PART THIRD.

Original Communications.

ART. I.

On Construction and Degeneration. (With especial reference to the Lungs.) By T. C. ALLBUTT, B.A., M.B. Cantab., Physician to the Leeds Infirmary.

ESSAY No. II.

IN April last I had the honour of laying before the readers of this Review certain opinions on the states of the animal body in health and disease. I pointed out the growing belief that the higher ranges of vital action, correlative with certain visible developments of structure, are dependent upon the building up of more and more complex structural units; that what we call the manifestations of force in healthy function result directly from the stability of such units; that immaturity depends upon incomplete molecular construction, and disease upon the arrest or failure of it; that the processes of such failure or degeneration exhibit those of growth in an inverse series, so that resulting phenomena can only be called healthy and morbid in a special and relative sense; lastly, that the elaboration of such structural complexity depends upon the influence of neighbouring matter, which has already attained the required degree of complexity, and by resolution is converting tension into energy.

If the organs, therefore, which are set apart in the higher animals for the exercise of such energy—i.e., the “constructive glands”—fail in previous attainment of the required tension, we must find as consequences imperfect elaboration of structural elements, failing structure, and failing function. In many of those affections which are called “blood diseases” we see a dynamic change throughout the whole system. With a lessened energy of molecular construction we get diminished tension, and the changed state “*ἐν δυνάμει*” becomes manifest “*ἐν ἐνεργείᾳ*.”¹ Structural advance is therefore proportionably slackened, and general equilibrium also disturbed, as is seen in quickened circulation and inordinate action of organs. Thus arise many forms of disease, varying in individuals as the external conditions, and as the paths of least resistance in the peculiar structure of each. For instance, a common result is fibrous degeneration, showing itself as rheumatism

¹ In using Aristotle's words for the sake of convenience of expression, I should perhaps guard against any real distinction between the two terms as in his sense.

and fibræmia in systemic weakness, or as fibrous tumours in local weakness. Either through general or local want of tension in molecular combination, the special structural character cannot be impressed on nutritive material, and the parts degenerate from the special towards the general—that is, from the differentiated structure of a particular organ to the simpler fibrous mode common to all parts of the body. What is lost in intensity is, for the most part, gained in extensity, and the loss in quality is gained in quantity.

If the failure in tension be still greater, we descend through transitional forms from rheumatism to pyæmia, and from fibrous to cellular tumours. In gonorrhœa, for example, the contact of matter in the state of cellular degeneration tends to propagate a similar descent in contiguous matter in the blood-vessels and neighbouring tissues. A greater demand is made upon the constructive glands in the vicinity, and their functions and structure thereby modified or disturbed.¹ If the upward processes be active, the degenerative influence produces little effect, and molecular tension is not overcome to any perceptible extent, or to an extent only perceptible in modified function. A brick taken out of a well-compacted wall is lost with indifference; if, however, the wall be less coherent, local dislocations will ensue upon the removal. If, again, the parts hang loosely together, shock or demolition will result throughout its structure. Thus, in still weaker states of the body, that diminished tension of parts caused by the influence of local purulent declension may be propagated indefinitely throughout its constructions. A general tendency to failure will, in such a case, show itself in the rigors of shaken *nervo-muscular equilibrium*, in the rapid pulse of shaken nutritive equilibrium, and in structural changes passing through half-rheumatic and half-pyæmic phases, down to the dissolution of all the higher states of molecular tension, in the liquid blood and cellular degradation of rapid pyæmia. The infinite multiplication of the lower forms which replace the higher is exactly parallel to that phenomenon as observed in the epidemic degenerations of animal and vegetable forms.²

How in local failure of structural tension, with diminution of resulting energy, the more special structures degenerate into the less special, sinking cadence by cadence through the infinite series of fibrous, fibro-cellular, amorpho-cellular, and amorphous degenerations, has been so ably shown by Dr. Wilks, that I need but allude to his labours.

