so that the positive is brought into contact with the peripheral end, and the negative with the spinal end of the exposed nerve, then pain is produced, but no muscular contraction.

The peripheral termination of motor nerves, as connected with the ultimate muscular fibre, is a most interesting subject of inquiry. Kühne supposes that the neurolemma always joins the sarcolemma, and that the nerve-molecules pass beneath the sarcolemma so as to come into intimate contact with the contractile substance. To these nerve-molecules he has given the name of peripheric nervous nodules.

Dr. Lionel Beale contends that the nerve-fibre is far more extensive than is supposed by Kühne; that it extends into the interstices of the ultimate muscular fibres in the form of a most elaborate network; that the nerves never lose themselves in other tissues, or become continuous with them; that they are brought into close relation with muscular fibre by their nuclei, but never lose their distinctness as special nerve-tissue. And I think he is right.

If, then, we admit the existence of a current of nerve-force, we must also admit that every act of muscular contraction and every perception of sensation involve a given expenditure of nerve-force; a disturbance of electric equilibrium along the whole course of the nerve, and a corresponding movement to restore the equilibrium, an inverse sequence of phenomena being understood; namely, a centrifugal disturbance in the case of muscular motion, a centripetal disturbance in the case of sensation, and in each case an inverse reaction to establish the equilibrium.

Pflüger's experiments have led him to conclude that one and the same irritant applied to a nerve acts more powerfully the further it is applied from a muscle, in the case of a motor nerve, or from the spinal cord in the case of a sensitive nerve. His idea is, that a progressive molecular movement is developed at all points of a nerve; so that the sum of force is greater at the extremity of a nerve, along which an irritation has travelled, than at the point where the irritation was applied.

Whatever the peculiar nature of the nerve-force may be, we know that muscles cannot act singly, but that the cooperation of a group is necessary to perform every movement of the body, whether it be made for locomotion, respiration, deglutition, or any other special motion for which the muscles are intended; and there is great reason to suppose that such consentaneous action results from the functional activity of separate groups of ganglionic cells in the spinal cord (each group being strung together by nerve-fibres like the jars of a Leyden battery) which transmit their influence through the motor nerves. Each group is probably excited to action by a longitudinal nerve-fibre which conducts the mandates of the will to the organ of coordination; and thus the telegraphic nerve-fibres in the anterior columns are relatively few to the number of motor nerves which proceed from the spinal marrow.

Sympathetic Nerves.

The physiological researches of Professor Bernard and others, have led to the conclusion that the sympathetic nerves are motor nerves of blood-vessels—vaso-motor nerves—and that they form a complementary organism, placed by the side of the cerebro-spinal axis, communicating with it, endowed with similar attributes, obedient to the same laws, but exerting their action on different tissues.

In 1851, Professor Bernard showed that a section of the cervical portion of the sympathetic nerve is always followed by a dilatation of the blood-vessels, and an increased afflux of blood in those parts of the head to which the sympathetic nerve is distributed. In 1852, Dr. Brown-Séquard demonstrated the converse; namely, that either direct or reflex excitation of the sympathetic nerve by galvanism is followed by a contraction of the blood-vessels and a diminished afflux of blood. Again, in 1857, he showed the resemblance between the effects of a section of the sympathetic nerve in the neck and a transverse section of a lateral half of the spinal cord. In both cases a paralysis of the vascular nerves, and therefore a paralysis of the blood-vessels, is induced; there is a greater afflux of blood in those vessels to which the divided nerves are distributed; nutrition is increased, and the vital properties of nerves, muscles, and blood-vessels are augmented. Many points of resemblance are also found, on comparing the side of the face where the sympathetic nerve has not been divided with the posterior limb of the uninjured side of the spinal cord. Both receive less blood than usual; in both the temperature is diminished, and the vital properties of both are decreased.

