosts, whereby cessation of hostilities, capitulation, and annihilation are finally secured. All this sorrowful conflict waged in the persons of unfortunate lepers, we say again, is absolutely preventable, and, if the requisite treatment be but initiated, soon ought to be curable, or, if unhappily fairly in progress, mitigable, by means plainly indicated in the foregoing *résumé* of the subject; we, therefore, reiterate the opinion that research, instead of dwelling on the effects, should turn its attention to the elucidation of the absolutely initial causes of the disease, which are usually to be found in that debatable organic region or buffer zone occupied in common by the frontier physiological agencies or forces of health, and the marauding or invading pathogenic scouts and advancing forces of disease. This debatable zone may be said to be non-existent in the absolutely physiologically healthy body and its individual tissues and organs, and, therefore, no pathological opportunity presents itself for the inroads of the disease; under such circumstances, consequently, the maintenance of an unbroken hygienic wall of healthy protective texture around the citadel of life must be constantly sought after as the only means effectually to resist the invasion of such an enemy.

Hygiene of the person universally, combined with the scientific use of germicide therapeutic agencies under all threatening circumstances, and with a world-wide individual and national co-operation in working out the destruction of the *lepra bacillus*, promises to rid the planet of a disease which has been one of the greatest scourges of humanity since the beginning of history, and, by inference, from the beginning of the race.

EXTRACT XXXV.

ON TUBERCULOSIS.

THE term tuberculosis is here chosen in preference to the terms consumption, phthisis, or tabes, as having a generic signification and adaptability which the latter terms do not possess.

Tuberculosis, as a generic term, includes a very large array of specific varieties of the disease, each of which is due to the growth of a, or the, specific *bacillus tuberculosis*—a near relation of the *bacillus lepræ*—in a structural *medium*, capable of determining its particular manner of growth and pathological development, and the evolution of the particular form of the disease. Thus, according to the incidence of its etiological factors, it attacks the pulmonary tissues, the parenchyma of particular organs, the free surfaces of lining membranes, and the textures of the skin, manifesting in each instance its specific characteristics modified by the *medium* in which it is developed, and the textural nature of its environment. This classification is now rendered possible and necessary by the discovery that they are each and all due to the growth and influence of a common microbic organism, and that they are each and all dependent for their individual and distinguishing character on the operation of local modifying influences and factors on their common pathological evolution from one variety of microbic organism.

Being thus evolved from the growth of a common pathogenic micro-organism, it must follow that the organism must obtain access to, and become supported by, some available nutritive material possessed in common by the

various textures of the bodies which, for the time being, become its habitat, and where it develops and perpetuates, and is communicated seriatim to other, or all, available or suitable localities and organs within these bodies, until it usurps and finally secures complete possession ; the physiological yielding to the pathological *régime*, amid a scene of material and dynamic exhaustion altogether *sui generis*.

We are inclined to think that, like its relative leprosy, it at first finds a lodgment in and a foothold on inert and devitalised materials or substances undergoing exfoliation and removal from the system of the individual attacked, such as are afforded in the situations usually chosen by the bacillus in its first attempts at invasion ; as, for instance, in the vesicular cavities of the pulmonary parenchyma and the surface layers of the skin, where, in particular, its presence is usually first observed after the influence of its pathological presence has become manifest.

In its origin, therefore, we see the operation of etiological factors conducted along kindred lines to those which can be traced in the evolution of zymotic disease generally, and perceive to some extent the operation of the particular etiological factors in the evolution of the individual tubercular manifestations.

If the infection be air-borne, we would naturally conclude that the terminal air spaces of the lungs, where, from the "calm and repose" of the residual air, the bacillary spores could be dropped, deposited, or "sown" on the already prepared soil of the exfoliating endothelium, would be "ideal places" for the rearing of such organisms and the propagation and distribution of their ripened seed. But, on the other hand, if the infection be transferred in more or less fluid or solid form from person to person, we likewise see that the skin would most readily lend itself to "culture of the organism, and could propagate and convey it to the deeper-seated parts, along which it would ultimately reach and overrun seriatim by contiguity and histological continuity the various vulnerable structures and organs to which it might find access.

The intestinal canal is another situation from which the microbe secures admission into vulnerable regions by passing, along with articles of food and drink, through its

lining mucosa, and attacking the agents of nutrition, destroying their functional powers, and disseminating toxins, until mal-nutrition and inanition "prove superior to the powers of life."

In relation to the intra-corporeal distribution of the tubercle bacillus, we are convinced that the invasion of the cerebro-spinal cavity, and the subsequent tuberculous tainting of the streams of cerebro-spinal lymph issuing therefrom, becomes a principal, and perhaps the greatest, means of carrying into the most remote regions of the body the seeds of the disease, there to become fresh centres for its further dissemination and the spread of its pathogenic influence.

Amongst the phenomena of tubercular infectivity is one most remarkable, we would say, almost unique, feature, viz. the harmless retention for long periods of the bacillary organisms, in spore, or germ, or adult condition, within the invaded structures, without their giving rise to more than passive symptoms or attracting the attention of their host. In such circumstances the enemy, so to speak, lies low until the time arrives that, from an attack of inter-current disease and a lowering of the power of resistance, with most likely the accumulation of adynamic and more or less devitalised material, it is enabled to supply itself with the means of renewed development and pathological progress, and to engage with renewed vigour in its work of destruction and "consumption," not usually to be stopped until it has become completely victorious over its now helpless victim.

The local incidence of the disease, its methods and manner of development, the pathological changes it effects in individual structures and organs, and its ultimate results all conform to the character and nature of its microbic origin and essence, which enables it first to effect a lodgment in, or take possession of, its victim at any time, and to wait the "current of organic events," until the time arrives for it to take action, when it will its lethal "tale unfold." In this it is but too frequently successful, but not always, as clinical experience has told, and as modern research is now demonstrating in its beneficent work of prevention and cure.

We may regard it from this point of view as axiomatic, *that no disease germ can develop at the expense of absolutely healthy and physiologically active tissue*, and that, therefore, the immunity of absolutely healthy people is thus secured, even though they be exposed to the attack of infectious disease, if they but unremittingly attend to the removal from their bodies, externally and internally, of the effete materials on, and in, which such organisms can alone live and move and have their being.

Consistently with this view of the genesis and progress of tuberculosis, we, therefore, find the period of incubation of the disease to vary according to the condition of health and the character of bodily hygiene of its subject at the time of infection and during an indefinite period thereafter; moreover, we find that the infection frequently proves abortive, as when the pathogenic germs are successfully resisted by an impervious wall of physiologically perfect tissue structure and perfectly dynamically endowed tissue elements, or when these germs have been mechanically removed or therapeutically destroyed or neutralised by proper systemic hygienic agencies by, or in, conjunction with properly devised artificial means; in other words, by the rational and commonsense union of natural and artificial agencies, climatic and therapeutic, such as changed environment, improved ingestion, and facilitated egestion, whereby the *vis medicatrix naturæ* is assisted in resisting and overcoming the onward progress of pathogenesis or pathological cell proliferation at the expense of the normal or physiological metabolism.

Pulmonary tuberculosis, or the most prevalent form of the disease, is, we may conclude, generally due to air-borne infection, the germs of which by inspiration are carried into the remotest recesses of the vesicular textures of the lungs, and deposited on the surrounding exfoliating endothelium, or in the exfoliated and unexpectored *débris*, to which it adheres, and in which it grows, forming by subsequent accumulation and arrested removal, it may be, caseated or calcified particles or masses, or miliary tubercles, and ultimately, it may be, attacking the now somewhat imperfectly vitalised surrounding endothelium and adjacent pulmonary inter-vesicular textures, which it

gradually disintegrates, and, with the aid of a cough, succeeds in expelling, leaving a cavity behind, which in time is joined by other such cavities, due to similar pathological processes, and converted into the fully developed "tubercular pulmonary cavity," such as is met with in the advanced or concluding stage of the disease.

This pathological sequence of events is generally slow, but it must be remembered that it is not necessarily always so, because cases are sometimes met with in which the whole phenomena are so hurried, and the progress so rapid, that from the first a fatal issue is inevitable, the assistance of hygiene and therapeutics being alike futile.

In many of the slowly progressive cases, however, the phenomena of *metastasis* are to be observed; thus when the peculiar cough of pulmonary phthisis becomes established, and the disintegrative changes, due to advancing growth of the bacillary organisms of the miliary tubercles and the consequent breaking down of contiguous lung textures begins, we observe, and may trace, the invasion of the central nervous system, by zymotic growth of the specific bacillus, along the pneumo-gastric terminal fibres, and their connected trunks and inter-neurilemmar spaces, into the cerebro-spinal cavity. Having reached this cavity, and overrun its contained lymph and nervine elements, the bacillary organisms are conveyed far and wide by the distributive agency of that lymph, as it is continuously excreted, along the inter-neurilemmar spaces of the entire cerebro-spinal nervature, sensory as well as motor, hence the secondary invasion of the skin and the joints, as well as the textures and organs more directly innervated by the sympathetic nervous system, by way of its *rami communicantes*.

Moreover, there are cases of tuberculosis or tabes, in children especially, where the invasion of the intestinal canal is effected primarily by imbibition with the food or drink, and secondarily from the lungs by the expectorated tubercle, laden with pulmonary *detritus*, which conveys the bacillus along the secretory paths by which the chyle is conveyed into the blood streams, leaving *en route* in the mesenteric glands sufficient organisms to produce, through destructive changes and mechanical blockage, a more or

less complete stasis of the lacteal circulation, and ultimate inanition of the dependent body structures, with consequent withering and death of the entire organism.

Other causes there are whose initiation is dependent on primary cutaneous invasion, facilities for which are afforded in the exfoliating epidermis, where the bacillary organisms find a soil and pabulum ready prepared for their specific mode of growth, progress, and distribution, and where the morbid phenomena displayed resemble in many respects those of leprosy. In this, we may take it, we have not a resemblance only, but a close relationship, in specific origin, character of infective organism, and morbid changes wrought in the dermal and epidermal structures.

Tuberculosis, therefore, in whatever phase or form observed, conforms in manner of origin and evolution to the *laws of zymosis*, to use a concrete phrase, *i.e.* being due to the growth and spread of a living organism within a living organism, it parasite-like incubates or takes root in totally or partially inactive or adynamic materials or structures within its host, lives for a time passively or more actively, and, according to the resisting power and physiological impermeability of the living materials and structures, doggedly and steadily waits the advent of favourable conditions for its further morbid progress and pathological domination, locally and generally; when it usually sooner or later effects its fell purpose with a gradually declining opposition, and ultimate capitulation and annihilation, material and dynamic, of invaded structures and host alike.

The indications for treatment in such morbid or diseased conditions must be deduced from a study mainly of the natural history of the tubercle bacillus, together with a close observation and study of the circumstances and conditions of health of the subjects of its attack, and will, we are persuaded, be found, shortly speaking, to resolve themselves into a destruction of the organisms—tubercular—root and branch hygienically, and by the withdrawal of the susceptible from its sphere of influence, or the fortification of the susceptible against its attack, the neutralisation of its destructive influence, and the adoption of therapeutic measures to meet its various manners

and methods of pathological development and progress. The details of these measures have already to a considerable extent been thought out and adopted with greater or lesser success, but it yet remains to render thoroughly effective the means of absolute prevention of the disease, and its banishment to the region of extinct morbid entities and stamped-out plague spots.

EXTRACT XXXVI.

ON CANCER.

AFTER the study of leprosy and tuberculosis, but more especially of leprosy, we find, on approaching the subject of cancer as a morbid entity, that a certain suggestiveness of, in some respects, similarity between the affections of an etiological and intrinsic character presents itself, and gives us a clue, which, if we can follow it, seems to promise some, we hope, good result; at any rate, we think no harm can be done to the subject or ourselves by a short indulgence in *amateur detective exercise*, even should it turn out no more than fiction.

Thus, having endeavoured to prove that leprosy is a disease primarily of the nervous system, and that it is due to mechanical and bacterial interference with the excretory economy of the systemic nervous system and to the morbid after-effects accruing therefrom, we would, therefore, take up the clue suggested by our study of that disease, and endeavour to unravel, as far as we can at least, some of the profoundly important and no less interesting problems involved in the study of cancer. The disease now called cancer, or malignant disease proper, has not so long been a subject of lay, as well as professional interest, as leprosy has, though, no doubt, it has entailed quite as much study, and has given rise to even a greater modern desire on the part of the profession and the educated public to fathom its true nature, in order to the devisal of appropriate means for its relief and extinction. So far as results can be computed, we have only as yet attained a distant view of some of the salient features of the *terra incognita*

surrounding the stronghold of the dreaded monster cancer. It seems, however, to pursue the metaphor, that we are approaching a vantage ground from which, if we can possess it, we can command a fuller view of said monster in "full prospective and perspective," and be enabled thereby to "take fuller advantage of the situation."

Cancer, then, to our mind, consists primarily of, or originates in, a disparity or want of *parallelism*, between the functional or dynamic and the structural or material elements of the textures involved in and associated with the morbid process, the physiological *status quo ante* gradually, and at first imperceptibly, giving place to and merging in the *status quo post*; the local conditions of health of the affected part or parts being gradually usurped by those of disease, the healthy physiological *régime* being called upon to yield and meet the material and dynamic requirements of the pathological, whose lethal emissaries and agencies convert the chemico-physiological machinery or plant and organised material into formative instruments and raw material for its own fell purposes and terrible ends.

As suggesting this view, it will be observed by those engaged in the work of cancer research that the structures primarily attacked, and from which, when subdued, the disease usually delivers its furthest invasive movements in its further work of spoliation and reduction, are those whose functional activity is being, or has been, temporarily slowed or stopped, and whose consequently more or less disused or obsolete material impedimenta have not yet been removed or otherwise physiologically employed by the functionally active surrounding structures, and which, therefore, become the material bases for the forces of morbid activity, and easily lend themselves to the possession of malignant as well as more innocent pathological agencies and organisms.

A *nidus* is thus presented by every tissue and organ whose functions are "giving out," and whose materials are being left more or less derelict and exposed to the tender mercy of the resident and surviving cosmopolitan non-hygienic "rats" and adventurous parasites by whom they may be discovered amid the organic traffic still maintained

by the active tissues and organs before it is "choked" and turned into the channels prepared by or evolved from the formative activities of the encroaching and overwhelming disease. Cancer is thus primarily, like leprosy, a *disease of arrested egestion, i.e.* arising through delayed removal of functionless organic substances, which, from imperfect organic hygiene, are allowed to cumber the body, thereby becoming a prey to bacterial and other morbid agents, as well as, it may be, forming a material basis for the destructive display of chemico-pathological energy, or allowing the devitalising influences natural to all organic matter, whether active or passive, vitally incorporated or physically attached, to exercise their disintegrating powers.

In contrast to leprosy, however—and herein lies the great difference in etiological evolution between the two affections—cancer primarily manifests itself or begins its morbid work in structures belonging to or innervated by the sympathetic nervous system, and if it does synchronously involve the systemic nervous system and systemically innervated structures, it does so by progression along anatomical and histological lines, determined by mutual continuity and contiguity, therefore, we usually find by carefully directed enquiry into individual cases, that the first symptoms of the disease have manifested themselves in such organs as the mammæ, the uterus, and any particular organs or structures whose functions have been from any cause ceasing to be exercised on their accustomed scale, and whose idle machinery or asthenic and adynamic material parts, are being left for removal by hygienic phagocytes and other scavengers, or for morbid utilisation by any microbic or other wandering disease agencies which have gained access to the scene of dismantlement and textural disintegration, and are permitted to begin the work of disease production—the same deduction applies to traumatised textures.

It follows from this, therefore, that cancer evolves itself, or is evolved, from health, that the physiological state of the affected structures suffering from stasis of katabolic material gradually gives place to the pathological, and that there is no absolutely true dividing line, or "line of demarcation," between them, a conclusion which may

likewise be applied to the evolution of organic disease generally.

Being a disease of nerve origin, and involving primarily the sympathetic neural elements, it is necessarily dependent for the manner of its evolution and progress on the structural conditions imposed by the histological disposition and functional work of the sympathetic nervous system. These structural conditions of the sympathetic are fundamentally different from those of the systemic nervous system, at least on its sensory side, where, for instance, the nerve terminals end in the skin, and are there provided with a means of direct, entire, and final disposal of effete or excrementitious matter, the stoppage of which leads to the production of such diseases as leprosy; on its motor side, however, we find a greater analogy or resemblance between the two systems in their terminal distribution, inasmuch as these so-called motor terminals end in muscle, and *thereafter* pursue a further course along the lines of least resistance, or until the highways of the proper vascular and lymphatic circulation are once more reached.

Lapse of function, traumatism of texture, and retention or non-removal of the functionless tissue in molecule and mass become thus the foundations on which the initiation of the morbid entity known as cancer, or malignant disease, as of many non-malignant diseases, rests, and from which its succeeding stages are by continuity evolved, and the life of the subject, if that continuity be allowed to proceed unbroken to its usual close, sapped and destroyed.

On this foundation the future stages of malignant growth are laid, and from this point begin to spring the chemicophysiological phenomena, the phases of cellular mitosis, morbid developments and changes, and the more evident signs of bacterial workings in the forms of structural monstrosity and toxinal impregnation, which make up the sum of the pathological circumstances and phenomena comprised under the generic term cancer.