If the reason of disease be such as I have endeavoured to set forth, should we not have bestirred ourselves to clear out of our minds and

¹ This secondary disease of the glands in all parts of the body is a study of much interest. I hope during the next year or two to investigate it more thoroughly, "*ne et oleum et opera philosophiæ nostræ perierit.*"

² Whether the so-called "*parasitic*" forms which accompany the degradation of superior forms, are modifications of pre-existing structural elements, as are pus-cells, or whether the originating germs be introduced from without, is of secondary importance in this inquiry. In either case there must be a parallelism of structural processes between the parasites and the decaying constructions from which they take their existence. Dermatologists are agreed that whatever be the source of the originating germs of favus and like forms, they can luxuriate only in failing constitutions, and are to be extirpated by constitutional melioration, just as are the forms of structural degradation in the lung. Thus the essential relation between the development of masses of favus and of masses of tubercle is one of likeness.

out of our books all those forms of expression which connote the foreign nature of morbid growths? Still more, should we not be very wary, in allowing the use of such expressions as "deposits from the blood," and the like? In the absence of proof to the contrary, we are bound to regard all morbid products as modifications of local construction, local degeneration being the starting-point.

A cancerous tumour of the pylorus is no more a deposit from the blood than is the pylorus itself. In one sense both, in another sense neither, are deposits therefrom. Neither could arise without nutritive material, and, on the other hand, neither could arise except as implicated in the development of neighbouring parts. Cancer is formed in an individual as any other tissue is formed, all being alike parts of a certain scheme of evolution, and dependent on the blood only for material of nutriment. Perhaps few regard cancer from any other point of view; but if language is to be believed, still fewer look upon "tubercle" as of similar generation. The development of the body, indeed, depends on circumstance as well as on original natus; nevertheless, some parts of certain organisms tend, in spite of all circumstance, to follow an order of structural arrangement which we call "tubercular," rather than another order, which we call normal. Both are equally natural, but the latter is the more useful. The "blood" no more deposits the one than it deposits the other. Nevertheless, many able writers persist, from habit or conviction, in speaking of the deposition of tubercle as dependent upon the blood, in some special or structural sense. Their words convey an idea of implantation from without, and they talk of finding tubercles as they would talk of finding truffles.

It seems, therefore, worth while to consider more particularly the reason of tubercular generation, taking its generation in the lung as an instance of its modes. Phthisis pulmonalis is a chronic pulmonary disease, as opposed to acute pneumonia; and nearly all chronic thoracic diseases have relations with phthisis. We could not possibly have the two opposite modes of disease—the acute and the degenerative—better contrasted, the former due to external hindrance or violence, the latter to internal weakness. I have preferred the word "degenerative" before the word "chronic," as I consider the distinction of time to be always accidental, and often fallacious. Degenerative disease, the so-called "chronic," is not a mere extenuation of the acute. The one may end in the other; the one may so pass into the other, or be so engaged with it, that demonstration alone cannot show their difference at any given moment; they are, nevertheless, always separable in reason. In the lung, as elsewhere, the acute disease is that which comes of causes from without, such as intropulsions by cold, mechanical injuries, or the sudden action of some poisons; the chronic (or degenerative) disease shows failure, on the other hand, from within; and according to the degree of internal weakness it presents many varieties of degeneration, from a slow development of inferior structural products to swift disorganization. Between acute pneumonia and ulcerative pneumonia, or phthisis, there lies a series of semi-acute, semi-degenerative pneumonias varying in character as the ratio of the external to the internal causes.

In slow phthisis small portions of the lung structure slip imper-

ceptibly into lower stages of organization, giving rise by loss of quality to increase of quantity or mass. Such masses are no longer fibro-cellular, but more or less cellular, passing into the amorphous, and hardening as their moisture evaporates from the lung. The establishment of small points of lesion is followed by a more or less efficient reparative process, which often excites inflammation at corresponding points of the pleura and other neighbouring parts. The permanence of these masses or tubercles, like their origin, depends primarily on the stability of the circumjacent tissue, and they are themselves accidental manifestations. The etiology of phthisis pulmonalis, therefore, lies not in the tubercle, but in the properties of the lung-tissue and in the processes of its construction and degeneration.