By the doctrine that the blood-vessels and secretory organs are dependent on the influence of the sympathetic nerves, almost all physiological and pathological phenomena which have hitherto been obscure, admit of an explanation. Moreover, some experiments which Professor Wagner has lately made upon the head of an executed criminal, tend to prove that the contraction and dilatation of the pupils are due to the influence of the sympathetic nerves. The head was cut off by the guillotine, the blade of which passed through the sixth cervical vertebra; and, eighteen minutes afterwards, the experiments were commenced. An electro-magnetic current was applied to the divided end of the great sympathetic trunk, first on one side of the neck, and then on the other. The eyelids of the corresponding eye were observed to separate, and the pupil to dilate, until the breadth of the iris did not exceed four-fifths of a line. The experiment was repeated six times in twenty-five minutes, and always with the same result. After the nervous trunks had become insensible, the superior cervical ganglion was laid bare, and similar results were obtained on applying the magneto-electric current to it. (*Zeitschrift für Rationelle Medicin*, 3e serie, bd. 5, Nos. 2 and 3.)

[*To be continued.*]

ON DIPHTHERIA.

By J. West Walker, M.B.Lond., etc., Spilsby.

The study of diphtheria is a subject of the greatest possible interest and importance. It is interesting on account of the comparative novelty of the disease, and of the as yet unsatisfactory state of our knowledge bearing upon its pathology and treatment; and, when we reflect on the terrible mortality with which it is so frequently attended, its importance, I think, can scarcely be overrated. Happily of late this mortality, which occurred more especially during the climax of the epidemic, has considerably diminished; the disease, however, still continues to prevail extensively, keeping the public mind in a state of anxiety and alarm, and justifying, I trust, any one who shall endeavour to contribute, however slightly, towards a better understanding of its true nature.

As might be expected, a visitation so serious has greatly aroused the observant faculty of the profession; and thus facts have been abundantly accumulated and recorded, and speculations the most opposite and conflicting, freely and confidently promulgated. To attempt to generalise somewhat these facts, and reconcile these opinions, is what I propose to myself in the present paper.

By some, by far the greater number of my professional brethren, diphtheria is looked upon as a distinct acute specific disease, having general and local symptoms; and this is the view which justifies our great nosologist Dr. Farr, in giving to it its present name and place in his classification of diseases. By others, again, it is believed to be but a modification of some one of the previously recognised diseases—of common epidemic sore-throat, of

scarlet fever, of croup, etc.; and undoubtedly a considerable amount of evidence can be adduced to show a close relationship, in particular cases, between diphtheria and each one of these several disorders; thus tending to prove that, whatever the true nature of the affection may be, it must have a relation to them all generally, rather than to any one particularly.

The principal characteristic of diphtheria, that from which the disease takes its name, undoubtedly is the peculiar, leather-like pseudomembranous *formation**; and this it is which I propose to consider first. I shall next examine into the general symptoms with which this pathognomonic sign is observed to coexist. Lastly, I shall endeavour to find out what relation or connection, if any, the general and local symptoms have to one another. I shall then, I hope, be able to build up a theory of the disease under consideration.

In speaking of the *physical properties* of the diphtheritic formation, it will be sufficient to consider it as when fully matured; for, owing to the rapidity of its construction and to other circumstances, it is often very difficult to trace it through its stages of development and growth. It will be found to vary greatly in colour, tenacity, consistence, etc., according to site, stage of development, and other modifying influences. In some cases, it presents the appearance of curd or cream; in others, that of white kid or wash-leather; and between these extremes may be observed every gradation of consistence. The *soft* or curdy variety is always greatly infiltrated with various secretions, the subjacent part being in a state of much exudative inflammation. Under the microscope, according to Dr. Jenner, it consists of "pus-corpuscles, other larger and smaller corpuscles, epithelium, and oleoprotein." The *tough* variety may be seen either in isolated distinct patches, or as an uniform layer, forming a complete mould of the subnatant parts; and, when well developed, it has the tenacity of leather. At the centre, its thickest part, it has been known to measure as much as the eighth of an inch, gradually becoming thinner towards the edges. The colour varies from white to yellowish white; or owing to the admixture of blood, to brown or black. When it is about to be thrown off, a process of decomposition takes place, beginning at the edges; and then it is that fœtor is perceived. The microscope, beyond the fibrous characters, reveals chiefly negative properties; it seldom or never discloses vegetable or other growths, such as the *oïdium albicans*, which Dr. Laycock supposed to be the specific cause of the complaint, but which other observers have failed to discover in the true diphtheritic product, though often in discharges of other more harmless diseases affecting chiefly the cavity of the mouth. It is soluble in alkalis; shrivels in acids; out of the body it gradually softens and decomposes. It is never organisable.