The first stage of cancer, and, of course, the initial influences essential for its establishment are comprised herein; from here, therefore, we must necessarily begin to trace the disease, and become familiar with the conditions, material and dynamic, on which the quality of malignancy

depends, and from which also the diseases known as new growths and tumours, innocent as well as malignant, proceed, and are evolved into the distinctive morbid entities known to medicine and surgery.

It goes without saying that, without some preliminary mastering of the situation, it is impossible to appreciate in anything approaching its fulness, the evolution and true nature of cancer, and even with this it is impossible to realise the real proportions of the many material and dynamic problems that present themselves to the diligent researcher along the unfamiliar lines of tardy progress and patient scientific conquest.

We would advise, therefore, after microscope and test-tube, and other accessory research means have somewhat exhausted their powers to penetrate the many secrets wrapt up in this fell disease, that "a general survey of the situation" should be indulged in, with a view to the focussing of all information attainable, from whatsoever source available, on the subject, to the end that a really intelligible estimate of its true nature should be made, and thereby a possible basis for treatment laid down for its prevention, cure, or amelioration.

When this has been done, it may haply be found that what we are now in search of as the first cause of cancer is already within our range of vision, and that what we are now inclined to regard as its first etiological factor or cause is but the consequence and sequel of interrupted parallelism between the functional and material conditions of transitional or perishing textures and organs, and consequently but a secondary result of a former cause, as well as, in turn, a secondary cause of succeeding pathological phenomena, and, therefore, only a connecting link in the chain of causation and evolution of the disease. If such a *dénouement* to the expenditure of intellectual energy now and for many years so persistently exercised all over the world ever should become an accomplished fact, we are persuaded that a more hopeful outlook for the unfortunate sufferers from cancer will be the result, and that science and art will alike be the gainers.

On non-removed functionless material, whose involution has not been effected in due time from faulty materio-

dynamic parallelism, we have an ideal *nidus* for the development of bacterial organisms; it is not, therefore, required that embryonic cellular organisms, belated amid the physiologically active cell communities of the adult and ageing body, should become the hosts for the development and growth of the generic cancer organisms, neither is it necessary nor consistent with the laws of nutrition for their evolution into malignant growths, that other formative materio-dynamic agencies should come into existence beyond those already existent and active in all developmental processes, whether physiological or pathological, evolutionary or involutory, to initiate and perpetuate the fell process of cancerous conversion, or perversion, of healthy texture into that of usurping malignancy and destruction, with all the train of consequences entailed. Here we may find in the disturbed relationships of the dual natures in their related nutritive and formative functional rôles in the structures affected, the materio-dynamic factors to work out, with the aid of involutory tissue elements, the whole sequence of morbid events, from inception to close, from the primary invasion of healthy structure until its complete disappearance in and incorporation with the altogether foreign elements of malignant disease. All the characteristics and factors of malignant disease are, or may be, therefore, purloined, so to speak, from the innocent materio-dynamic belongings of the physiologically healthy body, and converted or perverted into those of the pathological occupancy of that body.

Thus the characters of malignancy are impressed on physiologically normal, but, it may be, adynamic, structure, and become the ultimate pathological and lineal representatives of that normal condition in structure and function, each and every structure so affected, giving a character to the malignancy in accordance with its own structure and function, and transferring its materio-dynamic methods to it to become the pathological pattern of procedure until frequently all trace of the original becomes merged in its malign counterpart. Natural, if not normal, structure, therefore, is the matrix in which cancer begins to develop and on which it thrives, the *materies morbi* becoming fixed, and converting to its own

use the forces and materials which it finds belonging to the structure selected, which it ultimately overruns and perverts from innocency to malignancy, to the entire undoing of its ultimately powerless host. What that *materies morbi* may be is a question no doubt of the very greatest interest and importance, but the work of depriving it of the means of support and propagation is a work of proportionate and even greater importance, and one which, in these days of the conferring of immunity, should not be beyond the powers of properly directed effort and the combined working of the agencies now employed on the problem.

Whatever the *materies morbi* of cancer be, whether microbic—and the weight of evidence favours that view—or not, it seems to gain access to the seat of attack through, in the first instance, permeable layers of tissue, reachable from the most accessible inner or outer coverings of the body, such as the sub-mucous and sub-cutaneous, through their overlying epithelial and epidermal structures respectively; and, in the second instance, by invasion of, or *metastasis* to, deeper-seated structures and organs by lines of continuity, histological and vascular, and by sepsis of the fluids, lymphatic and sanguineous. Here, moreover, the virus, besides meeting little textural opposition, finds ready to hand for its mal-nutritional purposes quantities of dead and de-vitalised materials in the act of being shed, which meet its immediate wants and supply it with the required opportunity to invade and convert to its increasing materio-dynamic demands the elements of the physiologically living and active tissues. Having effected a footing thus, by introducing into the hitherto normally working sympathetico-systemic formative and nutritive *régime* the element of materio-dynamic discord and perversion, it finally usurps and takes possession, to the ultimate and entire spoliation and undoing of its host—the physiological becoming gradually merged into the pathological, structurally and functionally.

This finding brings us nearer to the point and manner of origin of the disease, where it seems to make, at any rate, clearer the various factors at work and the parts they respectively take in initiating and continuing the patho-

logical process of cancer evolution. The factors can only be two, viz. material and dynamic; the age incidence, the character of the tissues first involved, and their obedience and adaptability to the *presiding formative* and *nutritive impulses* of the *local nervatures*, afford a means of departure from the physiological methods which have hitherto prevailed, and an opportunity for the introduction of pathological methods of dynamic arrangement of the somewhat devitalised tissue elements and the ordinary alimentary materials, which, together with the collaboration of chemical and bacterial agencies "in wait" for an opportunity to take in hand the work of involution which at all times sooner or later has to be taken in hand by such emissaries, and so the required malignant parasite or influence is found and put in possession to perform the work of spoliation by the production of those tissue changes characterising the disease so long familiar to us under the dreaded name of cancer. All which ought to be preventable to the extent that every human being ought to be in possession of the undisturbed power of reaching the *legitimate* "length of his or her days" without subjection to the danger of such occurrences.

A proof or an evidence that muscular fibre is nourished by or from nervine sources is that the nerve-plate endings enter within the sarcolemmar sheaths and pass between the sarcous discs filled with nerve substances and surrounded by cerebro-spinal lymph, while the blood vasculature is only spread out within the inter-musculo-fibril spaces amid the interstitial substance and non-muscular elements of the muscle substance, the one merging in the proper muscular elements, while the other expends itself in the maintenance of the non-muscular or interstitial tissue. The blood circulation thus never reaches the proper sarcous substances or contractile elements of the voluntary musculature, leaving the systemic nervature to effect the double function of materio-dynamic provider and distributor, a view of the subjects involved which brings into physiological line and order several at present very obscure and somewhat contradictory problems bearing on the subjects of nutrition and the etiology of certain neuro-muscular diseases.

The reason that the two lobes of the pituitary body remain histologically separate while enclosed in a common capsule, and constituting one excretory organism, is, that they belong to different embryonic structural elements, and owe their nourishment and innervation to different sources, viz., neuro-systemic and neuro-sympathetic, or the ecto-dermal and the hypo-dermal, because we see throughout the body generally a well-marked distinctness maintained, a fact alone due to distinctness of innervation and sources of nutrition, and therefore dependent on physiological "law and order."

Mr. Bland Sutton, as reported in the *Lancet* of date May 18th, 1907, gives a most informative and clear exposition of the subject of cancer up to date, and amongst many very interesting conclusions, he draws one, with regard to the structural incidence of primary cancer to the effect, that the systemic nerve tissue, voluntary muscular substance, and fat cells, are the only tissues unaffected—secondarily, they of course come in for attack and suffer in common.

This conclusion appears singular and at first sight inexplicable, but, on considering it in the light of the dual organisation of the nervous system, it seems to be dependent on certain histological facts of pathogenic relevancy and resolvent power to explain the problem. Thus the structures named comprise those composing the systemic nervous system, or the true systemic nerve elements, and the only sympathetic structural element devoid of a proper nuclear and nucleolar body within its intra-cell substance; hence in the former, or primary, the formative impulse or materio-dynamic phenomena of malignancy are initiated and administered by sympathetic nerve agency, while in the latter, a stored substance, the absence of a neuro-dynamic or formative nuclear agency renders the fat cells non-responsive to the primary genetic incitements to malignancy.

From this point of view cancer would seem to be determined primarily by a materio-dynamic disturbance of the law of parallelism amongst the sympathetically innervated tissue elements, whereby the metabolic and formative energies of the affected cells take on strange or

pathogenic modes of growth and proliferation, at first differing little, it may be from the normal, but ultimately altering so completely as to assume the character of an altogether abnormal structure, with the superadded character of malignancy, and incompatibility with the maintenance of life.

Primarily the structures named escape on account of histological peculiarities as to their position and character, but fall a prey to the secondary invasion and pathogenic intensity of the disease with equally dire results, and, if possible, with less power of resistance to the influences of malignancy than those displayed by the primarily affected sympathetically innervated structures.

EXTRACT XXXVII.

ON SYPHILIS AND GONORRHŒA.

THE former of these diseases, syphilis, is one of the greatest scourges to which modern civilised man, and from him barbaric man, is liable; we say modern because, so far as investigation of the incidence of the disease in or amongst ancient civilised races has been carried, it is not possible for us to assume beyond doubt that it had any existence; at any rate, archæologically we come across no particularly definite trace of it, unless we extract a hidden meaning referring to it and other diseases of an allied nature from such Biblical expressions as that "the sins of the father" shall be transmitted to or visited upon his offspring "to the third and fourth generation"—and this, no doubt, would very exactly express our experience and present state of knowledge on the subject. We, however, forbear from entering into a discussion of its historical bearings, and would rather advance some views emanating from our study of the disease in the light of the ideas of which we have become possessed in relation to its neurological bearings.

The view that the disease is bacterial in origin is now largely held and taught, it behoves us, therefore, while investigating the subject of its *materies morbi*, to study and discover the lines along which it delivers its attacks, so as to be prepared to devise a rational and scientific prophylaxis, as well as a successful curative treatment.

The inoculation of the specific disease having been effected, and absorption of the *virus* having taken place,

we may be prepared to find that the textures involved in the inoculation and absorption are undergoing a more or less complete necrosis and disintegration at the affected points, and that the disease is evolving from a local into a general pathological condition, the prevention of which latter occurrence ought, therefore, to be the aim of all well-directed treatment.

Should this unfortunate occurrence, the change from a local to a general affection or disease, have been overlooked or neglected, and the changes dependent on the further development of the pathological phenomena constituting the disease having been allowed to begin to display themselves, we shall now observe that the absorbents, as represented by the lymphatics, begin to display symptoms of involvement, it may be, along the course of the nearest lymphatic vessels and in the glands to which they lead by a process of inflammatory engorgement and thickening, a brawny swelling of the peri-lymphatic textures, and a more or less conspicuous enlargement of the glands first interposed in the lines of invasion. This condition is known as *bubo*, and is due to the invasion of the matrix of one or more of the lymphatic glands, of the groin by preference, owing to the prevailing manner of infection. Should this bubonic barrier arrest the progress of the *materies morbi* and secure its removal from the *system* before it has had time and opportunity to infiltrate and infect it, then we are warranted in expecting an avoidance of the long sequence of untoward events, consisting of the secondary, tertiary, and consequential transmitted or inherited stages of the disease.

Should, however, this desirable arrest of the disease not have been effected, and an entrance have been secured into the body proper by the *virus* of the disease, then we may expect the invasion in detail of all its parts, organs, textures, and fluids, and the sapping of its health to its "very foundations."

The line of attack of the disease in this instance has been by way of the lymphatics through imbibition of its poison by the open mouths of its vessels or spaces, where they lie exposed in the depths of the primary sore, and where the culture of the lethal organisms or specific *virus*

is secured, and thence finding its way along the lines of least resistance, it reaches, by way of the lymphatic vessels, the gland or glands, where its further progress is challenged and, it may be, arrested, but where, if allowed to pass, it secures an entrance into the lymphatic circulation, and subsequently into the circulation proper and the textures of the body generally.

But, while this may describe the usual line of attack of the disease, we are persuaded that the invasion of the system may be accomplished by, at any rate, *one other direct route*, and this route we would describe as *nervine*, and thus the primary sore in its processes of destruction and disintegration of the textures involved in the area of infection lays open not only the lymph spaces and vessels, perhaps with the blood vessels, but the *nerves* distributed to the part with their inter-neurilemmar spaces, into which and along which the *virus* filters or develops by the growth of its specific microbe in the medium of the cerebro-spinal fluid into the interior of the cerebro-spinal cavity, where it is at liberty to repeat itself in endless generations or until its pabulum is exhausted and immunity attained.

An entrance having been thus effected along the nerves leading from the scene of the primary sore by the specific *virus*, the cerebro-spinal fluid having afforded it a ready-made culture medium, it is at liberty to attack not only the nervous system, for which it is said to have a peculiar, we might say, morbid affinity, but every organ and texture of the body with which that system is connected, whether by its afferent, efferent, or association trunks and fibres, ganglionic cells and processes, systemic and sympathetic.

In the quasi-enclosed region in which the cerebro-spinal fluid is formed, contained, and circulated, we see a congeries of conditions ideally adapted for the growth, preservation, and dissemination of such a specific microbic poison, and where it is at liberty to attack directly and at first hand the meningeal coverings of the brain, cord, and nerves, with their enclosed nervine contents, and to give rise to the very various pathological changes following the invasion of this region, whence, passing from this region along the nerve trunks and fibres, it readily

finds its way into the matrix and parenchyma of organ, of texture, and viscus throughout the entire body, injuring and destroying in its malign progress, and leaving in its wake an amount of wreckage scarcely to be paralleled in the whole category of disease; here, moreover, we perceive the operation of the *vis medicatrix naturæ* along certain lines indicated and determined by histological and anatomical continuity, as, for instance, in the peripheral eruptive displays manifested at the various stages of the disease, where the terminal arborisations of the cutaneous nerves constitute the scenes of the elimination and exodus of the specific *virus* on the secondary and tertiary attempts to "clear the system."

The spots and patches of eruption will be found, primarily, to conform to the arrangement and form of the final distribution of the cutaneous nervature, and to involve, secondarily, the neighbouring cutaneous textures in which pigmentation and perhaps destructive changes may follow, the pigmentation being due, most probably, to the influence of neurolysis on the hæmoglobin of the surrounding blood elements.

In this disease it would seem as if "brood after brood" or "hive after hive," so to speak, of bacterial organisms, as they have become deposited and hatched in the depths of the cerebro-spinal lymph, become released and, overflowing or breaking their barriers at their weakest points, overwhelm the neighbouring regions of what may be called the neutral structures, infiltrating and leaving deposits of pathological *débris* here and there throughout the areas of disturbance, these occurrences synchronising with the secondary and tertiary stages of the disease. Moreover, such outlets from the cerebro-spinal cavity, as the nose and pharynx, represent or coincide with the scenes of the most destructive activity of the secondary and tertiary manifestations of the disease, the determination and incidence of which are due to the anatomical and histological disposition and physiological functions of the parts affected, *i.e.* being the eliminatory outlets of the antero-central regions of the cerebro-spinal cavity, they are naturally made to bear or feel the full brunt of the destructive changes wrought by the discharging bacterial

organisms and toxic *débris* resulting from the growth and discharge of their repeated generations, the same conditions entail very much the same consequences in coccygeal elimination.

Such *seeming coincidences* as these latter occurrences display are, therefore, due to the progress of this fell disease along definite lines, anatomical, histological, pathological, and clinical, and represent the natural history and evolution of a morbid entity as clearly and as explicitly as that of any disease to be found in the whole family of the exanthematous affections. We, consequently, claim that the etiology, morbid anatomy, and clinical phenomena, of this disease find a clearer explanation along these lines than along any other lines with which we are acquainted.

Gonorrhœa, although usually classed from its manner of causation with syphilis, is a disease of an entirely different character in manner of attack, symptoms, complications, and clinical behaviour. Instead of beginning with a primary chancrous sore or sores, it is usually ushered in by urethritis with more or less consequent painful micturition and muco-purulent discharge, which, after running a more or less acute course for a somewhat indefinite period, eventuates in complete recovery without the occurrence of secondary or consequential symptoms or complications.

This, however, does not always characterise the course, behaviour, and decline of the disease, as there are cases where it is usually accompanied or followed by affections of a rheumatoid character, involving the limbs and joints, which run a more or less acute or continued course, and terminate, in many cases, in synovitis, which may display the presence of the *gonococcus* or microbe of gonorrhœa. It may further be remarked that it is a disease of a much less malign character than syphilis, and that in a large percentage of cases it terminates without leaving any wreckage behind, but, nevertheless, it is one which, if not arrested by what may be called "nature's police" on its entrance of the system, will give rise to severe and well-defined morbid processes: these latter, as we have said, are generally of a rheumatoid character, and evince themselves in the manner customary to those affections by the

occurrence of more or less acute pains, confined principally to the muscles and fibrous structures of the limbs, with intercurrent or subsequent involvement of the joints of these limbs, accompanied by considerable febrile and general disturbance.