If I may again refer to my former use of the words Construction and Degeneration, it will be seen that the former word signifies the elevation of organic matter through higher degrees of intensity and complexity, by the influence of neighbouring matter already possessed of such properties; and that by degeneration I mean the resolution of such neighbouring matter into more extense and simple forms, with conversion of tension into energy.

Let us now conceive an action of some depressing agent upon the whole body. In place of the highest degree of tension we shall get a proportionate relaxation throughout the tissues. The tension between the tissues and the circulating fluids will yield, and will show itself in quickened pulse, defective cell generation, weak and flabby tissues, and local changes in the relation of these to the blood, as seen in wandering congestions, perspirations, fluxes, and the like. Such symptoms are common in states of debility. These results become more manifest in more advanced states of depression. There is imperfect cell-generation, as seen in unhealthy mucous membrane on the tongue, stomach, and bowels; also in the loss of subcutaneous tissue, falling of hair, clubbing of nails, and like signs. As the depressing cause continues, failure of function and structure must penetrate deeper, until some one or more of the vital organs are affected, and death sooner or later ensue.

Such a simple depressing influence ending in death, we see experimentally produced in the case of negroes, monkeys, dromedaries, &c., when transferred from a warm to a colder or less pure atmosphere. Such a form of decay and death, again, results from the action of an exhausting disease like diabetes. It becomes, then, a most interesting question with such conditions to determine which internal organ or organs will first give way. Given a body with no special tendency to disease, and a due molecular tension throughout, which internal organ or organs will first give way on the lessening of such tension by any simple depressing cause?

The remarkable constancy with which degenerative pulmonary disease shows itself after a more or less prolonged action of depressing causes, would lead us to the conclusion that phthisis pulmonalis owed its appearance to no specific vitiation. This form of disease seems rather to be the most direct route taken by general structural failure. In such states, we should avoid speaking of the supervention of phthisis

as the arrival of a new and distinct disease, and should rather speak of reaching phthisis as a particular stage on the way of dissolution. No doubt the lungs may, in certain individuals, be congenitally weak, and so liable, as any organ may happen to be liable, to degeneration, in spite of all circumstances. But it would also seem that in the healthy body, where all organs are of normal validity, the lungs are relatively the weakest in structure. When, therefore, depressing causes, original or accidental, acting upon such a body as a whole, become stronger than is compatible with completion of construction, the part where structure will first give way is probably somewhere in the lung. Clearly, when conditions are adverse, some part of the body must go first, unless all parts are of equal strength, which we believe not to be the case. Disease of such a part would then be common, and we should expect to see a previously healthy body put under exhausting conditions finding its way to disintegration along the line of the failure of such part.

Now no structure in adult man seems more likely to present such weakness than the lung. We see therein a structure at once exceedingly delicate and exceedingly elaborate. Other parts may vie with the pulmonary structures in delicacy, but I think not in delicacy and complexity together. The lung has to strive, not only against the evanescence of delicate elements, but also against the demands of an elaborate organization of such elements. The degeneration of cells in the stomach is not so serious a matter as it would be did this necessity there also exist of reconstructing them after an intricate pattern. Hence the peculiar disadvantage at which the pulmonary structures stand; and hence their early liability to irreparable injury under the action of causes affecting the whole body alike. Of all the bodily organs, the lungs seem in the adult to stand the nearest to the brink of destruction.¹ Seeing, then, that the causes of phthisis are as many as exercise a common influence of depression, we need not look beyond for any specific vitiation in the blood or elsewhere. "*Frustra fit per plura, quod fieri potest per pauciora.*"

I presume, therefore, that as material is abstracted, say in diabetes, or as tension is diminished, say by change of climate, constitutional feebleness, or other causes, so all parts of the body become progressively degenerate, such degeneration being less or more important as it invades less and more important structures; and that such degeneration early becomes breach of continuity in the delicate and complex lung-structure, the activity of progressive ulceration being in an inverse ratio to the reparative power. Such causes, when they act powerfully, will bring on rapid destruction, as in the reported cases of starvation pro-