Such is a slight sketch of some of the facts which have been observed, bearing chiefly upon the physical properties of this pathognomonic sign. There are, however, other features, of perhaps more importance, which require enumeration. Thus, with regard to its site; it is a singular and important fact that it manifests itself on such parts of the body only as are exposed to the action of the air; hence it follows that it is to be met with anywhere on the skin, and on a limited portion of the mucous membrane, as the lips, gums, cheek, fauces, tonsils, palate, uvula, pharynx, and possibly, though rarely, the uppermost part of the œsophagus; on the interior of the nose, lacrymal canal, larynx, trachea, and bronchial tubes; on the conjunctival membrane of the eye, and lining membrane of the vagina and os uteri. On the subject of this selection of site, Empis, in a valuable essay translated by Dr. Semple for the New Sydenham Society, remarks: "One fact which is rather remarkable in relation to the seat of *diphtherite*, is this: namely, that all the parts which are completely removed from the contact of the air are preserved from the invasion of the disease. Thus we very frequently see the membranous affection occupying the lower part of the throat, and the posterior wall of the pharynx, and spreading gradually to the larynx and the deeper parts of the air-tube; but I have never seen true *diphtherite* propagating itself by continuity into the œsophagus and the parts of the digestive canal, which are withdrawn from the influence of the air;" and he naïvely asks, "May the presence of air, then, exert in these circumstances some influence which escapes our notice?" (*Memoirs on Diphtheria.* New Sydenham Society: p. 311.) That the diphtheritic formation, whether occurring on either of these sites—the tegumentary or the mucous surface—is essentially a like morbid product, is, I believe, generally admitted. The fact, however, is fully established by Trousseau and Daviot, in their respective essays, by reference to numerous cases. The latter author in another of Dr. Semple's translations, says: "There is also a point upon which I ought to insist, in order to prove, if necessary, the perfect identity existing between pillicular inflammation of the mucous membrane and cutaneous *diphtherite*. It is the fact that, during our epidemic, under the influence of the same cause and a similar predisposition, I have seen *diphtherite* raging simultaneously on several members of the same family, attacking in one, the pharyngeal mucous membrane; in another, the cutaneous tissue; in another, the respiratory passages, and lastly, in another, all those organs at once or successively and presenting no other modifications than the symptomatic differences peculiar to each region." (*Memoirs on Diphtheria.* New Sydenham Society: p. 379.)

Another peculiarity of this diphtheritic formation, about which most observers are agreed, notwithstanding the remark of Daviot to the contrary, is, that in order for its appearance on the *skin*, the epidermis must at least be removed. It may then be seen complicating and interfering with the proper healing of slight abrasions, ecchymoses, leech-bites, blistered surfaces, herpetic and other eruptions, cuts, wounds, burns, etc. So also, in order for its appearance on the *mucous membrane*, I think it will always be found that the site chosen is a part, which at the time is congested, ecchymosed, inflamed, ulcerated, or undergoing some pathological process.

It is, however, from its great proneness to spread especially in a downward direction, either by extension of an individual patch, or by coalescence of patches having distinct centres of origin, and thus, as in the larynx, affording mechanical obstruction to the performance of a vital function, that probably the greatest importance is to be attached to the presence of this singular morbid product.