How the *gonococcus* in this disease reaches the muscles, fibrous structures, and joints, is a question very difficult to answer, whether it reaches them by way of the blood circulation through the entrance of the gonococcal bacillus into its stream and its subsequent deposition in the textures of these parts, or whether it effects an entrance, like syphilis, into the cerebro-spinal fluid or lymph, and thereafter enters the motor nerve sheaths from the cerebro-spinal cavity, where its multiplication and growth have been effected, or, as is most likely, in both ways. The latter method, however, deserves study, and we may take it that the *virus* effects an entry into the nerve terminal distribution of the urethral nervature through the inflamed and traumatised mucosa, and pushes its way, by a process of continuous sepsis or contamination of the neural lymph and microbial growth, along the inter-neurilemmar lymph paths into the cerebro-spinal lymph cavities, where, incubating anew, it is diverted into and along the motor nerve inter-neurilemmar lymph spaces, between which and the *gonococcus* there apparently exists a mutual affinity, where it progresses in like manner until it reaches the muscles and other susceptible textures, as well as the joints, where the vitality of the microbic brood is found to be as robust as when its progenitors left the urethral canal.

Thus these two diseases, syphilis and gonorrhœa, have a somewhat similar line and manner of attack, and a somewhat analogous method of invasion, but a very dissimilar after history as regards their respective temporary and persistent after effects on the affected individuals, as well as on their progeny.

The frequency with which these and other kindred diseases enter the system, either directly or indirectly by invasion of the neural lymph and lymph inter-spaces and paths, becomes more and more apparent as we look more deeply into their etiology and manner of development; we, therefore, cannot help thinking that valuable infor-

mation must flow from their study in this light regarding their prevention, amelioration, and cure.

A clinical Lecture has just been delivered by Sir W. R. Gowers at University College Hospital (*vide Lancet*, Dec. 1, 1905), entitled "A Metastatic Mystery," in his usual most lucid style, and effectively illustrated. The title of the lecture is transparently honest and brief, and no doubt expresses the high-water mark of special knowledge on the subject; yet the case, as viewed in the light of our expressed views and personal knowledge of the subject, resolves itself into one of *belated* manifestation of tertiary syphilitic symptoms confined to the motor cerebro-spinal nervature and part of the musculature of the right side, and to the lateral aspect of the meninges overlying the mid brain, all manifestly due to the localisation of the basal tumour described to the antero-lateral aspect of the pons. We would assign as the place of origin of this tumour, which we are satisfied is the *fons et origo* of the attack, the locally involved sub-arachnoid surface, where we may suppose a gummatous growth originally evolved itself, and increased to the size mentioned, sustaining itself by a pseudo-encapsulation, and succeeding in keeping itself stationary as to further growth by the process of discharging from within or passing away from its external aspect a continuous flow of epithelial and other material due to its local presence and disturbing influence, which found its way along the lines of least resistance, which were the antero-lateral aspect of the spinal cord, to the motor nerve roots, issuing at the points indicated by the vertebræ affected, the trunks of the nerves distributed to the muscles implicated, the periosteal coverings of the bones, and the deeper osteal structures where they were inserted. Likewise ensued the upward cephalic progress from the scene of the tumour's irritation, the tainted fluid causing, evidently, from the illustration supplied, an opaque and thickened condition of the meninges, and spreading laterally, to some extent, but ultimately finding a means of exit for the tainted material through one or more of the Pacchionian bodies and the tables of the skull into and under the periosteum or peri-cranium. Each of the abscesses and periosteal inflam-

mations was, therefore, due, secondarily, to the progress of the outflowing fluid along the lines of least resistance leading from the tumour, and were owing to the sustained flow of that fluid, a circumstance which, moreover, explains the stoppage of the growth of the tumour and the cessation of the evolution of head symptoms. The other local visceral involvements seem to us due to the distribution by the pneumo-gastric nerves to the pulmonary and hepatic structures respectively, and not to distribution by the blood circulation, which, we would suppose, had not been called upon at all to distribute the etiological material agencies to any of the parts affected.

We must now, therefore, recognise the great fact that a *third* vasculature, viz. the *nervine*, has to be added to the two mentioned by Sir W. R. Gowers, viz. the *blood* and *lymph*, and that it, in fact, seems the most prolific in the conveyance of disease-producing materials, the *great cause* of *metastatic* phenomena, and the medium by which much of the *mystery* involved in such occurrences can find a clear and scientific explanation, because an explanation founded on anatomical and histological truths, and, therefore, absolutely consistent and decipherable.

It is thus most interesting and instructive to observe that that chameleon-like disease, syphilis, manifests its symptoms not haphazard, but strictly in accordance with structural anatomy, and that an explanation can be afforded of such contradictory external manifestations of it as appear on the skin, on the one hand, and the muscles and bones, on the other, these being the structural areas to which the sensory and the motor systemic terminal nerves are respectively distributed, and where the "shape and form" of the secondary and tertiary morbid phenomena are respectively determined.

EXTRACT XXXVIII.

RHEUMATISM, ACUTE, SUBACUTE, AND CHRONIC, WITH RHEUMATIC ARTHRITIS.

IN taking up this large and varied subject, we feel ourselves unable to deal with it systematically, or to do more than touch on a few of its aspects which dovetail with or bear on our views of the nervous system and the pathology of some of its diseases.

We shall not, therefore, attempt to consider whether its *materies morbi* is bacterial or chemical, or both, or neither.

Whatever its nature, wherever it may have come from, whether from within the body itself, as in autotoxis, or from without; from some septic source of infection, we shall not wait to enquire, as the literature of these very far-reaching problems is so voluminous that we have been unable to do more than touch it, besides, it is now so highly specialised that it must, necessarily, be left to the criticism and appraisal of experts.

On thus refraining from dealing with the very technical and highly interesting department of clinical research embraced in that congeries of pathological likes and dislikes, that agglomeration or gallery of contradictory morbid entities known as rheumatism, we are reduced to the necessity of expressing only a few thoughts suggested, as above indicated, from their neural bearings on the practical, clinical, and therapeutical sides of the subject.

Guided by these limitations, we would begin by saying that the main theatre for the observation of the manifold phases of the disease known as rheumatism is the *muscular*

system, with its aponeurotic coverings and interlying fibrous, fibro-elastic, and connective layers or processes of bounding and supporting tissue, its tendons, with their sheaths and more or less lubricating surrounding *material*, and their final attachments to the bones, where the periosteum and ends of insertion of the tendons become so intimately blended as to make the union as complete as is possible or compatible with the junction of two histologically different structures, besides the periosteum, by continuity along the shafts of the bones of the limbs, its reflection over the epiphyses of these bones, its junction and blending with the ligamentous structures of the joints, and its ultimate association with the joints through contact with their cartilages and synovial membranes. From this statement we want to make it clear that a bond of union is effected or exists between the structures named by continuity and contiguity of texture of such an intimate character that a passage by *capillary and osmotic circulation* is possible, and not only possible, but in more or less constant operation through the implied inter-textural spaces, lacunæ, and channels.

On to the nervous system we shall now tack all this complicated array of highly organised structures, indeed, we must recognise that all these structures belong to and constitute, so to speak, an appendage and part of the nervous system, and that the nervous system is as intimately blended with the muscular system as the muscular system is blended with the skeleton through tendons, periosteum, ligaments, and joints.

This association and interdependence of the nervous system, the muscular system, and the osseous system, constitutes the basis on which we must elaborate our contribution to the literature of that far-reaching subject, rheumatism.

Rheumatism must be regarded as an affection, ranging from the slight and almost imperceptible "*rheum*" of our forefathers to the *acute rheumatism* of the present day, ranging also from the absolute helplessness, fear, and dread, of acute rheumatism to the unyielding stiffening and deformity of chronic rheumatic arthritis.

These two varieties of the affection may be looked upon

as the extremes of the train of rheumatic conditions and the pathological entities known as rheumatic.

Rheumatism once initiated there is a great danger of its progressing through more than one of its recognised stages, and it becomes our bounden duty, if consulted early enough, to devise a treatment so as to arrest the disease at the earliest stage possible, in order to prevent its progress towards its succeeding and permanently disabling stages.

It is allowable, consequently, to conclude that, when an attack of *acute rheumatism* is imminent, that attack may be averted or modified by a smart appeal to the excretory functions of the skin through the peripheral nerve-endings and sudoriferous glands, which may, in this case, be considered the easiest and safest exits from the nervous system of the cerebro-spinal fluid occupying the spaces and inter-spaces, in which we hold the *materies morbi* of the attack is lodged, and whence it invades the muscular system and associated parts in order to prevent it forcing itself along the motor nerve trunks or structures into the muscular tissues.

By anticipation we may thus prevent the occurrence, shorten the duration, or mitigate the severity of an attack of acute or sub-acute rheumatism by inducing free diaphoresis, combined with physiological rest of the entire muscular and nervous systems, and the use of the other subsidiary therapeutical and dietetic desiderata necessary in the particular case.

The toxic matter, which, at this juncture, is stored in the nervous system, and, it may be, in the act of invading the muscular system or individual groups of muscles, will thereby find a natural exit through the cutaneous sweat organisms on to its outer surface, leaving only that which has found an entrance into the motor nerve inter-spatial channels, nerve terminals, and sarcolemmar sheaths and sarcous elements proper of a greater or lesser number of the muscles to be dealt with.

This latter, the toxic matter, the "real element of discord" or exciting cause of acute rheumatism and, it may be, other forms of the disease as well, must also be medically dealt with in such a way as that it will be neutralised

in situ or dislodged, and eliminated from the sarcous elements of the muscles involved through the lymphatics leading from the muscular system into the circulation of the blood proper.

If this procedure, the use of our artificial aids along the lines on which nature is working, prove successful, the result will be the restoration of the mechanism and contents of the *cerebro-spinal* and *muscular circulations* to their normal and aseptic condition.

Thus will the disease be cut short and cured, and thus will be prevented the occurrence of more prolonged, though less acute, rheumatic processes or diseases, with their accompanying loads of suffering and their greater or lesser degrees of attendant or permanent crippling.

Thus, also, will be averted such fatal "turns and twists" as sometimes mark the progress of cases of this disease, and which those in charge often regard as absolutely beyond their control, such as *metastasis* to the cord and brain, including the entire cerebro-spinal cavity, with its other contents, liquid and solid, or to the muscular substance of the heart, with its covering and lining membranes and valvular structures.

We, perhaps, ought here to remark that it seems to us that the phenomena of *metastasis* can find an explanation in the occurrence of a more or less sudden regurgitation of the toxic matter occupying the motor nerve trunk sheaths, the nerve terminal structures and muscles from and along them into and amongst the contents of the cerebro-spinal cavity, and terminating there, in the case of metastasis to the brain, but passing out again along the intra-spaces of the pneumogastric trunk, in the case of metastasis to the heart.

If, therefore, this metastatic movement can haply and happily be diverted along the peripheral sensory nerve trunks and fibrils with their attached terminals and the sudoriferous glands, a fatal issue may be prevented.

Thus, it will be seen that muscular rheumatism, or rheumatism involving the motor nerves and the muscles, can be prevented, in the first place, by being promptly seen to and relieved or cured; and, in the second place, by securing an excretory or forward, or a retrograde or

backward, movement of the contaminated cerebro-spinal fluid contents of the motor nerve tubes, and, concurrently, by aiding the neutralisation and elimination of any toxic matter which may have secured an entrance into or been evolved in the sarcolemmar sheaths and substance of the affected muscles.

Bearing the *indications* naturally suggested by these views in mind, diaphoretics, properly so-called, aided by the use of every external and internal measure, general and local, which the individual case may require, in order to initiate, sustain, and prolong the process of excretion necessary until the *materies morbi* of the disease is dislodged, must be promptly, continuously, and, of course, rationally and guardedly used; the after-treatment being regulated, necessarily, by the condition of general health and local disablement in which the process has left the patient.

These observations refer to *acute* rheumatism, or rheumatic fever, only; let us, therefore, continue on the same lines to attempt to elucidate the subject of *sub-acute* or *articular* rheumatism. This latter affection is frequently a sequel of the former, as well as an apparently independent affection, but when produced by the subsidence of an acute attack, it may be regarded as a continuation of the toxic invasion of the textures continuous with the involved muscles; *i.e.* by the infiltration of the tendons attached to or continuous with the affected muscles, or rather the agglomerated sheaths of the muscles, with their attachments to the bones, periosteum, and ligaments surrounding the joints, and the cartilages covering the ends or extremities of the bones and their contained synovial fluids.

All this results from the histological continuity and contiguity of the parts enumerated, and may often be traced in regular sequence. The appropriate treatment in individual cases may, therefore, now be directed on somewhat more clear and definite lines than has too often been the case in times gone by, or when mere empiricism was only possible.

The *chronic* form of the disease may also, we think, have its pathology to some extent cleared up by a patient

continuation of the same line of enquiry, and its treatment correspondingly improved and made more scientific.

Since the above observations were made on the subject of rheumatism generally, and in its various phases and methods of manifestation, we have to a little further extent pursued our enquiries regarding the occurrence of *metastasis to the heart*, or *cardiac rheumatism*.

The occurrence of cardiac complication during or after the currency of an attack of acute rheumatism becomes much clearer to us in its etiology and pathology by the application of these views to its consideration.

Thus cardiac rheumatism, with resultant peri-carditis and endo-carditis, is to be regarded as due to a metastasis of the toxic matter of the disease from the more distant, deep, or peripheral parts of the body and spinal cavity along the trunks of the pneumogastric nerve or nerves to the fibres distributed to the heart, and thence into and throughout its muscular substance; where, driven by the sustained working and action of that never-ceasing and continually moving mechanism, it is projected into its very innermost parts, consisting of its series of muscular eminences and valves and lining endo-cardial, as well as enclosing peri-cardial, membranes, by direct communication from the one to the other and from first to last.

Chronic rheumatic arthritis, moreover, may be said to result, in some cases, if not in many or all, from the percolation or infiltration of toxic material, from the muscles through the tendons, periosteum, bones, and cartilages, and thence through the synovial lining of the joints themselves into their central cavities and contained fluids.

◊ In cases of this description, of the more acute order, the rate of pathological change may be both rapid in rate and destructive in the extent of its incidence, or slow and more ankylostotic or exostotic, when more or less osseous material is deposited during exacerbations of the disease in the periosteal texture or the superficial layers of the bony textures involved.

A case of the latter description might be cited in illustration—as it was closely observed and noted by its subject from inception to cessation—of the characteristic symp-

toms, and as affording a complete picture of a condition which is only occasionally procurable by the medical man; as already said, its subject followed its progress with the greatest interest and intelligence, and supplied the following details of the case: A. A., a gentleman past middle life and previously healthy, was some time ago, during a very hot summer, in the habit of sitting with his window open and enjoying the fresh air, which *blew in a current* between the window and the fireplace, and struck his head, neck, and back on their right antero-lateral aspect. This was continued during the hot months, and produced no injurious effects until near their close, when he began to experience pain in the neck, extending to the point of the shoulder, of the exposed or air-struck area, and to perceive a gradual extension of it from the trapezius down the deltoid muscle to its insertion, where the periosteum of the humerus became acutely painful, both to pressure and on movement of the muscle; here it remained for some time, the area of periosteal pain extending laterally and downwards until the biceps became involved at its origin, and afterwards at its insertion in the forearm, when shortly afterwards there began to be felt a thickening of the distal phalanx of the thumb, both on its palmar and dorsal aspects, with pain on pressure and use. This thickening continued to increase in hardness, and gradually to assume the character and "feel" of an exostosis at the points of insertion of the distal ends of the flexor and extensor tendons respectively. No other parts were involved to even a slight extent, except for a *vague general aching* when the arm was "lain upon," and the acuteness of the train of muscular pains began to diminish as soon as the phalangeal pain and thickening began to be decidedly manifest. No disturbance, constitutional or otherwise, took place, and the case pursued a slow and even course, leaving a thickening of the distal phalanx of the thumb at the points mentioned, with at times a slight aching down the area originally involved. Now this seems the record of an ordinary slight case of rheumatic-gout, or rheumatoid arthritis, and so it was; but it is meant to convey the truth that the attack arose from a prolonged partial exposure of the origins of one or two of the

cervical branches of the brachial plexus at their points of origin in the neck, and that the superficial or cutaneous excretion at those points of the cerebro-spinal lymph was transferred from the superficial afferent or sensory to the deep efferent or motor roots of the involved nerves to be finally disposed of; and, thereafter, instead of being excreted through the skin, as in the other parts of the spinal nervature, it was reflected along the corresponding motor nerves—these being the nearest lines of least resistance—thence entering and traversing the muscles named, with their periosteal attachments, in the order mentioned, and ultimately being deposited as exostoses in the periosteal layers of tissue covering the distal phalanx at the points of attachment of the affected thumb muscle tendons.

Here, we contend, is a manifestation of a disease, from inception to close, along certain definite histological lines, carried by obvious and definite agencies, and leaving definite after-effects in a consistent and intelligible manner, like any concrete pathological entity.

It is, moreover, an illustration of the manner in which earthy or ossific material is conveyed by neuro-muscular agency along continuous circulatory ways from the purely central nervine to the skeletal structures of the body, and a collateral proof of the truth of the contention that fractures do not properly unite when the systemic nerves are severed.