¹ With advancing years the relative activity of organs among themselves varies, as the functions themselves are modified. Thus in early life it is not the pulmonary structure, but rather that of the constructive glands which seems to go first. That scrofula, which is simply a feebleness of the constructive powers, should commence in the constructive glands at a time when their delicacy of structure and their vascularity is greatest, and the demand upon them the strongest, is probable enough. With advancing years the conditions are changed, the glands are less active, and accordingly less liable to disease. The atrophy of all these glands in old persons is a regular observation in the deadhouse. To this subject I hope to return.

ducing pulmonary gangrene; if they act with less energy, we shall only find a gradual accumulation of larger masses of an inferior product, in place of the less bulky but more highly organized lung-tissue.¹

In like manner we shall find, according to the activity of the causes, degeneration more or less advanced in other organs, such as the heart, the liver, the stomach, or the intestines. All these degenerations belong to that pathological unity, the phthisical process, which is the process of simple structural disintegration of the human body. Of this process, ulceration of the lung is an early and serious manifestation.

Let us proceed a step beyond this point. The line of thought which leads to discovery of the relations which pulmonary degeneration bears to that of other organs, will lead us on to discovery of the relations which the degeneration of certain parts within the lung bears to that of the other parts. That rapid disintegration or gangrene of the lung which results from depressing causes of severe and rapid action, as it is quickly developed, so it owes its initial position in the lung more to the accidents of accession (such as slight passing congestions and the like) than do those slower degenerative processes which, being independent upon passing accident, obey some more uniform law. It is notorious that some uniform condition exists which determines degenerative disease towards the apexes of the lungs. This condition, however, remains undiscovered. I have stated my belief that degenerative disease is early manifested in the lungs because of their more delicate and complex structure. Can we now extend this reasoning to the parts of the lung itself? Let us take the lung in a simple state of its evolution; let us take, for example, the lung of a serpent. In it we find the vascularity and complexity towards the apex, while the base is a mere membranous bag. If we take the lung of a tortoise, we find a like relative distribution of the more and of the less delicate and complex tissues, though the fuller development of the whole organ makes the difference less obvious. As we pursue our investigations upwards we find this distinction less and less manifest as the progressive evolution of pulmonary structure advances; so that in mammalia the distinction between apex and base is no longer evident. But it can scarcely be supposed that a law holding good for so many stages of the ascent is suspended for the remainder; and it is much to be wished that an accomplished microscopist would find leisure to investigate this matter. The result of my own slight observations, and of my inquiries among my friends, carries me only to this point—viz., that it seems true that the lung-structure in man becomes more delicate as it approaches the trachea.² All the analogy, indeed, afforded by the exquisite and continuous gradation of form and colour in nature would prepare us to expect gradation of structure in the lung. This much is certain—that whatever may be true of the lung as a whole, the structure of the lobules is undoubtedly such as I have suggested. The structure of each lobule increases in coarseness

¹ I may perhaps say here that I avoid in general any use of that metaphorical and deluding term "inflammation."

² In my microscopical researches I have had the advantage of friendly aid from the Rev. W. T. Kingsley, of Kilington.

from about the air-tube to the periphery ; the extreme difference in size of the cells being in about the ratio of ten to one. Now when the degenerative tendency is so intense as to invade large parts of the lung from the beginning, as in pyæmia or large superficial burns, there we find disease starting in the finer portions of the lobules and progressing towards the coarser. In such pneumonias we accordingly find many foci of disease separated by more healthy tissue ; and such states we call lobular pneumonias. Such pneumonias are, of course, degenerative, allied to phthisis, and opposed to the acute pneumonia.

In acute pneumonia, we find large portions of the lung uniformly injured by the pressure of congestion, which acts thus uniformly in accordance with the law of gravitation. This disease, therefore, takes the bases of the lung, which generally lie at greater disadvantage ; or under certain circumstances it attacks the backs of the lungs when the congestion happens so to fall. Even at the bases the lung-structure is too delicate to bear a sudden intropulsion, which might have left other organs unharmed.