Let us now glance at the constitutional symptoms with which this leather-like pathognomonic sign is associated. The first thing which strikes us is their great variety in kind, and their still greater diversity in severity and importance. In some cases, especially in the many instances of *cutaneous* diphtheria, constitutional symptoms may be considered as almost or altogether wanting; the general health may, I grant, perhaps be somewhat deranged; but we are quite unable to trace the slightest connection between such derangement and the purely accidental formation of the diphtheritic product. The same, too, holds good when the formation presents itself in the cavity of the *mouth*, on the lips, gums, lining membrane of the cheek, etc. It may then almost always be observed that, whenever general symptoms are present, they denote such a derangement of the system as occurs in

* I employ the word *formation* here and in other parts of this paper, not because I particularly like it, or think it conveys a very correct idea of the thing signified, but because I consider it less objectionable than *exudation*. I use the term somewhat after the geologic sense, as expressing merely a something formed, without implying anything as to the how or whence formed. Exudation, I believe, expresses but one of the factors necessary for the construction of this singular morbid product.

cancer, stomatitis, and other allied affections. The patient may show signs of disordered nutrition, vitiated secretion, unhealthy digestion, general debility, etc.; but nothing which can in any way be considered as having any specific relation to the diphtheritic formation. It is, however, in the *throat* that the characteristic pseudo-membrane is most frequently to be seen; so much so, that by those who advocate the doctrine of diphtheria being a distinct specific disease, this region of the body is considered to be the especial site of the local symptom. When, however, we look to facts, we find the diphtheritic formation, even here, to be associated with the greatest possible variety of general symptoms. The throat with regard to its pathology is a peculiar region; being, as it were, an inner portal between the external world and the interior of the economy; it has to receive the impression of all atmospheric changes or impurities. In this climate of ours, many habitually suffer from throat ailments, enlarged tonsils, ulceration, or that form of chronic inflammation termed relaxed throat; and with such ailments the diphtheritic formation frequently coexists, general symptoms being almost or altogether absent. We find, too, that a more or less sore throat, in other words, a pathological change going on in the mucous membrane of the throat, is the constant concomitant of all the acute specific diseases. Not unfrequently the diphtheritic formation makes its appearance in the latter stage of phthisis and other chronic disorders. These exhausting general diseases are numerous, and differ greatly in specific characters; and yet diphtheria, in ordinary language, is said to be connected with them all, thus making it self-evident that it can have no especial relation to any one. In such cases, we are compelled to admit either that diphtheria is a constitutional disease which can coexist in the same body, and at the same time, not only with one but with a great variety of general diseases; or that the particular manifestation is but a local complication, which at certain seasons affects and fixes upon parts of the body undergoing disease.

Owing to the possession of certain positive characteristics, several diseases of the fever class now admit of accurate and close definition, thus rendering their recognition comparatively easy and sure. Between these well-defined diseases and the condition of uninterrupted health, there exists, I believe, an important series of general diseases belonging probably to the same class, but which, owing to the possession of only negative properties, are not capable of such accurate definition or classification. All we know is, that the balance of the economy is disturbed; that general fever exists; and when, as is not unfrequently the case, local complications coexist, we give names and direct attention to such local complications rather than to the specific blood-disease with which they may happen to be associated. When epidemic, as such diseases almost always are, we speak of them as the "reigning illness," epidemic catarrh, influenza; or, as when accompanied with sore-throat, epidemic sore-throat, etc. Now and then, herpetic eruptions appear in the course of such complaints, always producing improvement in the general symptoms; and thus manifesting a close relationship to the exanthemata. Not unfrequently, pneumonia or other inflammation attends these deranged states of system, when the coexisting inflammation becomes all important, and its origin in a disease of the general system is generally overlooked and misinterpreted; and (to digress a moment) in this fact may, as I believe, be found the reconciliation between the various opinions existing as to the right mode of treating this terrible disease. When it is idiopathic, occurring as a very rare affection in otherwise healthy subjects, possibly the heroic remedies so much extolled by practitioners of the last generation may answer best; while for the blood-disease, running as it does its appointed course, it is marvellous to what extent the local inflammation may be neglected, and the somewhat expectant plan of Dr. Hughes Bennett, or the more decidedly stimulating plan of the late Dr. Todd, be resorted to. These several blood-diseases may either one and all be the effect of a single cause, manifesting itself in a diversity of ways owing to modifying influences; or of a variety of causes closely related or possibly correlated to one another. Be this as it may, should such diseases at any time appear with well-marked epidemic prevalence, virulently typhoid characteristics, malignant consequences, and having throat-ailments as the particular local complication, we have all the circumstances which obtain with regard to general symptoms in the most well-marked cases of diphtheria. Again, should such general symptoms be found to occur only in connection with the diphtheritic formation, or, on the other hand, it only with them, we might be justified in looking upon them as component parts of one specific disease. Unfortunately, however, both these premises are found to be faulty, the latter especially so; for, even when in the throat, we find this remarkable formation coexisting with the general symptoms, not only of all the acute specific diseases—scarlet fever, measles, small-pox, erysipelas, ague, etc.,—but with every possible derangement of the general health.