Had there been here no “*concentrated and continued exposure*” of the *limited* surface of the neck between the coat collar and the hair of the head, as above described, there would have been *no case* to record. We may add that there occur in like manner such pathological sequences as the synchronous, consecutive and mixed, but etiologically connected, bacterial and other diseases, due to cerebro-spinal sepsis and neuro-muscular morbid phenomena—myopathy, for instance, cold abscesses, multiple exostosis, and acute and chronic osteo-arthritis, with spontaneous disarticulations, become evolved in clinical experience in complete and definite order, one merging in the other as parts of a single morbid entity, as well as all the constantly occurring associated groups of pneumogastrically determined and distributed diseases, acute

rheumatism, chorea, cardiac, diplococcal, pneumococcal, and other invasion, with, it may be, pulmonary, gastric, and other abdominal complications, besides a large number of frequently associated and anomalously related morbid symptoms and diseased conditions.

The case of A. A. referred to, again came under our observation in a little more than fifteen months from being last seen, and complained as follows: About six weeks ago, on the occurrence of a few days of rather warmer weather than had for some time prevailed, I slightly lightened my clothing, and shortly began to experience in my lower limbs, but more especially in my right from the knee downwards, a feeling of vague rheumatic pain and a loss of tactile sense over the anterior aspects of the lower half of the leg and the upper aspect of the foot, with some loss of muscular control of three first toes. Elsewhere there were no such phenomena, and the general health was good. The condition, therefore, was akin to his former attack, and was determined locally by the existence of the same predisposition and the local incidence of exciting causes sufficient to precipitate a renewal of the morbid phenomena as above narrated. It was essentially one of limited incidence, and consisted of neural circulatory stasis and consequent blockage of the motor and sensory neural channels, with paralysis of the efferent and afferent nervature to the extent of the incidence of the local causation.

The condition did not seriously cripple its subject, and continues gradually to disappear from both nervatures as the phenomena of neural circulation and the materio-dynamic needs of the muscles and skin were met by properly adjusted nutrition and metabolism.

EXTRACT XXXIX.

ON URTICARIA.

URTICARIA, or nettle rash, is an affection with which both the laity and the profession are so very familiar that it has perhaps thus escaped the scientific attention to which its intrinsic nature otherwise entitles it.

In intrinsic nature it is a neurosis, or, strictly speaking, a peripheral cerebro-spinal lymph disturbance, in which that lymph, from local accumulation in certain nerve terminal arborisations, it may be, associated with toxics, distends those terminal textures and modifies their innervation, sometimes locally and sometimes generally, but always in accordance with nerve terminal distribution raising the super-imposed cuticle, and producing a sensation of itching, tingling, and sensory distress often altogether disproportionate to the visible and tangible local changes.

It generally ensues from dietetic errors, and delivers its attacks without previous warnings, these manifesting themselves, "like bolts from the blue," in pale or more or less tinted patches or areas conforming to afferent nerve terminal distribution.

The rapidity with which these cutaneous invasions frequently ensue, after the exciting cause has been at work, renders it probable that that exciting cause is of a subtle toxic character, as rapid in the production of its effects as, for instance, prussic acid and kindred toxic agents, and operating along chemico-physiological lines determined by the prevailing affinities between the toxic agent on the one hand and the physiological tissue elements on the other. Thus in urticaria arising from partaking of such

articles as certain shell-fish, green fruit, or oatmeal, a very short interval frequently suffices to produce the characteristic rash and to set up the familiar local itching and sensory disturbance, so much so, that ordinary bacterial and physical methods seem far too slow to effect the morbid changes. We are, therefore, driven by necessity to contrive an explanation which will at once meet this difficulty and be more or less scientifically satisfactory.

The toxin, or *materies morbi*, contained in the articles mentioned, whatever it be, must almost at once effect an entrance into the blood stream, therefrom to be deposited in the cerebro-spinal fluid, or possibly communicated to certain neurons, and thereafter transferred by neural circulation to the implicated peripheral nerve terminals, where its presence is soon attended by stasis and accumulation of the local neural lymph, with consequent elevation of the overlying cuticle, and, it may be, more or less lasting œdema, and possibly also associated capillary hæmal changes.

On the exhaustion of the pathogenic influence of the toxin, the effects of its attack, local and general, gradually subside, frequently almost as rapidly as they were developed, leaving, it may be, a more or less desquamating cuticle over the affected areas, and, it may be, a more or less perverted innervation of the implicated terminal nervature.

Whether at the bottom of such local nervine pathological phenomena there is temporary occlusion of the neural excretory apparatus in the areas affected it is impossible yet to say, but reasoning from analogy, there seems at any rate reason for supposing that, besides an increased arrival of local cerebro-spinal lymph, there is increased difficulty of excretion of that lymph, with the inevitable local elevation of the affected areas, ephemeral or more lasting.

The more intense and violent varieties of the affection are characterised by the elevated areas assuming a more or less papular and vesicular development, along with, it may be, implication of the locally associated hæmal vasculature, consisting of a more or less pronounced erythema, which sometimes so completely overshadows the original nervine

phenomena of the attack as to be the only apparent pathological condition calling for consideration and treatment.

All this implies that we have in urticaria to deal with an exanthematous disease, the incubation of which is so rapid as sometimes to be reckoned by hours, or even minutes, efflorescence or eruption by a like period, and the establishment of the *status quo ante* by the same brief method and manner of pathological development and sequence. Moreover, the behaviour of the more intense and violent varieties of the disease but accentuate this differential diagnosis, and bring it into line with that of the pronounced exanthemata in manner of origin, culmination, and decline, and proclaim the great fact that the central nervous system is the *fons et origo* of the great proportion of eruptive diseases. Given facilities for the introduction of an exanthematous *virus* into the cerebro-spinal cavity, including the cerebro-spinal fluid and the nervine structures proper, the cultural conditions there found by that virus are so intrinsically conducive to the spread and pathogenic influence of it as to ensure its easy pathological progress, whether it be chemical, physical, or bacterial, in nature and properties; from which it follows that we are likely to discover that, with every increase of facilities and powers of differential diagnosis, the number of diseases having a nervine origin is ever increasing, and that the sphere of nervine influence within the area of pathogenesis is constantly broadening and extending, and affording, at the same time, a clearer view of the therapeutic paths to follow in our everyday ameliorative and curative work.

Thus, the *vis medicatrix naturæ* proclaims or indicates in her whole behaviour that we must constantly aim at clearing both the central and peripheral nervine elements of the pathogenic influences at work in the evolution of exanthematous disease, and in assisting to neutralise the untoward effects of their morbid work.

EXTRACT XL.

INFLUENZA.

A continuation in the domain of "the practice of medicine" and clinical experience of the views already formulated on the cerebro-spinal circulation, etc.

THE term influenza is of Italian origin, and refers to the epidemic aspect of the disease recognised by that name, hinting at a belief in astrological influences as the origin of this most truly typical epidemic, and now, in this country, endemic, disease. The French *la grippe* is expressive of the manner and nature of its attack.

Neither term expresses anything as to the real nature of the ailment, both are delightfully indefinite, but pass current with the public, and, for that part, with the medical profession itself, as great realities. During the hurry and bustle of the progress of an epidemic, and even during the long sequence of years in which it has been endemic of late, no expressive name or title has been suggested for it.

In the light of what has been said in these pages previously, influenza may be described as a disease owing its existence to the influence and operation of a subtle poison, microbic or otherwise—we may now conclude that it is microbic—acting, primarily, on the nervous system, both central and peripheral, and, secondarily, on the various "systems," organs, and structures of the body generally.

It must be understood as almost entirely effecting its entrance into the bodies of its victims aërially from a con-

taminated atmosphere, through the exposed surfaces of their bodies, or from the walls of the air passages, including the nasal, oral, pharyngeal, laryngeal, tracheal, and pulmonary.

The entrance of the *materies morbi* having been effected, and the period of incubation—which is usually comparatively short—having been passed, the series of phenomena characterising the disease occur in rapid succession, and terminate, in the mildest cases, in a few hours or days, and in the more severe cases in as many weeks or months, or it may be fatally, or in more or less permanent disablement.

The phenomena or symptoms of the disease primarily centre in the nervous system, being, it may be said, at once, or soon, followed by rapid loss of strength without any possible corresponding loss of body weight, and hence are, and must be, the outcome of a more or less profound disturbance of the machinery of the production, conservation, and distribution of nerve force or energy through contact of that *materies morbi*—microbes and toxins—with the central nerve elements.

Taking for granted that this disease is truly zymotic, it would appear that its rise, progress, and decline synchronise with the stages of existence of its specific microbe or bacillus, and that, in mild uncomplicated cases, spontaneous recovery is effected without the need of medical intervention, it follows that the line of conduct to be pursued, when dealing with such cases, must be founded on a broad as well as minute study of its “natural history.” And here we might interpolate a few observations on the subject of zymotic diseases generally, or on what we might call zymosis as now taught.

We remark, firstly, that these diseases are characterised by very differing periods of incubation, very different manners of attack, as well as very different degrees and rates of progress, due to the particular “system,” or part of the body, implicated. The disease under consideration, influenza, is, as has already been observed, very short in its period of incubation, the *materies morbi* acting almost at once on the nervous system. Typhoid fever, acquired, it may be, through the lungs, alimentary canal, or cutaneous surface, incubates slowly, apparently in the systemic

blood circulation, primarily, and then, secondarily, attacks certain specific parts. Smallpox and the exanthematous fevers generally are more or less slow in their respective periods and manners of incubation, and may be said to accomplish that process within the blood streams and the adjacent cerebro-spinal lymph, afterwards manifesting themselves in their own peculiar and specific ways, and on particular parts, according to the laws of what may be called "natural selection." While it may be said that cholera confines itself to the invasion of a more limited part of the human organism, where it germinates, lives, and is eliminated within a much more limited area than is claimed by almost all the members of the great families of the exanthematous and zymotic diseases.

On dealing clinically with this disease, influenza, and observing the progress the cases of it may have made and the stage they have arrived at when aid has been called, and questioning closely on the sequence of symptoms, we have been struck with a few outstanding, almost constantly recurring, phenomena, such as the *local* "feeling of relief" to the head experienced on the occurrence of free nasal and ophthalmic discharge, and the *general* relief experienced on the establishment of copious discharge from the skin; frontal and general headache, gravedo, and nose-ache disappearing, or being modified, on the establishment of the former, the general "aches and pains" evincing a corresponding improvement in the latter. The explanation of these events would seem to be that a local outlet is afforded to a superabundant and contaminated cerebro-spinal fluid in the first cases, and that a general relief is attained in like manner by diaphoresis in the other.

The speedy accomplishment of these events is, therefore, of the greatest importance in order to "cut short" the attacks or cases, and to prevent the possibility of the occurrence of the graver sequelæ of the disease, and this must be aimed at by the promotion of these local and general discharges from the "breeding places" of the disease, in order that the parasitic and pathological intrusion and confusion may be converted into purity and order.

Along with lachrymation and running at the nose, as

“safety valves” may be classed herpetic eruptions on and around the eyes, nose, and mouth, as well as the skin surrounding these parts; while, along with general diaphoresis, may be classed eruptions of the same character, which make their appearance on different parts of the general cutaneous surface, as affording additional points of exit to the toxic materials—the latter eruptions may occur regularly or symmetrically, unilaterally or generally, over wide areas.

What, therefore, it seems to us essential to recognise is, that each of these herpetic points, papules, vesicles, or bullæ, represents a discharging “nerve terminal,” and must be looked upon as a highly beneficent excretory agency under the circumstances.

In this connection it might be pertinently asked whether, in many cases of cutaneous disease, the pathological processes may not be initiated in a like beneficent manner by a natural or physiological discharge? the cause of which should be carefully sought for, and the apparent natural intention aided and assisted in order to procure the co-operation of the *vis medicatrix naturæ*.

It may further be noticed that the situation of the prevailing general “pains and aches” of influenza is generally to be found in the track of the great nerve trunks, and at points where it might be supposed that “nervine lymph stasis” and pressure from cerebro-spinal fluid are most liable to occur. Thus frontal and occipital headache, circular or coronal headache, and headache confined to the upper regions of the skull, predominate, while face-aches centre in and radiate from the root of the nose, or where the principal frontal exit is provided from the cerebro-spinal cavity. Likewise the area of exit of the brachial plexus from the spinal canal is a favourite locality for the manifestation of the characteristic pains, the dorsal and the lumbar regions follow in proportion until the climax is reached in the sacral, and even coccygeal termination of the cord, where the pains often encircle the pelvis and pass into the lower limbs.

The same may be said of the great visceral nerve trunks—the pneumogastric, for instance—entering and distributed throughout the body, the sympathetic, through

its many connections with the cerebro-spinal system, becoming involved.

Thus, the sequence of pathological phenomena may be traced, and their varying intensities accounted for, as well as the complications and sequelæ of this disease explained.

As referred to before, the *materies morbi*, having obtained an entrance into the nervous system either through its blood supply or directly from the Schneiderian membrane of the nostrils or mucosa of the air passages, finds a medium suitable for its growth and propagation in the cerebro-spinal fluid, within the cerebro-spinal cavity, and surrounding the cells and fibrils of the brain and spinal cord, as well as within the neurilemmar sheaths, encircling the ramifications of the nerve structures throughout the body.

It will in this way become apparent that an explanation can be afforded of the rapidity with which the strength of the patient disappears, even ere the body-weight has had time to materially diminish; the explanation being that the production and distribution of nerve energy or force has been stopped or interfered with in proportion to the amount and virulence of the poison imbibed and produced.

The rapid loss of strength, independently of the loss of body-weight, is in strong contrast to the loss of strength which takes place, say, in typhoid fever, where it is associated with and in proportion to the loss of body-weight, and is due to the disintegration and loss of tissue, and the over-evolution of caloric and continued high temperature.

On the subject of the prevailing *sequelæ* of influenza, we may remark that they begin and follow on very much the same lines as those along which the disease has conducted its attack, viz. on the brain and nervous system and connected muscles first, and on the visceral and other more outlying organs and structures second.

We would, therefore, remark that those *sequelæ*, which are directly traceable to changes wrought by the disease within and on the nervous system, may be accounted for, as has already been pointed out, by the operation of the toxic and mechanical influences of the specific *materies morbi* of the disease on the various structures of that

organism alone, or almost alone, and the consequent disturbances, suppressive and perversive, of its functional powers.

The other *sequelæ*, represented by pneumonia and pulmonary congestion, with the consequences flowing from them, or the secondary morbid processes, flowing directly or indirectly from the invasion of the nervous system, and not as primary or coincident diseases, may be traced to the passage along the pneumogastric nerve trunks of the germs or bacilli of the disease, and to the subsequent attack of the lung structures, first in connection with the nerve terminals, and thereafter by the implication of the pulmonary parenchyma.

The latter untoward secondary occurrences may thus be regarded as typical examples of the failure of nature, or of nature and art combined, to *clear the system* of the presence of the rapidly multiplying disease germs ere they have had time to overflow into and invade the extra-nervine structures of the body generally.

While remarking on the subject of the *sequelæ* of influenza, we have also had occasion already to mention that herpetic eruptions are common on various parts of the body as symptoms or consequences of the disease, more especially round the mouth, nose, and eyes, as well as on distant parts, such as the genito-urinary and anal regions, and that the cause of the preferences in site seemed to be the anatomical nearness of the points of exit of the cerebro-spinal fluid, viz. the nasal and coccygeal excretory organisms.

In other words, the pent-up cerebro-spinal fluid, it may be, under more than ordinary pressure, finds its way along the channels of least resistance leading from the particular part or parts of the nervous system or nerve structures involved, besides invading the more open and yielding contiguous channels and inter-spaces.

We forbear, for the present, from entering into the very important matter of the therapeutics of the disease, but feel constrained to add a few lines regarding the results of late research bearing on the subject of its genesis.

For instance, that Pfeiffer has discovered and isolated the microbe or bacillus of influenza, that it is the smallest

such organism—according to some accounts—known to science ; and that, consequently, it has only been possible to detect it by the very highest microscopic power, that it has an *affinity* for such substances as the cerebro-spinal fluid, and, as we infer, has been actually found within that fluid when drawn from the cerebro-spinal cavity. If these things be so, and we have so far no reason to doubt the truth of them, then we say we are warranted in advancing the statement of opinion that there is no longer any difficulty in recognising the possibility and probability, yea, the certainty, of the direct invasion of the cerebro-spinal cavity through the channels and air passages described in the preceding pages, that the continuity of these channels, with their fluid contents, affords just such a means of access to this hitherto reputed to be “shut sac” that the spores of the smallest living organism known to science find it an “*easy way*,” and that, therefore, the morbid entity known as influenza is revealed from inception to close in a way which is seldom possible in the complicated fields of pathological research and bacteriological problems.

We might here add that the lower animals, who are liable to attacks of influenza, evince very much the same symptomatic and pathological phenomena as those described, and that the horse in particular has shown a peculiar liability to attack ; “pink eye” in them being often the *epizootic prelude* to an *epidemic spread* of the disease. In reference to this peculiar liability of the horse to influenza, or pink eye, we would suggest that the *materies morbi*, being air-borne, attaches itself with the utmost facility to the large moist surfaces of the conjunctival membranes of the eyes, from which they are removed by the palpebral surfaces and lachrymal fluid into the nasal ducts, and thence into the nasal passages, where they are at liberty to enter and develop along the olfactory peri-neural lymph spaces into the cerebro-spinal cavity, when the *local* give place to, or are followed by, the *constitutional manifestations* of the disease.