We seem, then, to have reached this point. Of all structures in the body the lungs are most liable to lesion, as being the most delicate and complex. Such lesion may arise by injury from without, giving rise to acute pneumonias, or by weakness from within, giving rise to degenerative pneumonias. The type of the former is common acute pneumonia of the bases ; the type of the latter is an ulcerative pneumonia of the apexes, known as phthisis pulmonalis. Between these two extreme types lies a series of pneumonias, partaking more of the acute or more of the degenerative character, as congestion or structural weakness is the more efficient cause of their accession. At this point, having arrived at something like a period, I may close the present essay.

I have to thank the Editor of this Review for the opportunity of laying before the profession certain propositions, and their application in the case of diseases of the lung. That I have given in this essay a mere outline of this application, and have altogether declined the discussion of other forms of disease after a like manner, is due to a want of sufficient time and space at my disposal, and in no way to want of will. This, however, is the less to be regretted, as I think we have the necessary facts already among us. On reviewing the number of facts collected during several years past in illustration of my own opinions, I find few that are not in possession of my readers. What is wanted is not so much a wider knowledge of phenomena as a change in the point of sight from which we regard them. As physicians, we are oppressed with an overlying weight of doctrine handed down to us from their worshipers the practitioners of physic of years past.¹ The science of biology being then non-existent, and non-scientific method barely understood, half fanciful and half metaphysical interpretations were the fig-leaves by which their ignorance

¹ Fortunately the study of abstract Physiology is passing out of the hands of those who have to study the applied science. Hitherto this science has flourished as astronomy and meteorology would flourish if left to sailors. Clearly their first classification would be a "pathology" of storms and eclipses.

was concealed. Although their interpretations are now mostly changed, yet much of the nomenclature and of the terminology belonging to them remains. When these are stripped off the truer lines of modern thought will become more evident; diseases will be seen in their real light, no longer as separate entities, but as conditions of existence; biology will swallow up pathology; and partial and fragmentary conceptions will be replaced by unity and consistency.

It will be a happy day for students when they are taught no more to see in the sick man a state made up of several diseases shaken together like bits of glass in a kaleidoscope; and when they are led rather to recognise in health, in disease, and in all the varieties of biological phenomena, but so many modes of being, and so many states of life.

ART. II.

Cases illustrating the Formation of Morbid Growths, Deposits, Tumours, Cysts, &c., in connexion with the Brain and Spinal Cord, and their Investing Membranes. With Observations. By JOHN W. OGLE, M.D. Oxon., F.R.C.P., Assistant-Physician and Lecturer on Medical Pathology, St. George's Hospital. ✓

THE great importance which, for the most part and for various reasons, attaches to the subject of intra-cranial and intra-spinal morbid growths, deposits, &c., would appear to render even every individual instance of such maladies worthy of careful consideration and special remark. Considering the difficulties which not infrequently exist in ascertaining the presence of these diseases, difficulties which increase when we attempt their localization,¹ and which become still more formidable when we essay to discriminate one form of intra-cranial or spinal morbid growth from another, bearing in mind also how very frequently the symptoms accompanying such affections² are symptoms also of other diseased processes, such as hæmorrhage, dropsy, inflammation acute or chronic (whether in direct relationship with, or quite independent of the compression, irritation, &c. of the nervous structures incident to the presence of such growths or deposits), the assemblage and classification of, and the comparison between numbers of such cases cannot fail, I think, to prove a measure not merely affording very considerable interest, but one also productive of no little instruction.

Moreover, apart from the more general question of diagnosis—a question which must be regarded as fundamental and essentially necessary as a basis for everything else in our thoughts touching the nature and cure of diseases—it cannot be gainsaid that very much which recommends itself as most serviceable and most assured in our physiology has been derived to us from the study of phenomena origi-

¹ The determination of which is a point earnestly to be desired, specially as respects the aid which we thereby obtain towards a correct prognosis.

² Modified as they doubtless must be by the exact situation, rate of increase, essential or anatomical character, and general mode of advance, &c., of the morbid production.