If the *faucial* region is the most common site for the diphtheritic formation, the *laryngeal* is by far the most dangerous and important; and here it is that we observe such general symptoms as attend cases of croup; which may be primary and uncomplicated when the disease commences in the respiratory tube, or secondary and complicated when it is simply an extension of mischief from above, the croupal symptoms being then mixed up with those of the primary disease under which the patient at the time laboured. Diphtheritic measles is particularly liable to be attended with croupal symptoms.

Now comes the question: What connection is there between the local pathognomonic sign and the general symptoms? We have seen the latter to be most varied in every particular, the former to be *sui generis* with regard to physical properties, and possessed of certain pathological peculiarities. But, more than this, we are quite unable to establish any concordance between the amount of the local complication (except in croupal cases) and the severity of the case; frequently the danger is but slight, and the *formation* very abundant; and, on the other hand, the *formation* may be very scanty, and the danger most imminent. This latter state of things particularly prevailed in the Brighton epidemic; so much so, that Dr. Ormerod, who contributed an account of it to the *Lancet*, somewhat complains that the name diphtheria inadequately conveys a correct idea of the nature of the complaint. Again, there is no order of time or sequence as to the appearance of the local symptom as is the case with the exanthemata. Often, the characteristic formation is abundant before the development of general symptoms; and often again it appears at the climax or during the latter stages of some general complaint. When, then, we consider these facts, coupled with the pathological peculiarities of the pathognomonic formation before enumerated—its presence on parts only which are exposed to the action of the air, and requiring such parts to be undergoing morbid changes; its frequent appearance in the same subject, not only with like but often with vastly different general symptoms—we have an accumulation of evidence pointing to the conclusion that there is no especial relationship between the characteristic local symptom and any one particular state of the general system, but that the diphtheritic formation is merely a local and external complication which, as it were, engrafts itself on many diseases generally.

If these suppositions be correct, the true *nature* of diphtheria must be very different from that hitherto received. We can no longer consider it to be an acute specific disease, having uniform general and local symp-