The influenza bacillus is essentially an air-borne and atmospherically delivered zymotic organism or morbid agent, and requires for its rapid spread the provision of free space open to air currents, where it can play at large

on susceptible subjects, animal and human, without "let or hindrance," in their unprotected condition of complete unsuspection and unpreparedness for attack. Hence the west ends, the open places, and the great buildings and institutions at once become victimised, while the slums and narrow streets, alleys, and entries escape the winds respectively sweeping through and over them, with the effect that influenzal incidence *seems* a new epidemic departure until its character has been to some extent revealed by hygienic analysis and comparison with related natural history methods and manners of propagation.

EXTRACT XLI.

HYDROPHOBIA.

A SHORT consideration of the subject of that dreaded and dreadful disease, hydrophobia, seems to us likely to yield valuable results when conducted by the light that can be shed by the foregoing views.

Let us, therefore, first remark that the dog, with its kindred species the wolf, seems especially prone, in consequence of its anatomical peculiarities—at least so far as its olfactory organs are concerned—to *take*, and *give*, that disease. Thus, accepting, of course, the truth of what has been already referred to, that from the mouth of the animal a direct passage or passages run through the anterior palatine or incisor canals, and thence, in unbroken continuity, along the cavities of the “organs of Jacobson” to the base of the skull. In the lining membrane of these organs a portion of the olfactory nerves of either side, along which the *virus* of the disease finds a passage, is distributed, and, consequently, a direct route is open into the interior of the cerebro-spinal cavity, independently of the communication maintained by the main body of the olfactory nerves and tracts, where, after incubating for a longer or shorter period, the *materies morbi* gathers strength and virulence enough to produce the pathognomonic symptoms and pathological changes characterising the matured disease.

The cerebro-spinal fluid having become surcharged, a retrogressive movement of it is commenced along the channels by which the original infection was imbibed, as well as all other effluent channels, and then the affected

animal is in a condition to spread the disease, either by direct inoculation through its teeth and saliva, or indirectly, sometimes, in our opinion, by poisoning the food and water used by other animals to which the affected animal has gained access.

The slowness of the infection, or the prolonged period of incubation, in so many cases, may be explained by the indirectness of the route travelled by the poison when inoculated into distant parts of the body, and where, necessarily, it is somewhat a matter of accident whether it reaches the central nervous system along the nerve elements, or by the more circuitous route of the general lymphatic and blood circulations.

EXTRACT XLII.

ECZEMA.

ECZEMA, constitutional and acquired, local and general, may be regarded as largely due to general nerve influence or to the effects of local irritation on certain peripheral nerve terminals in skin or other exposed surfaces produced by their contact with certain substances, such as sugar in the cases of grocers and confectioners.

In the former, the constitutional or innate variety, the external manifestation of the disease or rash, may be regarded as due to the expulsion of the *materies morbi* and to the irritant influence it exercises at the peripheral or excretory extremities of the implicated nerves with their related sudoriferous outlets, and the consequent inflammation excited with its attendant serous exudation and vesiculation: while in the latter, the local or acquired, it may be regarded as due to irritation arising from the contact and, it may be, the absorption of the offending saccharine or other substance.

The latest clinical illustration of this disease occurring in our experience may be cited as a case of the constitutional variety, which, in virtue of an accidentally experienced process of counter-irritation, was precipitated or *determined*, as it were, and *diverted* into local channels.

The subject of this attack, a domestic, aged about fifty years, and never particularly robust, being subject to rheumatism and recurring attacks of acute dyspepsia, felt herself "on the eve" of one of these, which was ushered in, on this occasion, by a period of vague general discomfort and local itchings, tinglings, and pains extending

piecemeal over the whole cutaneous surface, with a feeling as if the hands were being inflated or "blown up" in "balloon fashion," and as if the skin of the arms were being expanded; very little rise of temperature, quickening of pulse, or other notable general symptoms, were observed then or during her subsequent progress towards convalescence.

The feelings here enumerated emanated from within, and were initiated there, but afterwards became generally experienced without, or externally, for a brief period, and then were focussed in the fingers and hands to the wrists, where, after a few hours of work spent amongst materials containing a large proportion of turpentine and other irritants, the terminal result was that punctuated inflammations arose over the exposed and implicated parts, with vesiculation of the cuticle, and œdema of the whole hands. The general, as contrasted with the local, effects of this process of accidental counter-irritation were not less remarkable, in that the entire skin, with the exception of that over the counter-irritated or affected parts, the hands, became absolutely free from the itching referred to as soon as the fucussing was precipitated, and did not show afterwards the slightest disposition to or manifestation of rash or disease.

Eczema may also be caused or precipitated during periods of predisposition by simple local irritation, due, for instance, to the friction of articles of attire, such as collars and cuffs, whose edges have become broken and serrated, and to the local pressure, for instance, of such articles of everyday use as spectacles; the effects of these irritants becoming visible and sensible at the seats of friction and pressure, respectively, and if not hindered by the removal of these irritants, progressing or spreading, it may be, to eczematous dermatitis of considerable proportions, or laying, it may be, the foundation of a general attack. The irritant influences here mentioned being, primarily, only local, and superficial in their action, if withdrawn in time, immediately give place to a healthy condition of the irritated part or parts in proportion to the absence of predisposition, and provided the parts affected have only been the epidermis and outer layer of

the dermis, with the nerve terminals therein distributed, and, it may be, the outer capillary vessels, blood and lymph; and provided, also, that no solution of continuity of these has taken place, nor other morbid results been induced. Should, however, any rupture or solution of continuity of nerve or vascular textures have occurred, and healing by first intention not have taken place, then a neuro-vascular irritative pathological process is the result, which will persist and extend in proportion to the strength and continuance of the original irritation and the intensity of the existent predisposition.

The diseased process thus initiated may, at this stage, be described as neuritis—if we are entitled to the use of the term—involving the nerve terminals and fibrils, distributed to the parts affected, with their peri-neural sheaths and the vascular and other textures immediately surrounding them, the neuritis being accompanied by more or less thickening of the dermis, due to exudation (neuro-dermatic) from, it may be, the capillaries, as well as from the nerve terminals implicated, *i.e.* from the peri-neural or neurilemmar sheaths, with the medullary and axis cylinder or nerve terminal sheaths proper, the first of which enclose inter-spaces containing cerebro-spinal fluid, and the latter the more solid, medullary, and axis cylinder substances respectively, the rupture of one, or both, of which sheaths, and the exudation of their contents, afford the thickening material. Should the fluid portion of the extravasated or exuded material predominate, vesiculation, followed by surface leakage, may ensue.

The first stage in the development of these untoward pathological changes or results requires the pre-existence of what may be called a hyper-æsthetic condition of the peripheral or cutaneous nerve expansions, along with and due to, it may be, an unusually acrid condition of the peri-neural lymph or fluid, as well as the existence of the necessary mechanical or other irritation.

As an example of a constitutional and local predisposition to the occurrence of eczema or neuro-dermatitis, we might mention the *gouty* disposition or habit of body wherein the operation of slight exciting causes usher in or precipitate a local manifestation of gouty symptoms or

processes, cutaneous and others, or a well-defined attack of gout of the more prevalent or typical variety. Here the operation of exciting causes sufficient to initiate a gouty manifestation of morbid processes would not suffice to disturb the equilibrium of health in the now pre-disposed, and would, consequently, pass entirely unnoticed.

An illustration of the gouty variety of eczema, or neuro-dermatitis, is afforded in the following case which has lately come under our notice, and which we have very closely watched and more fully reported and commented upon than its intrinsic merits perhaps required.

A. A., aged 61 years, previously active and healthy and free from disease, constitutional or acquired, began, a few weeks previous to applying for advice, to manifest an unusual irritability of the skin, resulting in slight erythematous reddenings of it at points where friction was experienced, such as the dorsal aspects of the thumbs and forefingers of both hands at their carpal ends mainly, or just where the shirt cuffs extended to, and the lateral and upper parts of the nose where pressed by spectacles; these were the only spots on the whole surface of the skin to manifest the erythematous appearance referred to, elsewhere the skin was perfectly healthy, and the condition of the general health of the body unimpaired. On the removal of the exciting causes of these local manifestations improvement began to take place, and continues, but has not as yet (after one month of treatment) resulted in complete recovery of the former condition of the skin, nor in the disappearance of disagreeable local sensations, hyper-æsthetic, and par-æsthetic, as well as an-æsthetic.

The condition originally set up by the irritants mentioned, and which still to some extent persists, is one, primarily, of peri-neuritis and neuro-dermatitis, involving, in clearly defined small surface areas, the peripheral cutaneous nerve terminals, with their neurilemmar coverings, and, secondarily, of hyperæmic and inflammatory vascular local changes dependent on the primary nervine disturbances. The clearly defined small surface areas are situated over the papillary elevations of the dermis, are smaller or larger according to the development of these individu-

ally, and are usually grouped around one particular papilla, which seems to be the primary seat of the initial neural disturbance, each papilla so affected becoming, as the neighbouring vascular structures become, secondarily engaged or implicated, gradually surrounded by a halo of hyperæmic or congested cutis, and surmounted by a miniature scaly cap of rapidly shedding horny epidermic scales from what appears to be a hypertrophic development or keratine, or, in this case, neuro-keratine from the nature of the structures involved. The local discomfort has not, on the whole, been severe, and has been mainly due to disturbances of the nerve elements, and manifested in degrees of itching in intensity from the slightest to the very severe—there has been virtually no pain—a peculiarity of this feeling of itching is, that it is only felt proceeding *from* the seat of the eruptive patches, which vary in size from a pin's head to a sixpenny piece, to the distal ends of the thumbs and fingers affected, *i.e.* the sensation of itching passes from the proximal, as represented by the nerve structures of the implicated skin, to the distal distribution of the implicated nerve fibre terminals on the bodies and points of the fingers and thumbs before it can be consciously appreciated, or, in other words, the molecular disturbances, initiated in the affected nerves, pass onwards or forwards to their peripheral terminal extensions preparatory to their conscious appreciation by a *reversal* of the currents of the molecular disturbance. The sense of itching, however, can be correctly localised or located when the eyes are closed, but when the local areas of disturbed sensation are rubbed or scratched, the molecular disturbance ensuing, continues to extend exclusively in a peripheral direction along the tracks of distribution of the affected nerve fibres to their terminal arborisations, their proximal parts being entirely unaffected. All these phenomena have been, and are still, confined within the layers of the skin, the affected parts being easily and conspicuously movable over the underlying cellular and deeper seated structures, the hyperæmic reddening, discolouration, and pigmentation being little affected by pressure or position; a noteworthy observation made in this case, relating to the distribution of the areas

of morbid cuticular disturbance, was that the dorsal, as distinguished from the palmar aspect of the affected carpi and digits, was alone affected, that the lines of demarcation between the two aspects were sharply defined, and that above the wrist joints the inner, as distinguished from the outer, surfaces or aspects of the forearms were affected, so far as any infinitesimal sympathy, structural or functional, was concerned.

As an explanation of these *seeming* local preferences of the disease, besides its unmistakable distribution on strictly nerve "trunk and fibre lines," we would suggest that the anatomical and histological characters of the affected and unaffected areas, respectively, constitute it one of *natural selection*, founded on the progress of the *materies morbi* along the lines of least resistance, these being afforded in and determined by the more soft and yielding cutaneous textures covering the affected, as compared with the more resistant and denser unaffected parts, where, naturally, the facility or otherwise of the nervine circulation is modified by the nature of its environment.

Pigmentation, to some extent, marks the sites of the disappearing eruptive patches, and seems to be due to the slow absorption of neurolised hæmoglobin, and, it may be, the limited presence of arsenic, due to its therapeutic introduction during the course of the treatment latterly pursued. The nasal development of the eruption, which was followed by disturbed innervation of the frontal parts of the scalp with a few small patches, or rather points, of keratosis, disappeared in less than two months, leaving the affected parts of the skin quite normal both in colour and texture. About this period the wrists and hands, which had also greatly improved, began to show, especially on the dorsal aspect of the left wrist extending to the back of the same hand, a blush of cutaneous hyperæmia, with a slight sense of itching, in patches more or less corresponding in position with those of the primary attack, and which looked like a slight recrudescence of the disease, and seemed to point to the presence of lurking remains of the eczematous *materies morbi*, and to an effort of the *vis medicatrix naturæ* to "clear the system."

Immediately after this slight recrudescence, an acute

return of the eczematous nerve disturbance, in the form of intense itching over the areas formerly affected, was experienced, along with a thickening of the cutis, and at one spot over the metacarpal bone of the right thumb at its proximal end, a small amount of a clear translucent fluid was exuded in three separate minute droplets. At this point, the capillary circulation of the skin had undergone no alteration, in the way of congestion or reddening, so that the extravasated fluid could not have come from these vessels—whence then could, and did, it come? From one or other of the two sources remaining it, therefore, must have come, *i.e.* either from the lymphatic channels, or from the inter-neurilemmar spaces of the cutaneous nerves, and from the former of these it was most unlikely to come, inasmuch as these vessels—lymphatic—pursue a course in the same direction as the blood vessels, and, therefore, have to discharge their contents at their proximal, or trunk, extremities, where stasis and regurgitation are obviated by the onward flow of the blood streams, and by the provision within themselves of a complete series of valvular textures, which effectually bar the backward flow of their contained lymph, along the lumina of their tubes, passages, and spaces; moreover, at the distal, or peripheral, extremities of the lymphatic vessels and spaces no great amount of fluid can accumulate, and, therefore, no appreciable intra-vascular pressure can exist, hence, we must regard exudation from this quarter as impossible. From the latter source, the inter-neurilemmar spaces of the involved nervature of the part, it *must* have come, therefore, and come through the overcharging of these spaces by the lymph, or fluid, occupying them, which lymph, or fluid, being derived from, and continuous with, the cerebro-spinal lymph or fluid, and, consequently, emanating from the spinal cavity, had been driven, it may be, by super-normal pressure, through its neurilemmar barriers, on to the cutaneous outer surface, bringing with it, we may conclude, the *materies morbi* of the disease, from the recesses of that cavity in which it has been hatched and matured by morbid processes at work amid its liquid and solid contents.

Eczema of this variety and, we may take it, of most

other varieties, except those of purely external origin, must, therefore, be a disease, primarily, of the nervous system, first invading the cerebro-spinal cavity and its contents, and secondarily, the systemic—peripheral and cutaneous—nerve coverings, endings, and inter-spaces. The sequence of the pathological events characterising the onset and progress of the disease, the nature of the structures selected by it, as the theatre for the display of its morbid processes, the correspondence of the extravasated fluid, in consistence and appearance, with cerebro-spinal fluid, or lymph, plus, it may be, an admixture of neuro-keratinous material, due to rupture and disintegration of the containing textures, surrounding the terminal arborisations of the cutaneous nerve fibrils, all lend themselves to prove that we have to deal with a disease of the nervous system.

In this connection, the occurrence of what are denominated keratosis and hyperkeratosis, may be said to be due to the pathologically free discharge into the peri-nerve textures of cerebro-spinal fluid, loaded with neuro-keratine, and, it may be, the medullary and axis cylinder substances, filtered through the disorganised remains of the neuro-keratine sheaths surrounding the final divisions of the terminal fibrils, with the subsequent consolidation, and thickening, of these peri-neural textures, while the “weeping,” so conspicuous in certain cases, may be said to be due to the abnormally free discharge of the more un-mixed, and liquid, cerebro-spinal lymph.

For three months longer the case under discussion continued to manifest the formation of spots and patches of hyperkeratosis, at places over the surface areas primarily affected, easily detected by touch, and mostly apparent to the sight, along with irregular stretches of an-æsthesia, par-æsthesia, or even kak-æsthesia—(used to indicate an absolutely “*bad*” feeling)—in the distal distributions of the implicated nerve fibres. In association with these latter sensory phenomena, a limited motor paralysis of certain of the extensor muscles of the left forearm took place, leading to the production of fairly well-defined “*drop wrist*,” and the serious curtailment of the range of movements required in everyday work. The explanation

of this latter occurrence seeming to be that it was due to invasion, by the same *materies morbi*, of a contiguous set of motor-fibre channels, at a certain point in the distribution of the implicated nerve trunk, where the continuity of the common inter-neurilemmar spaces, and their contained fluid, was maintained along the common sheath, enclosing both the affected sensory and motor fibres, thus proving that here a common cause has been productive of two forms of morbid nervine processes, leading to results quite different in character, in accordance with the anatomical nature and functions of the parts involved, the result in the one case being an eruption (cutaneous), and in the other a paralysis (muscular).

The muscular paralysis, above mentioned, continued for a few weeks, after which it slowly disappeared, apparently with the absorption, neutralisation, or elimination of the *materies morbi*, the cutaneous phenomena also slowly disappearing meanwhile.

The simultaneous occurrence of two such diverse morbid processes, as the results of the action of one *virus*, or *materies morbi*, opens a somewhat novel, but wide, field of investigation in the etiology and pathology, as well as the therapeutics of disease, and promises important aid in the work of grouping and classification of the morbid entities with which medical science has to deal.

In concluding our remarks on this case, which terminated in complete recovery, we would claim that undoubtedly the source of the local disturbance, and disease, was to be found within the cerebro-spinal cavity, amid the fluid with which it is pervaded, and that a chemical, if not bacterial, sepsis of that fluid took place, eventuating in its overflow, into a limited number of the inter-neurilemmar spaces, leading out of, and continuous with, that cavity, and the subsequent invasion of the textures in which they happened to terminate, and to which they were distributed. An eczema and a paralysis are thus parts of the same disease, or, more exactly, they constitute parts of one disease, of which they are symptoms, the full and true nature of which disease is still to be discovered. That the *gouty constitution* underlay it we have already indicated, but what that really is, and how much it means, we are yet

far from knowing, and, hence, we accentuate the necessity of obtaining clearer views and notions of the "essential conditions" underlying this, as well as *all* diseased states bearing the title *gouty* and *rheumatic*, they being terms which cover a large area of the field of diseased conditions, and which require more care in their use than they have hitherto obtained.

The later stages and progress of the disease were characterised by slight but diminishing recurrences, when disturbances of sensation were felt, followed by the appearance, on small detached areas, of slight hyperæmia, with subsequent thickening of the overlying epidermis, and the development of a "brown paper" feel to the finger. This latter phenomenon, as already described, being due to the rupture of the neural coverings of the involved peripheral nerve terminals, or arborisations, and the subsequent invasion of the epidermic cell strata by the escaping neurilemmar lymph and nerve plasm, from the white, or medullary, and the axis cylinder substances, along with their ruptured and disintegrating neuro-keratine sheaths, or containing membranes, and thus constituting a limited *neuro-dermal keratosis*.

EXTRACT XLIII.

ACROMEGALY.

It may be now conceded that the pathological conditions representing the disease denominated *acromegaly* begin or coincide with the development of minute and gross histological changes in the pituitary gland, or hypophysis, and that, in fact, disease of that organ constitutes its starting point: that being taken for granted, we may now enquire how disease of the pituitary gland produces, throughout the entire body structures, such unique changes and symptoms as are observed in *acromegaly*. It seems a "far cry" to assign such changes as lengthening, thickening, consolidation, and thinning, or attenuation, of the bones, wasting of the muscles and hypertrophy of the skin, for example, to the existence of disease in the hypophysis, but yet we think we can, with the aid of the views we hold as to the function, or functions, of that organ, trace, to an extent hitherto impossible, the operation of physiological and pathological factors in the process, which will entitle us to describe it as one of *cause and effect*. Thus, regarding, as we do, the pituitary body as a true gland, and assigning to it the function *mainly* of dealing with, and excreting, the more solid, as well as fluid, nervine and neuroglial *débris*, which finds its way into the third ventricle of the brain, in such a way as to clear it of these waste products, which it does by a process of disintegration, liquefaction, and excretion into the surrounding cavernous sinus of the cephalic venous circulation, and also by the more direct routes of the central and lateral cranio-pharyngeal foramina, which are specially observable in embryonic or

foetal life—into the pharyngeal cavity, through the related and continuous uvular and tonsillar structures.

The lymph, or more fluid material, circulating within the third ventricular cavity, may, to some extent, find its way along the other passages and cavities leading from, or communicating with, it, viz. through the foramen of Munro and the aqueduct of Silvius, and, in the case of obstruction to these, through the pineal gland, into the sub-arachnoid and the sub-dural spaces, while the quasi-solid, or less fluid, residual material, from which the term pituitary is derived, remaining after the draining off of the supernatant lymph, finds its way into the glandular interstices, and passages, of the anterior portion of the hypophysis, from its posterior, or infundibular, portion, and thence passes by the cranio-pharyngeal foramina, through the uvular, and tonsillar, spongio-porous textures, into the pharynx and œsophagus. A portion of this latter, or pituitary material, also seems to percolate from the tonsils into the matrix of the hinder, or posterior, portion of the tongue—the truth of which is observable by all consumers of the commercial article known by that name—where it effects its escape, by the papillæ there so prominently distributed; hence, when these latter become occluded, as we may suppose they do, in certain pathological conditions, we find that the forward or anterior parts of that organ become invaded by the retained matter, when the phenomena of “furred tongue,” with its long familiar tell-tale features, and far-fetched stories, begin to develop in consequence; in which latter occurrence we see the operation of what may be regarded as the law of “compensation,” the anterior excretory agencies of the tongue taking up and performing the work of their posterior neighbours. A considerable, if not measurable, quantity of such material must, therefore, be tipped, or discharged, into the pituitary gland, calling for a never-ceasing activity of its structures and associated agencies, and necessitating the continued maintenance of a *fluidity of effluent*, so to speak, capable of securing complete patency of the oro-pharyngeal points of exit. Should this excretory process in any degree fail, or for any length of time lag, danger will arise from the accumulation of undealt with material, both to the integrity

of the gland organism, and to the system at large, which, if not relieved or removed, must necessarily end in the production of disease. This, to our mind, or in our opinion, is just what does occur in the disease called *acromegaly*, and the sequence of the accruing events may be described as follows: a stasis, more or less complete, occurs in the gland, beginning either in itself, on the one hand, or in the infundibulum, or the other points of exit, on the other, and which, if it persists, leads to a permanent damming-back of the pituitary materials, and to their overflow into the various channels leading from the ventricle. This overflow is followed by the invasion of the body generally, but some parts in particular, by the pituitary matter, along the lines of least resistance, or along the lymph paths leading from, in the first place, the intraspaces of the brain and cord, and thence, from the subarachnoid and sub-dural spaces, along the neurilemmar inter-spaces of the nerves, sensory and motor, and, consequently, into the tissue of the skin, the sheaths of the muscles, and their individual fibres, to which they are respectively distributed. Through its communicating fibres, the invading material also reaches the sympathetic system of nerves, and so also the parenchyma of every organ and viscus, to which that system is attached, it also reaches the diploë, and tables of the skull bones, through the Pacchionian bodies of the arachnoid, moreover, some *compensatory* escape must take place from the other "points of exit," such as the olfactory apparatus and apertures, and the coccygeal gland and related structures. The cerebrospinal lymph, which, in its normal physiological condition of fluidity, enters and penetrates all the passages and spaces above mentioned with ease, and without difficulty, on becoming contaminated, and loaded, or thickened, with the undealt with residuum of the pituitary material, or neuroglial and nerve mud, resulting from the incapacity of the pituitary gland structures, and associated anatomical parts, to perform their normal physiological functions, breaks up *en route*, leaving its more solid impedimenta, in the form of more or less amorphous deposits, amid the interstices of certain of the structures, which, from affinity for its elements, or histological difficulties in the way of their

transmission, or circulation, become more or less organised substances in, and around, the invaded textures and organs; hence, an explanation of the *apparent enigma*, of the association of disease of the pituitary body with the enlargement of bones, and a pachydermatous condition of skin, is thus afforded on definite anatomical and histological lines; an explanation, moreover, which should be fruitful in suggesting the lines along which clinical research may be most profitably conducted, and relief or cure secured, for a hitherto almost hopeless disease.

Thus, the overflowing, now pathological, cerebro-spinal fluid, circulating along the afferent or peripheral nerves, deposits in and amongst the cutaneous textural elements whatever portion of its more solid constituents as refuses to pass through the sweat glands, sudoriferous and sebaceous, with the inevitable result of thickening or hypertrophy of the skin. Thus, likewise, does the contaminated cerebro-spinal fluid, on reaching the periosteum of the bones to which the various muscles of the body and limbs are attached, and to which the motor or efferent nerves are distributed, deposit its more solid constituents on the surface and within the texture of these bones, with the results of thickening and lengthening of the shafts of the limb bones and obliteration of the cancellous interspaces of such osseous structures as the spinous processes of the vertebræ, along with the gross enlargement of the points and surfaces of attachment of the various muscles. Thus, also, do the Pacchionian bodies account for invasion of the diploë of the bones of the cranium, the obliteration of their cancellous structure, and the universal or local thickening of the whole calvarium, except what has been produced externally where the various muscles are attached through the motor nerves supplying these muscles. Besides these somewhat general hyperostotic effects of the disease on the skeleton, sequestered bony deposits are found attached or lying close to certain bones, or developed on or within the muscle sheaths and in connection with their tendonous continuations. A curious departure from the general hypertrophic progress characterising the disease is observed in the thinning of the bony walls of the pneumatic or air-spaces so plentifully developed along and

under the base of the skull and in part of the facial skeleton, the explanation of which seems to be that no infiltration of their texture is permitted on account of their anatomical seclusion from the sensory and motor nervature, or exclusion from the area of distribution of the hypertrophic material, and of the *natural attenuation* due to enlargement of these spaces on account of broadening and deepening of the osseous structures of the face ; moreover, absorption, due to lateral and downward pressure of the pituitary growth, more especially overtakes the body of the sphenoid bone, reducing it, in many cases, to a thin "vestige of itself." Further, and in like manner, it may be said that the wasting and consequent asthenia of the muscles of the limbs, as well as of the muscular tissue of the heart and involuntary muscular tissues generally, are due to the toxic, devitalising, and disintegrating influence exercised by the noxious cerebro-spinal lymph exuded into their substance by the motor systemic nerves. Likewise, the retrograde or degenerative optic phenomena developed in the course of this disease are due to the forward mechanical pressure of the enlarging gland as it ploughs its malign way, rending and obliterating the adjoining commissural nerve fibres of the optic chiasma until their terminal special sense continuations wither and die, shutting out and extinguishing the light of day from its unfortunate subject for ever. The general cerebral and mental changes observed in the progress of the disease are also due, to a great extent, to the incidence of mechanical pressure and the accumulation of effete matter, and continue to extend with the widening boundaries of the enlarging gland. From beginning to end, therefore, an inevitable, although generally protracted, process of centrifugal destruction and degenerative change characterise the course of this disease, which at last overwhelms and finally destroys piecemeal every vital organism and function. In considering this subject a little more in detail it has forced itself upon us that, in early embryonic life, the surplus cerebro-spinal fluid and pituitary material were disposed of by drainage through certain channels left or laid down during early developmental processes dating from before the time when the pharyngeal and hypo-

physcal cavities became contiguous, if not histologically continuous or dovetailed into one another, and which, on their common encapsulation, was succeeded by a permanent system of drainage directly into the pharyngeal cavity through the ante-natal or early central and post-natal lateral sphenoidal foramina, uvula, and tonsils; thus, in the embryo, physical contiguity if not continuity of texture, *intra-spatial continuity* of cavities and oneness of function, lay the foundation of an intimate after-life physical and functional relationship—a relationship which, to our mind, will be found to explain many of those ever-recurring sequences of pathological events or groups of morbid processes, which constitute such a large item in the daily work of observation and the more ordinary experience of every practitioner of the healing art. And so such expressions as a “simple cold,” an “ordinary sore throat,” and other kindred popular ailments of the region in question, will take their place amongst the definite scientific titles and morbid entities known to modern medicine. Concerning the functional *rôle* of the pituitary body, we become more and more convinced of the truth of our contention that the earlier anatomists were right in their conclusion regarding it, namely, that in structure it is a true gland. Being a true gland, therefore, we further contend that it both secretes and excretes. In the performance of the latter function, it excretes, as above mentioned, into the chain of hollow inter-spaces, and through them into the cavity of the pharynx, thus securing a continuous series of passages for the direct conveyance of the ventricular sweepings of cerebral *débris* from the third ventricular cavity into the usually patent and freely washed throat and œsophageal passage, the saliva suspending or dissolving and voluntary or involuntary deglutition conveying it into the stomach; any interference, consequently, with the performance of this function is soon and duly felt. In connection with this subject of the disposal of the excretion of the pituitary gland, we would remark that a common tipping-ground, so to speak, is provided for the surplus or residual secretions of the mouth, nasal passages, with their communicating air-spaces, the Eustachian tubes, and the parts in question—the upper surface

of the epiglottis being the tipping-ground—and that whenever these varied materials have been properly disposed thereon, the required act, voluntary or involuntary, of tipping into the œsophagus is at once effected, thus obviating the immanent danger of allowing their descent into the pulmonary cavities.

EXTRACT XLIV.

ON THE CAUSATION AND EVOLUTION OF SOME CASES OF GOÏTRE, WITH OBSERVATIONS ON CRETINISM, MYXŒDEMA, ETC.

WHEN discussing the methods of disposal of the pituitary secretion or excretion by the tonsillo-glossal excretory mechanism in a former study, we became possessed of the idea that in certain conditions of post-natal and adult existence favourable or conducive to the survival or renewal of the patency of pre-natal gland ducts, we had in view a *possible cause* of the *origin* of some diseases affecting ductless glands of which the thyroid may be regarded as a typical example. This gland, during its embryonic and fœtal stages of existence, undergoes many evolutionary and developmental changes in the arrangements of its parts preparatory to their permanent association as component lobes or divisions of the same glandular organ, its two lateral lobes undergoing a separate or unilateral development, and ultimately uniting with and merging into each other through the central lobe or isthmus, which is the terminal inferior extremity of the duct known as the glosso-thyroid or thyro-glossal, whose superior extremity begins at or *opens* through or by the *foramen cæcum* on the posterior aspect of the upper surface of the tongue, and "hereby hangs a tale." Anatomically speaking, no duct can *open* by or through a *foramen cæcum*, and hence we must believe that the thyro-glossal duct is no exception to the rule. Therefore, the thyro-glossal duct gave passage in its pre-natal or fœtal con-

dition to material either going to or returning from the thyroid isthmus, and latterly, when the evolution of the entire thyroid gland had been effected, the entire gland. That being so, what more reasonable and likely could we suggest than that an unusual post-natal patency of the thyro-glossal duct, either as a survival from pre-natal times or the product of causes conducive to the revival of its dormant, pristine, ante-natal patency and conducting powers, allowed of, or lead to, its original functional rôle being re-taken up.

These possibilities, and the fact that cystic tumours and local ballooning of its *lumen* take place post-natally from time to time, render the further possibility, nay probability, of the occurrence of the invasion of the central inter-spaces of the gland—a most likely and, in fact, an actual occurrence. The natural, and perhaps sometimes exaggerated, endothelial secretion and resultant material *débris* might, in the event of the renewed patency of the duct, be sufficient to produce ballooning of the gland, but, if not, we have not far to seek for the requisite material for its accomplishment if we but turn to that *pituitary dumping-ground* situated “all round” the upper extremity of the *lumen* of the duct, where it originates in the before-mentioned *foramen cæcum*, into which or where the V-shaped sulcus or gutter terminates or dips. This abundant supply has only to be tapped in order that an unfailling stream of the required ballooning material should inundate the yielding textures of the thyroid gland, and produce the disease known as *goître*; therefore, we may take it, *cum grano salis*, that this may frequently be the “state of things,” and, hence, that we must look “for a way out of the situation” by a careful survey of these local conditions, which may haply yield *practical* indications for the direction of both the art and science to be involved.

A renewal of the activities of the duct, an attenuated condition of its re-developed walls, and the presence around these walls of a plastic but circulatable material, which only waits to feel the “line of least resistance,” constitute the essential conditions on which the causation and evolution of this disease in such cases at least are likely to depend, and offer a rational solution of a very enigmatous,

curious, and geographically interesting pathological condition.

Along with *goître* proper, we may classify a recently described morbid condition, viz. *lingual goître*, and claim it as an example of ballooning of the upper extremity of the thyro-glossal duct, and a conversion of the *lumen* of the duct into a localised tumour, composed of the same material as constitutes the matrix of the proper goitrous tumour, a truly remarkable verification of the pathological inferences here drawn from the views we entertain regarding the pituitary excretory mechanism.

Throughout the sequence of physiologico-pathological events, of which this may be regarded as marking the point of differentiation or connection, if we may call it so, we still or continually see at work the moving principle of circulation, albeit a supernumerary stage here in the long series of physiological circulatory acts or events, *initiated* or *begun* in the primary act of taking food, and *ended*, in this instance, in the *primary pathological* circulatory act of *exudation* into the central cavity or intra-spaces of the thyroid gland, the concluding stages of which pathologico-physiological sequence of events have yet to be traced.

Moreover, the colloid material, so often discovered within the enlarged or goitrous thyroid gland, bears a considerable resemblance to what we might expect to find from its being the residual part of the material discharged into the gland from the tongue through the re-opened thyro-glossal duct after its imprisonment within the dumping-ground, and consequent inspissation from the separation of its more fluid parts from the more solid.

The passive circulatory *rôle* of the pituitary material resulting from the disposal of brain waste, which is discharged from the gland of that name, is thus a very large one, for have we not seen and traced it from its production in the cerebrum, through the basi-sphenoid *foramina*, along the spongy tissues of the uvula and tonsils into the pharynx, and by structural continuity into the body of the tongue, and thence through its papillary openings on to the surface of that organ into the cavity of the mouth, besides, under certain circumstances of patency, along the

lumen of the thyro-glossal duct into the cavity of the thyroid gland? A truly wonderful series of connected vascular disposals, a stoppage of or interference with which, as here, may have far-reaching consequences, physiological, pathological, and clinical, *if true!*

The very frequent occurrence of enlargement of the cervical glands seems also to be *possibly* related to the *local wandering* of pituitary material beyond its usual exit mechanism and vasculature, and its lymphatic absorption and passage into the nearest lymphatic glands, which here are the cervical; moreover, the enlargement of the glands usually begins with the most superior, which corresponds with anatomical and histological necessities, and progresses downwards from gland to gland, the matter accumulating, and undergoing caseation, before its relief by necrosis of super-imposed textures, and breaking down of the accumulated mass. Besides the anatomical conditions being satisfied, the characteristics of the gland ballooning material conform to those of an inspissated pituitary excretion, and warrant us in claiming for its etiology, in such cases, a real existence of *cause and effect* in their development and sequence—the performance by the glands of an unwonted physiological function leading to the development of a pathological condition.