toms. The leather-like formation, hitherto held to be the diagnostic sign, at once loses its significance, if it have to be viewed only in the light of a complication of nearly every ill that flesh is heir to; manifesting itself, it is true, only at certain seasons, such seasons being noted for the extensive prevalence of zymotic diseases generally. To show that the season of the present diphtheritic epidemic is so noted, I quote the following from Mr. J. N. Radcliffe's paper in the *Lancet*: He says, "If we examine the mortality returns for the thirteen years 1847 to 1859, we find that *scarlet fever* underwent a prodigious increase in 1858, and prevailed in that year to a greater extent than in any previous year of the thirteen; annual average deaths 17·411, in 1858 30·117. The mortality from *croup* advanced year by year from 1854; the disease being epidemic in 1857-58-59; the epidemic culminating in 1858. The mortality from this disease was also prodigiously above the average of preceding years, increasing from 3,660 in 1853, to 6,220 in 1858. The mortality from *thrush* was also greatly increased in 1858-59. The mortality from *quinsy* was increased in 1857-58; in the latter year attaining a higher point than in any previous year. The mortality from *noma* underwent a remarkable change in 1855-56-57-58-59; the acme being in 57. Finally, the mortality from *laryngitis* underwent a steady development from 762 in 1847 to 1439 in 1858. In fact, it is not too much to say," he goes on, "that all the affections allied to diphtheria prevailed epidemically, cotemporaneously with the epidemic of diphtheria." In other words, all and every state or condition of the general system with which the diphtheritic formation is known to be associated, prevailed epidemically, cotemporaneously with the present epidemic of diphtheria. Let me not be misunderstood. I dare not and do not deny that, during a diphtheritic epidemic, a distinct, and, to a certain extent, new zymotic disease may possibly exist, to which the name diphtheria may, though rather inaptly, be applied; all I maintain is, that if such a disease do exist, we have no positive symptom by which to recognise it; and that, as far as its general symptoms go, they only represent a condition of blood-poison analogous to, though possibly increased in severity over, diseases already known—presenting differences of degree more than of kind; and that the so-called local pathognomonic formation associated, as it is found to be, with an endless variety of general symptoms, can no longer be employed as a diagnostic sign.

But, it may be asked, are not swollen glands, albuminous urine, and the numberless varieties of nerve-derangement, symptoms sufficient to show diphtheria to be altogether distinct and different from other general diseases? In Dr. Jenner's book (p. 7), there is a foot-note which, in my humble opinion, sets glandular enlargements as a symptom of diphtheria in a proper light. He says: "Trousseau attaches much diagnostic value to the enlargement of the lymphatic glands of the neck in diphtheria. I cannot agree with him on this point. The enlargement of the glands has been, in the cases of diphtheria which I have seen, in proportion to the severity and depth of the local, nasal, pharyngeal, laryngeal, and tracheal disease. I have never seen it greater in proportion to the local primary mischief than in other forms of cynanche pharyngea. In children, generally, the swelling of the glands, other things being equal, is greater than it is in adults; and in strumous children the enlargement is always greater, other things being equal, than it is in ricketty or healthy children." Albuminuria occurring in diphtheritic cases is certainly a symptom of grave import; and great credit is due to Dr. Willoughby Wade, of Birmingham, for being the first to direct attention to it. Its presence may perhaps assist us in forming our prognosis; but for diagnostic purposes it avails absolutely nought. In well-marked cases of acknowledged diphtheria, it is as often absent as present; it is absent often in cases the most severe, and present in cases comparatively mild. In short, it can only be looked upon, as Dr. Headlam Greenhow has it, as an occasional concomitant of the complaint. Of all the symptoms indicative of diphtheria being a distinct general disease, the various manifestations of nerve-derangement undoubtedly claim the first place. Analogous conditions have from time to time been observed in connection with other general diseases; though, I must confess, with scarcely the same regularity and frequency. Unfortunately these symptoms, when present, appear too late to be of any diagnostic value. They occur mostly as sequelæ; and, although they may perhaps indicate the previous disease to be somewhat new in its nature, for practical purposes they become comparatively useless. But if, for the sake of argument, we allow the three symptoms just mentioned to be sufficient to indicate a specific general disease, we ought at least to find them to be constantly associated in the same individual case, a condition of things by no means corroborated by clinical experience; otherwise, these three several symptoms might just as well be held forth as indicative of three several states of system, and thus be made to support the theory of diphtheria being made up of a variety of diseases.

If, then, a variety of general diseases, alike only in having the common diphtheritic complication are any longer to be considered as one distinct disease to be called diphtheria, the sooner for all practical purposes the name is done away with the better, for it cannot but mislead. It conveys not the slightest notion of the true nature of the affection (or affections); and it renders utterly nugatory all attempts to reduce either diagnosis, prognosis, the question of contagion, or the method of treatment, to a scientific basis. Far better would it be to employ the word to all and every case generally, no matter what the general symptoms may be, wherein the pathognomonic sign presents itself, only reducing it to the rank of a qualifying adjective. We should then speak of cases as diphtheritic, whatever the general symptoms showed the patient to be at the time labouring under. We should be induced to study more closely such coexisting malady, and, not being led away by a name, be more likely to form a correct idea of any particular case.

The *theory* of the nature of diphtheria to be induced from the foregoing facts and observations may be briefly stated in the following conclusions, viz.:—

1. The characteristic formation is but an external complication, and has no specific relation to any particular state of system.

2. The general symptoms with which this formation is found to be associated are most various; ranging from the most trifling *malaise* to the most virulent septicæmia, and extending through the whole class of acute specific diseases.

3. Possibly, during the prevalence of a diphtheritic epidemic, there may be a distinct general disease, altogether different from other known diseases; but we have no positive evidence on the subject.

4. Diphtheria, in the sense in which the word has hitherto been employed, is to be looked upon not as one disease, but rather as many diseases alike only in being associated with the common characteristic formation.

Believing as I do, the theory of the nature of the disease under consideration embodied in the above conclusions to be essentially correct, I purpose in a further communication to point out how many of the discrepancies which have hitherto prevailed on the subject are, by it, readily removed and explained away. In short, I hope to establish its truth somewhat deductively; and to show—

That the difficulties which have beset bibliographers in collecting the ancient history of the disease are in a very great degree removed;

That the various questions arising on the subjects of diagnosis, prognosis, etiology, and contagion, admit of more satisfactory solution; and

That treatment having more reliable indications becomes less empirical, more rational, and more successful.

SOME ACCOUNT OF THE OPERATIONS PRACTISED IN THE NINETEENTH CENTURY FOR THE RELIEF OF TENSION OF THE EYEBALL, GLAUCOMA, ETC.

By J. Vose Solomon, F.R.C.S., Surgeon to the Birmingham and Midland Eye Hospital.

[*Read before the Midland Medical Society, February 3rd*, 1863.]

[*Continued from page* 452.]

The statistics of iridectomy operations are sufficiently favourable as to results on vision in acute *primary* attacks of glaucoma, but in the other class (subacute and chronic) are most unsatisfactory and discouraging. None have been published in England since Dr. Bader's valuable and very candid report appeared in the *Ophthalmic Hospital Reports*.

If, however, the profession should agree to consider, with Bowman, *all* excess of tension as glaucomatous tension, and apply for its relief iridectomy, the statistics will then bear the light of day, and criticisms from hostile schools of ophthalmology. Such a recourse to Von Gräfe's operation, I consider, would be most unjustifiable, because there are other surgical measures unattended by danger, and which do not entail a permanent deformity, that are fully competent to insure all the advantages which arise from the restoration of the intraocular tension to its healthy standard.

It has been asserted by Dr. von Gräfe and some of his followers in this country, that the removal of the glaucomatous state by iridectomy from one eye has no effect (practically) on its fellow. As a general rule, this is correct; but I have occasionally met with instances wherein the relief of the disease in the more seriously compromised organ has been followed by a spontaneous subsidence of the tension in the opposite eye.

An iridectomy sometimes gives rise to confusion of vision from the rays of light which pass through the zonula and margin of the lens, causing "circles of dissipation" on the retina. I propose to remedy this very serious optical inconvenience, when occurring among the labouring poor, by covering the coloboma with an artificial pterygium derived from the sclerotic conjunctiva; this proceeding has a great advantage over a perforated black diaphragm set in a spectacle-frame (a contrivance which one of my iridectomy patients has worn seven years), because it permits of lateral vision. Where the conjunctiva is much atrophied, my plan is inadmissible, and hence has not been applied in the case to which I have referred.