Besides rendering possible the occurrence of such disease as *goître*, the occasional occurrence of patency of the thyro-glossal duct also lends possibility, nay, probability, to the conclusion that the physiological disposal of cerebral residual matter is part of the function of the thyroid gland, and, if so, that we have here afforded a clue to the explanation of many very obscure symptoms and diseased conditions, whose only connection with each other is that they are in some way related to pathological conditions of that gland, and themselves lead to or flow out of that relationship. Thus, *cretinism* is associated with absence or atrophy of the thyroid gland, and, consequent, local and general *wandering* of brain waste, with implied hindrance of physiological or normal developmental changes, and the appearance of other related characteristic and specific developmental aberrations. *Myxædema*, likewise, asserts itself in association with non-effective thyroid

disposal of brain waste, and gives rise to symptoms due to systemic invasion and local and general pseudo-organic disposal of non-hygienic or effete plasma accruing from the absence of the proper gland disposal by certain structures, such as the cutaneous and sub-cutaneous tissues of the face and supra-clavicular regions, whose position, with relation to the outflow of this material and the nature of their anatomical structure, make them suitable dumping-grounds and storage areas in such emergencies.

A family relationship, in fact, on account of the position and function of the thyroid gland in the work of pituitary excretion, thus may be said to exist between such affections as *cretinism*, *myxædema*, and *dwarfism*, on the one hand, and *acromegaly* and *gigantism*, on the other, which makes more intelligible many of the likenesses and unlikenesses that characterise this group of diseases, whose etiology is so intimately associated with the negative and positive aspects respectively of pituitary excretion and retention.

EXTRACT XLV.

ON COCCYDYNIA OR COCCYGODYNIA AND HÆMORRHOIDS, IN RELATION TO THE FILUM TERMINALE OF THE CORD, AND THE COCCYGEAL GLAND.

THE former of these morbid conditions seems to us to be so intimately related to that gland as to be dependent for its causation on a condition or conditions of its structure and function, and, consequently, that we must look to it (the gland) to indicate and determine the line of treatment to be pursued in its abatement or removal. The situation of the affection is entirely determined by that of the gland, and would seem to be due to glandular conditions primarily, and secondarily to the implication of its proper nervature and blood-vessel arrangements. Being, according to our contention, a bladder or cystic structure developed in or surviving from the metamorphic and differentiating embryonic elements of the neurenteric canal wall, for the drainage and collection of the residual thecal cerebro-spinal lymph finding its way through the porous or patent lumen of the *filum terminale* or residual canal texture, it is liable to all the vicissitudes of a cystic organ, as, for instance, retention, suppression, or mal-composition of its contents, and, therefore, to the incidence of a wide range of morbid conditions, determined by its structural and functional relationships to the cerebro-spinal and alimentary canals respectively, as well as to those arising from its own intrinsic and immediate condition and surroundings. Hæmorrhoids may also directly and indirectly be largely influenced by conditions affecting the excretory mechanism of the coccygeal gland, their etiology

and course being alike affected by the existence or non-existence of the coccygeal excretion.

It would not be too much to say that the prevailing habits of modern civilisation, in so far as they are sedentary, largely pre-dispose to, and to a great extent excite, both these classes of diseases, inasmuch as the continued local pressure of the sitting position results in more or less closing the excretory mechanism or vasculature of the gland, with the effects that coccygodynia from retention, and hæmorrhoidal engorgement of the peri-anal structures from transudation through the walls of that vasculature, sooner or later begin to be experienced to a greater or lesser extent, according to the particular occupation or "walk in life." *Per contra*, we observe that the savage, and those who are much engaged on their feet in their daily occupation, as well as those who can live with a minimum of exertion, but adopt, in their frequent periods of rest, the habit of resting on their "hunkers," suffer much less from these ailments. We observe, further, that the tailed animal, and our nearest neighbours in the animal scale, do not seem to suffer much, if at all, from these diseases, and why? because these animals are possessed of a different method, and perhaps increased facilities, for eliminating their residual cerebro-spinal fluid along their caudal appendages, and through peri-caudal eliminatory mechanisms or sudoriferous glands. The horizontal position, moreover, assumed by most of the animals in question, must also do away to a great extent with the necessity for such an arrangement as exists in man because of their entirely different relationship to the incidence of gravitation and biological hydrostatics, if we may be permitted the use of the phrase.

What man gains in dignity through his erect bearing he therefore, to some extent, pays for, or forfeits, by the addition to his category of diseases of these somewhat *distinctively, if subsidiary, human ailments*.

Another, and a very troublesome ailment of the region in question, is *fistula in ano*, which may, likewise, be claimed as flowing out of and evolved from its peculiar anatomical position and surroundings; thus the perineal abscess from which it usually results is for the most part,

in fact we may say entirely, situated in the posterior and lateral aspects of the anal termination of the rectum, and why? because the excretory outlets of the coccygeal gland, according to our view of the matter, are largely latero-posterior, and pass through the textures of the usually fistulous parts, and, therefore, are subject to all the morbid influences, pre-disposing and exciting, which are operative in bringing about disease in this region, such, for example, as may arise from stasis of exuding lymph in or occlusion of one or more coccygeal gland outlets, and consequent inflammation and suppuration, with local abscess, tissue destruction, and recovery, with a more or less permanent sinus, peri-anal or endo-anal, or both. Moreover, the occurrence of suppuration and necrosis of the tissues involved in the evolution of perineal abscess may be said to be naturally or anatomically prone thus to leave a cavity with communicating sinus or sinuses which lend themselves to the passive collection of coccygeal gland excretion, to its greater or lesser retention, and to its continuous or intermittent discharge through the fistulous opening or openings, a condition of things which may easily become permanent, and be, as it were, a supernumerary cyst or bladder, and the quasi-functional exit or exits of the coccygeal organism in perpetuity.

In connection with the inferior or posterior termination of the cerebro-spinal cavity, many other local departures from the normal anatomical condition might be referred to, and many consequent local troubles might be enumerated, as related to these, in the way of cause and effect; but let it suffice to say that all these anatomical, physiological, and pathological occurrences are due, primarily, to the metamorphic character of the structures involved, and are the residual products of the great developmental differentiation to which the neurenteric canal is subjected in embryonic times; around this condition of metamorphism of structure and function, we are persuaded that a great many peculiar and otherwise anomalous pathological occurrences might be grouped with advantage to nosology, as well as therapeutics and surgical procedure, in many other localities besides the one under discussion.

Since writing the above, we have had an opportunity

of diagnosing a case bearing directly on the truth of our views regarding the functional rôle of the coccygeal gland, and associated anatomical ductiform outlets, as well as on the meaning and significance of the morbid entity *coccygodynia*.—M. G., a gentleman of active business habits, and at the time he consulted us in the middle of worry, had allowed his bowels, which were usually inclined to be costive, to become unusually so, owing to the various distractions with which he was at the time surrounded, and had thought to make things right again by having recourse to some aperient. This, however, he had not done, when the following occurrence dismayed and alarmed him into seeking advice, and he narrated as follows:—

“This morning I dreamt that I was visiting some mountain scenery, where there were other people besides myself engaged in the same pleasant manner, moving about to the best points for gaining views of the surrounding hills and dales, when a desire came upon me to gain a quiet retreat in which I might ‘relieve nature.’ In doing so, it seemed to me that I had chosen a place where I could be overlooked, and I immediately prepared to obtain another where such danger did not exist. I then awoke, and *realised* that it was true that I needed actually to follow out what I had so realistically dreamt. In doing so, and when in the act of micturating, I became aware of a trickling sound, as well as a feeling of a very embarrassing nature, due to the escape from the rectum of a fluid. Of what nature that fluid was became a question of pressing importance, as my character for personal cleanliness and the possible existence of personal danger, seemed to me to be in the balance, and I proceeded at once to strike a light and obtain ocular demonstration on the subject. I had thought it might be blood, or that it might turn out that my bowels, which at the time, as has been already observed, were costive, might have become relaxed, and hence my trouble; but neither the one nor the other fear proved true, and I was at my wits’ end for an explanation of the occurrence and a means of satisfying myself that there was really nothing seriously wrong with me, hence my visit to you.” On questioning him as to his *feelings* at the time of the occurrence, we

elicited that there had been absolutely no diarrhœa nor exaggerated peristalsis of the bowel, and that the fluid discharged was pale, in fact quite colourless, when examined on the carpet of his bedroom and in the basin of the W.C., where the greater quantity of it was discharged, with the slight exception of a few very minute flakes and shot-like particles of fæcal matter which had evidently been detached from the anal extremity of the rectum, which was otherwise empty, the solid fæcal matter not having as yet descended into it; there was thus no fæcal matter. The bowels still continued confined, and there was no feeling of discomfort or as if they were going to be moved, and there were no piles or solution of continuity of the mucous membrane. Whence then could this serous or watery discharge—which would measure from one to two ounces—have come, and what did it indicate? That the fluid could have reached the anal extremity of the bowel without admixture with alvine or fæcal matter it was impossible to conceive, and that the fæcal matter which was discharged represented only what was present in the otherwise empty recto-anal extremity of the bowel was equally apparent, rendered it necessary to seek a solution of the problem in another direction. That the serous or lymphoid fluid in question came from the blood circulation it was also impossible to conceive, inasmuch as no hæmorrhage took place, and no solution of the continuity of the lining mucosa of the bowel could be found, nor could local congestion or hyperæmia be discovered; hence we were and are driven by elimination of all possible likely causes or sources of the discharge to admit that it *must have come* from the inferior or posterior eliminatory apparatus of the cerebro-spinal lymph cavity, and that, in this case, it represented, it may be, the exaggerated physiological performance of a constantly operative and imperatively necessary excretory function. The actual cause of the accumulation of the cerebro-spinal fluid had been the sustained and effective contraction of the anal sphincter, which, on being overcome by sympathy with the kindred vesical operation then in process, allowed the accumulated excretion of the coccygeal gland to escape as already narrated.

We, therefore, claim that the truth of our already expressed opinions regarding the provision of an excretory outlet for superabundant cerebro-spinal fluid and its utilisation for purposes of post-rectal lubrication and the maintenance of local plasticity is, if not absolutely proved, so strongly supported as to warrant us in claiming for it the assent of anatomists, histologists, physiologists, and clinicians, as a principle which must always be considered in the solution of problems which concern the region in question, scientific and practical alike.

Another remarkable case, and, in our opinion, bearing out the truth of these remarks, is recorded in the *British Medical Journal* of date May 23rd, 1903, page 1209, which, therefore, we shall take the liberty of quoting:—
“A congenital coccygeal tumour about the size of a fœtal head, attached by a broad pedicle to an eight months’ fœtus. The tumour presented, and was mistaken for a large uterine fibroid. The tumour was situated between the coccyx and the rectum, subjacent to the levator ani muscles. *The spinal canal was continuous with the interior of the tumour’s capsule by an opening that admitted a No. 8 Urethral bougie*—[the italics are ours]. The tumour was solid and arranged in large lobules, which were held together by a loose frame-work of fibrous tissue. On microscopical examination it was found to consist of a fine round-celled groundwork, with *masses of cartilage* irregularly scattered about, and numerous tubules lined by a single layer of cubical epithelium. The tubules varied considerably in size, showed well-marked convolutions, and occasionally intra-cystic growths. The tumour possessed a well-marked capsule, which was loosely attached to all its surroundings, *except the tip of the coccyx*. It might safely be called a congenital adenoma, which in all probability arose from the embryonic neurenteric canal, rather than from the coccygeal gland.”

According to his presently available “lights,” we consider Mr. Hewitson amply justified in his opinion of the case as related, and we congratulate him on the terse but clear manner in which its salient features are recorded. We are, therefore, sorry to have to disagree with his opinion, and at the same time glad to have the opportunity

of claiming the case as an illustration of the embryonic and foetal arrest and perversion of the metamorphic changes in progress in the differentiation and division of the neurenteric canal.

In our opinion the tumour is not a new growth, or an adenoma arising from the embryonic neurenteric canal, but a simple enlargement or hypertrophy of the coccygeal gland itself and its capsule, due, in all probability, to imperfect or absent eliminatory facilities for, and the consequent accumulation of cerebro-spinal fluid and other *débris* in the enclosing *lumen* of the neurenteric canal and the developing coccygeal gland; this opinion being borne out by the macroscopic, as well as microscopic, character of the tumour and its contents, its normal, although hypertrophied, encapsulation, and its *still very patent* connection with the intra-meningeal cavity. We, therefore, claim this case as another proof of the truth of the views we have advanced in this hitherto very obscure and little noticed subject, and would add that, had this child survived, the local conditions were such as to justify a favourable prognosis. On "all fours" with this case is a case of pendulous tumour hanging from the buttocks, or a so-called tailed child, described and illustrated by Mr. J. B. Sutton on page 52 of his work on *Evolution and Disease*.

EXTRACT XLVI.

ON THE EVACUATION OR DISCHARGE OF COLLOIDAL MATERIAL THROUGH NARROW EXCRETORY CHANNELS, AS CONTRASTED WITH THAT OF MORE FLUID OR SEROUS MATERIALS.

GENERALLY speaking, the physical consistency of the residual material due to bodily waste, being serous or sub-serous, is evacuated through narrow channels secured by muscular sphincters or structures acting in a sphincteroid manner with the greatest success and comfort ; if, however, the consistency of the fluid be above that of serum, the narrow channels and the previously successful eliminatory machinery become clogged, and the usually increasing colloidal condition gives rise in two directions to a pathogenic state of affairs which may, and does, frequently lead to the production of definite states of disease. These two directions lead respectively to, on the one hand, *ballooning* of channels by the accumulating non-eliminated colloidal material, and, it may be, the formation of "cystic" or "new" growth partaking of the character of the original colloid and the nature of the histological elements of the excretory mechanism involved, and, on the other, to *shrinking* and ultimate obliteration of the inter-spatial *lumina* of the channelled textural elements, and *hardening* or *sclerosis*, with atrophy and disappearance of the structures involved. The recto-anal textures illustrate both these varieties of pathological development, and afford examples in the two directions mentioned of the working out of pathological problems by pathogenic factors, determined by the property of physical consistency of circulating

fluid and character of circulatory media—the pathological result, in the one case, being a condition of pseudo-hypertrophy or hæmorrhoids, and in the other, pseudo-atrophy or fissure of the anus.

In the normal condition of the “complexus” of circulations in the recto-anal textural economy, the circulatory machineries dovetail and harmonise in their working in such a perfect way that not the slightest discomfort is experienced, but, if the slightest departure from that normal condition obtains a “footing,” then a long list of possible pathological conditions begins to unfold itself, the various factors in which become determined, primarily, by the relative degrees in which three or, it may be, four definite circulations of the parts affected become involved, viz. the alvine, the cerebro-spinal lymph, sometimes, it may be, the systemic lymph and the blood circulation proper; and, secondarily, the manner in which their mutual disturbances work out the final pathological results. We may take it, under the circumstances here enumerated, that the condition of colloid, as applied to the consistency of excretion, can only pertain to the cerebro-spinal lymph, and can, therefore, only effect the production of a pathological condition through its action on the principle of circulation, and the consequent stasis of the excretory flow from increasing consistency of that lymph, and the engorgement of the cerebro-spinal lymph excretory vasculature. Under ordinary or normal circumstances the excretion of the cerebro-spinal lymph from the coccygeal gland and excretory vasculature is effected by the combined influence of proper gland contracture, the subsidiary local or external muscular compression of the gland, and the involved mechanical emptying of its excretory vasculature in its course through the peri-anal structures by the queezing or compression exercised by the intra-mural bowel structures on the passing fæcal materials through ordinary peristalsis, and the associated action of the abdominal musculature; but, when an unusual viscosity or hyper-colloidal condition of that fluid ensues from any cause so as to impede its excretion, the result is a *stasis*, with ballooning of the excretory vasculature, in the distal bowel border immediately beyond the sphere of influence

of the available circulatory factors—an incipient hæmorrhoidal condition, local or general, the super-addition of other circulatory difficulties, the ultimate general involvement of the entire circulatory machineries of the parts involved, and finally fully evolved pathological consequences, circulatory and textural. Prophylaxis must, therefore, be constantly kept in view, and such occurrences or emergencies prevented by the maintenance of free outlets to all excretory products by unhampered circulation and excretory disposal.