When estimating the value of other methods of treatment, the English section of the Berlin school appear to have forgotten that Von Gräfe has modestly said of his great discovery, "The theory is as yet infinitely darker than the empirical facts". (*Memoirs*, New Sydenham Society's edition, page 357.) They have also failed to remember that, in urging upon the profession the adoption of iridectomy, their appeal has been solely to "empirical facts", and in no wise to any physiological principle which has been made out with distinctness and certainty in the course of the inquiry. They have also overlooked the fact that, with the exception of a few cases of acute glaucoma, the profession have not been placed in possession of full details of the large majority of cases of glaucoma which have been treated by iridectomy. I submit they are not, therefore, in a position to demand of the innovators of iridectomy that which they themselves have hitherto withheld.

Few if any operations on the iris are more easy of performance, or less dangerous, than iridectomy, where the dimensions of the anterior chamber, the texture of the iris, the attachment of the zonula to the lens, and the tissue of the choroid, are normal. Unhappily, acute glaucoma not unfrequently attacks eyes which have been for years undergoing a slow disorganising process. In such instances, grievous accidents commonly attend on iridectomy, let the operator be ever so skilful and experienced.

The operation, in the hands of able surgeons, has been followed by one or more of the following accidents: opacity of the lens; loss of vitreous humour; hæmorrhage from the ciliary processes; escape of the lens some days after the operation; closure of the pupil; ophthalmitis; and even by sloughing of the cornea.

Whatever may be the ultimate position assigned to iridectomy as a curative agent in glaucoma, there can be no doubt that the publication of von Gräfe's *Memoirs on Iridectomy* by the New Sydenham Society has produced a most beneficial influence on the English school of ophthalmology, by causing greater exactness to be observed in the investigation of diseased processes and the effects of surgical treatment.

Several theories have been suggested to explain the relief of glaucoma by iridectomy. In Dr. von Gräfe's *Memoirs*, we find relaxation of the ciliary muscle, diminution of the secretory surface of the iris, a more perfect exosmosis through the cornea, put forth as in some measure explaining the diminished tension. I shall be forgiven if I remind the Society that, so far back as the spring of 1860, I orally enunciated my belief that the division of the ciliary nerves, at the point where they pass from the ciliary muscle into the iris, formed an important element in the operation; that thereby a more healthy action was induced in the ciliary ganglion, which, as proved by the experiments of Dr. Radclyffe Hall, presides over the organic function of the eye. Through the kindness of Mr. Square of Plymouth, my theory was embodied in the valuable practical address in Ophthalmic Surgery, delivered by him before the meeting of the British Medical Association at Torquay, in August 1860, and which was published in the Journal of the same year. Since that time I have been gratified by observing that the tendency of opinion among scientific surgeons has been in the direction which I was the first to indicate; viz., that the nerves of the ciliary vessels play an important part in the *rôle* of symptoms which constitute glaucoma, as described by the new school of ophthalmology.

I have been led to attribute considerable importance to *section of the ciliary nerves at the point where they pass from the muscle of the lens into the iris*—

1. From having observed the subsidence of non-inflammatory glaucoma after an intraocular myotomy* which was attended with so little discharge of aqueous humour as to occasion a doubt whether any had escaped. There was no loss of vitreous in these cases.

2. From the superior results obtained in glaucoma cases treated by iridectomy where the iris has been cut close to its origin, as compared with those in which such precaution was not taken; also from the superior results of intraocular myotomy, as compared with division of the ciliary structures at a right angle with the cornea, and with paracentesis of the cornea.

3. The phenomena of some forms of glaucoma are only explicable on the supposition that they are due to a non-inflammatory irritation of the vessels; *e.g.*, the transitory nature of the obscurations, the sudden and

* Intraocular myotomy is performed by making an incision, with a cataract-knife, on a line parallel with one of the equators of the eye, through the corneo-sclerotic union, pillars of the iris, and ciliary muscle.