Mucus is a secretion or excretion much in evidence throughout the alimentary and respiratory tracts and genito-urinary organs, and is formed in or by cells alternating often with others supplied with ciliary processes or flagellæ, which give the requisite direction and impulse to the mucous material for lubricating and environing the delicate mucosa and sub-mucosa; inspissation and over-consistence of it sometimes, however, making a pathological condition, and leading, it may be, to a specific form of disease of the areas affected, with secondary consequences of a far-reaching and often dangerous character, but seldom primarily in connection with the hæmorrhoidal condition. Pituitary matter, as it is excreted from the brain or gravitates along the channels of entrance and exit of the great blood vessels and nerve trunks as they pass through the base of the skull, as has already been described in connection with some cases of *goître* and some other affections, is another substance which lends itself to colloidal inspissation and, it may be, caseation in such affections as enlargement of the tonsils and of the cervical and other associated glands, thoracic and mediastinal, and, it may be, to some extent in the often allied pulmonary tuberculosis, miliary and general. In this relationship with the causation of these diseases, we would again call attention to the importance of a free exit being maintained for the evacuation of all cerebral and spinal *débris*, and cerebro-spinal effete products, as they have, when admixed with systemic lymph, a most hampering and deleterious effect on the systemic circulatory and excretory vasculatures, eventuating often in mechanical ballooning of glands and vessels, active inflammatory conditions, and subsequent

destruction of the involved parts and their over and underlying structures, with necessary permanent interference with the economy of circulation and excretion of effete products, general or systemic, and cerebro-spinal.

EXTRACT XLVII.

ON GLYCOSURIA AND DIABETES.

THAT a relationship exists between these two conditions there seems to be no reason to doubt, but that they are one and the same in nature and character we are not prepared to acknowledge. *Glycosuria* is frequently, if not always, to be regarded as a physiological condition of hyper-katabolism of the sub-cutaneous and general fatty tissues of the body under certain conditions of faulty systemic hygiene, and abnormally rapid molecular disintegration of these tissues, whereby their fatty elements are reduced to a glycerinoid or glycerosaccharine composition and consistency enabling them to pass through the kidneys; and *diabetes* may begin in this condition and be a continuation and exaggeration of it, while pathologically developing into a continuous hyper-katabolism of these and of other structural elements, as well as a direct or pre-metabolised conversion of various articles of diet into the condition of sugar, followed by a continuous and pathological activity of the renal glands.

Glycosuria, thus, in its earlier stages may represent only a physiologically exaggerated condition of a normal tissue change, which in the end slows down to its normal rate, leaving the condition of bodily health unimpaired and the bodily textures and organs unaffected, save perhaps in a more or less permanent lessening of their adipose, surrounding, and inter-penetrating elements, which seems to be the material outcome of the unusual katabolic activity and glycerosaccharine change in these latter usually passive structures. It, nevertheless, seems to mark an epoch in the history of its subject's health and metabolism

from which to date the commencement of involutionary change, and the necessity for altering the course of life in relation to physical exertion, mental effort, and the continuance of the worries of life, with all that represent pathogenic factors in the economy of tissue change and metabolism.

In like manner *diabetes* may represent only an aggravated and more or less permanent establishment of the condition here described as *glycosuria*, or it may represent a condition of an acutely pathological character in which the phenomena of tissue change and katabolism follow each other in such rapid succession that body weight is reduced at such a rapid rate that normal metabolism, however abundantly ministered to by raw material, becomes quite unable to keep pace with physiological requirements, and life flickers out amid scenes of involutionary tissue change, and chemical resolution of alimentary material, into saccharine excretion of the most alarming intensity and of the most wholesale character and proportions, in which treatment proves as futile as the play of a single fire-engine in a great conflagration. In this condition of pathological things, alimentary materials do not reach the tissues, being snatched up, as it were, by a pre-metabolic resolvent chemico-pathological activity, which sweeps them almost *in toto* through the kidneys, leaving the tissues to pine away and perish from inanition, deprived of their nutritive pabulum and wasted by pathological katabolism. At this stage of development of the disease the affected organism has become or is now a huge chemico-pathological laboratory, in which are simultaneously being performed the synthetic and analytic processes of saccharine or glycerinoid production to meet the morbid ends of some as yet unknown subtle disease factor or factors, the satisfaction of which usually culminates in materio-dynamic exhaustion and death.

We may, thus, compare *diabetes* to cancer, in that it converts the physiological tissues, and the raw elements of nutrition, with their inherent dynamic powers and energies, into the elements of its own specific pathological individuality and morbid being—with the universal result, the destruction of their subject—passing them out

of the body, through the kidneys, while cancer usually retains them within the body.

The physiologico-chemical processes undergone by the tissue elements, and the elements of the *ingesta*, represent, respectively, a retrogressive and a prematurely constructive vital activity, the former consisting of the premature or immediately post-metabolic resolution of tissue substance into fatty degenerative products and saccharine or glycerinoid elements, the latter consisting of the pre-metabolic resolution of the alimentary materials into saccharine or glycerinoid elements, in accordance, apparently, with the principle seen determining the production of glycerine from fatty matter as an artificial process, but modified by the play of vital energy, in its various stages, on the physiological and pathological results.

It may, therefore, be said to illustrate the failure of vital energy to maintain the histological and molecular cohesion of developed structure, and the inability of vital energy to obtain the development and organisation of tissue pabulum, each failure representing two aspects of a common vital failure to maintain and produce vital tissue cohesion and organic health.

The great result of this dual failure is profound general abnegation of function, and absolute materio-dynamic collapse, together with auto-toxis, due to the presence of devitalised and non-vitalised materials throughout the fluids and solids of the whole organism which have failed to find an exit through the overwrought kidneys, and which, therefore, have been brought into universal contact with the living and acting tissues, poisoning their nutritive supplies, and mechanically interfering with their freedom of action, individual and communal, until their very vitality has become asphyxiated and overwhelmed by sheer negation of its essential conditions.

When looking for indications as to treatment of these conditions, it, therefore, behoves us to remember that the presence of sugar in the urine is due both to ephemeral and persistent conditions, and that the one is amenable to treatment, while the other usually finally baffles all treatment, and that our prognosis should be, in consequence, of the most cautious order.

EXTRACT XLVIII.

A MODE OF EMPTYING ABSCESSSES, SEROUS CAVITIES, INCLUDING THE CEREBRO-SPINAL, ETC., AND THE OBTAINING OF PITTING IN SMALLPOX.

THE following observations apply to an instrument originally invented for the purpose of evacuating smallpox vesicles with a view to prevent *pitting*, but which may be adapted to the evacuation of any collection of fluid in any part of the body, and were a contribution to the International Medical Congress held in Rome in March and April, 1894.

Surgical aid in the prevention of pitting in smallpox (instrument shown), and on the use of the same instrument in the treatment of abscesses and the collection of fluid materials generally within the body.

Mr. President and gentlemen,—The subject of my remarks is mainly that of preventing the unsightly occurrence of pitting by smallpox, and, incidentally, that of the treatment of abscesses. Of course pitting results from the destruction of more or less of the dermal tissues, and is due to the formation of pus in the interior of the smallpox vesicles, and the disintegration of the surface layers of the dermis in immediate contact with the area of suppuration.

If this process can be prevented, therefore, by checking or altogether avoiding pyogenesis with its destructive dermal changes and consequent hollowing of the surface, the occurrence of pitting should cease.

To accomplish this it has for some time struck me that

the evacuation of the vesicles while the lymph is in its transparent condition, or before it has had time to become purulent, and the sterilisation of the interior of the vesicles by the introduction of an antiseptic, or what we may call *bacillicide*, might be effective.

This I have sought to do by combining in one instrument an aspirator and injector, the barrels of which unite in a single doubly tubular needle designed for insertion into the vesicles.

The needle having been introduced, the vesicle is emptied as far as possible, and, to a certain extent, refilled with the antiseptic.

The choice of this antiseptic is a matter of some difficulty, and is still to a certain extent in the experimental stage. It may be laid down, however, as an axiom, that the principles guiding the choice should be efficiency as a germicide, with innocuousness to the subject of treatment.

The instrument has already been subjected to the test of clinical experience in the treatment of smallpox, but to too limited an extent to enable me to lay down anything like final directions.

It seems to me further, that the principle of simultaneous or continuous evacuation and sterilisation (as embodied in the instrument) is capable of widely extended use in the treatment of abscesses, superficial and deep, and in emptying accumulations, morbid and otherwise, of liquid materials almost anywhere within the body.

The pistons of the instrument, it ought to be mentioned, may be operated by either screw or traction movement according to the size of the cavity to be evacuated and the nature of the contents.

One of the great advantages claimed for the instrument is, that only one insertion is necessary to effect both evacuation and sterilisation.

EXTRACT XLIX.

THE CELL UNIT AS THE CENTRAL TEXTURAL ELEMENT IN ORGANIC PATHOGENESIS.

IN assigning a structural limit to the commencing process of local organic pathogenesis, and tracing disease to its absolute beginning as a local entity, it would seem to accord with truth were we to assume the individual cell, or group of cells, as the *locale* in which its first morbid element or elements appeared, and from which the pathogenetic process spread from cell to cells, from texture to textures, and from organ to organs.

Thus the cell, wherever situated, is liable to invasion by chemical, physical, and bacterial influences, and so becomes the vehicle of conveying that influence or these influences to the cell or cells with which it is related through its attached and inter-communicating processes, or by structural or histological continuity, and which, being the lines of least resistance, constitute the easiest and direct means of spread of the disease, that spread being determined by and effected through, in the first place, the normal or physiological media. The cell may thus be reduced to an inert or pathogenic condition by the chemical or physical action on its contained protoplasm, of solidifying or liquefying substance or force, or become the nidus in which and from which dead matter is exuded or bacterial organisms are incubated and spread, should the hygienic agencies of the *vis medicatrix naturæ* be unable to cope with the circumstances so created.

While claiming the cell as the foundation pathogenic organic unit, it must be conceded that the lymph or fluid

surrounding and inter-penetrating the cell may be the medium of carrying to that pathogenic organic unit the *materies morbi* or the dynamic influence determining the process of pathogenesis, and of distributing the *viri* and toxins to surrounding cells and structures, and so be really the first, but not truly organised, material to become affected.

EXTRACT L.

ON CIRCULATORY STASIS AS A PATHOGENIC FACTOR.

ALL the circulations within the human body are liable to the phenomenon of stasis, and hence are liable to initiate mechanically many forms of disease, and to lay a foundation for the genesis of many more, according to the *locale* and extent of its incidence and character, and the nature of the super-added pathogenic influences. Thus gastro-intestinal circulatory stasis may mechanically give rise to fatal obstructions, or less lethal consequences, in accordance with the nature of its cause, or may be followed by consequences of an easily remedied character or which yield to the influence of the unaided *vis medicatrix naturæ*; hæmo-lymphatic stasis may originate œdema of all intensities between the most ephemeral and persistent, such as simple sub-cutaneous passive accumulation and elephantiasis; neuro-lymphatic stasis may originate adenoids and hydrocephalus, blood circulatory stasis may cause simple congestion or gangrene, stasis of the circulation of particular organs or textures may be followed by all degrees of local implication, in accordance with the structural elements affected, while stasis of the metabolic or nutritive circulation may induce an innumerable multitude of affections in proportion to the extent, intensity, and persistence of its incidence.

Indeed, circulatory stasis, however induced, and wherever existent, as a pathogenic influence exercises a wider range of morbid effect than any other *causa morbi* with which we are acquainted, and requires to be enquired after, in a far-spreading range of organic and even

so-called functional disease. From the preparation of the alimentary materials for the process of nutrition until their excretion from the body at all points of their circulation, but more especially at the "linking up" of the various circulatory acts, stasis is liable to take place, and to be followed by, it may be, a merely ephemeral disturbance, or a most lasting and destructive pathological entity. The appreciation, therefore, of every stage of the great process of circulation throughout the human body becomes a matter of the first necessity in all diagnostic and therapeutic work.

When circulatory stasis has done its mechanical work, and established a larger or a smaller area of arrested circulatory movement, it has then established a basis for the operation of further morbid etiological influences in the form, it may be, of still merely mechanical agency, or of the super-added physical, chemical, and bacterial morbid elements, which are ever ready to seize a chance to follow up a pathogenic opportunity, and to assist the process of involution "in season and out of season" in the young, the adolescent, and the aged alike; but, from this point of view, *involution* is as *natural* as *evolution*. At the *linkages* of the various circulations, great and small, wherever a change of *lumen* of vasculature or inter-spaces takes place, the predisposing causes of circulatory stasis exist in greatest proportion, and when disease presents itself for consideration at its very earliest stages, the truth of this can be observed with much greater ease and certainty than can be the case when pathological changes have ensued, which destroy the traces of the original incidence of the process of disease and the sequence of its various stages.

Who would at first sight suppose, for instance, that in the evolution of the formidable disease, elephantiasis, we had only to reckon with a simple erysipelas and inflammation of lymphatic vessels, which, being repeated, it may be, time after time, have left the whole lymphatics of a limb or limbs absolutely occluded and impervious to the passage of lymph, rendering the affected limb or limbs the receptacles of uncirculatable or derelict lymph and the accumulators of metabolic waste until the limits of

encircling cutaneous expansion have been reached or art has stepped in to avert final consequences? Who, moreover, would suppose, on the spur of the moment, that a fully developed hydrocephalus had originated in a simple closure of the central cerebro-spinal lymph exits, and a consequent damming back and accumulation of that fluid, with its far-reaching results on the processes of local ossification, and formative extension of the external cephalic structures?

And what more evident than the cause of the atrophic effects of arrested blood circulation on the process of nutrition of the tissues to which the affected vessels and arrested circulation lead?

In every instance of circulatory stasis it will be found that relationship to the heart and blood vessels determines to a large extent the manner of incidence of the arrestment phenomena, thus the proximal and the distal sides of that relationship, while they are attended with different dynamic procedures, yet combine to produce one unbroken *system* of circulation, beginning at the oral orifice of the body and terminating at its various eliminatory exits; on its proximal side the circulation being effected by a *vis a fronte*, and on its distal side by a *vis a tergo*, each of which is alike the product, directly and indirectly, of cardio-vascular contraction, aided by the other general circulatory agencies operative in organic fluid movements.

As we have elsewhere contended, the central and indispensable element in this circulation, both in its initiation and maintenance, is the *creation of auriculo-ventricular vacua*, which *result*, on the distal side of the heart, in *sending* currents of blood away from it and along the arterial vessels, and on the proximal side in *bringing* currents of blood into it and along the venous vessels, both of which currents, while sustained by muscular agency, superinduce throughout the whole range of the subsidiary and uniting circulations forward movement of the various fluids within these circulations, nutritive and effete alike, to the end that one continuous forward circulation of the entire fluid contents of the body should be maintained without stasis or regurgitation. The alternate contractions and relaxations of the heart in rhythmic

sequence determine the circulation of the blood absolutely, and, at the same time, materio-dynamically inspire, so to speak, the machinery of all the other circulations, simple and complex, subservient to the necessities of the organic life of the body. Any failure of the heart's action is, therefore, attended with general slowing of rate and lowering of tone of the whole circulatory system, and an increased tendency to stasis at its linking up junctures, capillary areas, and terminal metabolic or interstitial distribution.

Besides these forms of circulatory stasis, which are mostly illustrative of obstruction within the area innervated by the sympathetic nervature, and concern the circulation of the blood and the hæmal lymph principally, are a great variety of stases within the systemic nervous system itself, and the structures innervated by that system. Thus, besides hydrocephalus, stasis of, or obstruction to, the outflow or exit of neural or cerebro-spinal lymph, is attended by adenoids in the nasal passages and polypus amongst others, from obstructed olfactory excretion acromegaly, from obstructed pituitary outflow, pendulous tumour of buttocks or false tail, from obstructed coccygeal exit and various superficial tumours of the skin, from obstructed discharges of sweat and other material, including, in our opinion, retention of the sub-arachnoid fluid in cases of wens of the scalp.

This is a large array of obstructive ailments, but it may be said, with all truth, that it constitutes but a very small proportion of the total diseases traceable to stasis of circulation.

EXTRACT LI.

ON *MAL DE MER* OR SEA SICKNESS.

THIS is an affliction, we can scarcely call it an affection, with which the human family and some of their lower neighbours have been familiar since its members "went down to the sea in ships" or trusted themselves to less substantial means of support on the undulating surface of river, lake, or sea.

Its causation is but too apparent, and its incidence what would seem somewhat capricious, thus, one or a few only may succumb to it out of a large party, while one or a few only may escape out of a large party, when the exciting causes have been but slightly modified or intensified.

It is essentially of nervine origin, and due to the difference in the specific gravity of the various component parts or organs of the human body whereby their various rates of upward and downward movements are irregularly effected in every succeeding rise and fall of the craft, engendering mechanical jarring and concussion, and finally affecting the neuro-muscular economy to such an extent that general materio-dynamic demoralisation ensues, with the familiar consequences.

To illustrate this theory of its causation, we may fill a hat, or other hollow receptacle, with a dozen substances of different weights and differing sizes and densities, and throw them up out of the receptacle with some force, and it will be seen that they do not all reach the same height or traverse space at the same rate of speed, and that in descending their rates of movement are in the inverse

order. In like manner every upward and downward movement of the body affects its structures, organs, and viscera, although enclosed in a common envelope, in a similar manner, with the effect that disturbance of the physico-physiological equilibrium takes place, and produces disturbance, more or less profound, of the whole sympathetico-systemic nervous system, and, indirectly, of the whole related parts, with consequent sickness.

Every remedy for the condition has been used, prophylactic and remedial, with but very questionable effect, and we still, as our forefathers did, look forward to the *discovery* of some *infallible* means through which we may be saved from that dreaded and more or less unavoidable penalty of visiting Neptune "at home," and it may well be that every fresh remedy may fail, as usual, until we can succeed in devising a means whereby the incidence of the exciting causes can be altogether obviated or rendered abortive by the maintenance of the physico-physiological equilibrium amid the unstable elements of "wind and water."



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