THE GOULSTONIAN LECTURES ON INSANITY IN RELATION TO CARDIAC AND AORTIC DISEASE AND PHTHISIS.

Delivered before the Royal College of Physicians of London.

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LECTURE I.

WHEN deeply but unexpectedly honoured by the invitation to deliver the Goulstonian Lectures at the Royal College of Physicians, and the choice of a subject became necessary, my mind turned, in the first place, to the therapeutics of insanity. Ascertaining, through the courtesy of Sir H. Pitman, that it was neither usual nor deemed to be desirable that therapeutics should occupy the Goulstonian lecturer, I next turned to the pathology of insanity. Having recently written on the pathology of general paralysis, the most interesting, and a very frequent form of mental disease, I could not well deal with the pathology of insanity, except in its general aspects. This course seemed to be undesirable, unless in conjunction with the exposition of a new and more scientific classification of insanity, an ambitious task to which I did not feel adequate, and for the successful accomplishment of which, indeed, the time is not yet ripe. Therefore the subject selected was one of more common medical interest. In general terms, these lectures constitute an attempt to assist, however slightly, in the work of bridging over the chasm which unhappily has separated, more than is necessary, the study of mental disease from that of the general body of medical science, and the treatment of insanity from that of other forms of disease; and, in particular terms, they constitute an attempt to clear up the existing obscurity on some important relations of mental disease, to more accurately and definitely subdivide and arrange the phenomena concerned, and in accordance with the teaching of my clinical and pathological studies.

In the relations of insanity to visceral affections one is dealing with a subject which should interest other medical men as much as mental specialists; a subject which lies in the "border-land," which blends mental with general medicine, which at least, in some of its phases, may be equally studied by the family or consulting practitioner, and by the one engaged in the care of the insane, which, in other of its phases, can scarcely be studied adequately by either alone.

Intending to deal in a general way with the subject of visceral affections in the insane, I analysed the clinical and necroscopic records relating to all the viscera in nearly 250 cases, constituting slightly more than half of my necropsies at disposal, but found that persistence in that intention and work would reduce these lectures to a dry statistical record; and, in the event, it was found impossible to do more than deal—and even that inadequately—with some of the forms of heart disease, aortic disease, and pulmonary phthisis, in certain of their relations to insanity. Yet, over those of most others, my cases possess the advantage that the clinical and pathological material come from the very same cases, the clinical phenomena being noted and the necropsies made by the same observer.

General considerations as to visceral affections producing or modifying insanity.

Our emotions are closely bound up with our systemic conditions, and there was some degree of truth in Bichat's¹ notion that in the organic processes are located the emotions and passions; but upon this general aspect of the subject—upon the broad question of visceral states affecting mental—I need not dilate, and the less so as it has been eloquently set forth by Dr. Maudsley² in his Goulstonian lectures some years ago. His argument I need not reproduce; but let me, at a stroke, place the matter before you by

a citation or two. "The internal organs are plainly not the agents of their special functions only, but by reason of the intimate consent or sympathy of functions, they are essential constituents of our mental life." Again, "mind.....sums up and comprehends the bodily life." Now, if this be so, "the question arises whether each of the internal organs has not also a special effect, giving rise to particular feelings with their sympathetic ideas." Comparatively slender has been the clinical and pathological evidence hitherto brought forward in support of that thesis, and for decision of the questions involved. To add to that evidence will be one of the endeavours in what I subsequently place before you.

INSANITY IN RELATION TO DISEASE OF THE HEART AND AORTA: THE CEREBRAL CIRCULATION.

Before turning to the special groups of cases, let us glance at some general aspects of the subject.

That so little is known of the influence of heart affections on insanity or its production, so little of the influence of insanity upon the heart, so little, in a word, of the play of mutual action and reaction between the heart and the cerebral (psychic) processes and their results, is surprising when we consider how easily and obviously the heart is affected by every emotion, and how dissimilar upon the heart and circulation are the effects of each.

Moreover, in reference to some of the factors yet to be named—the factors of insanity in heart disease—it has been denied that any marked changes of repletion or depletion can take place in the state of the cerebral circulation; it has been denied that active hyperæmia or anæmia of the brain can occur; or that, if it occurs, congestion of the brain can produce any decided cerebral symptom, or even any noteworthy influence on the tone or activity of the mental operations. Thus we know how vigorously the theory of cerebral congestion as the alleged basis of several forms of brain symptoms was attacked by the late Dr. Moxon³ in his Croonian lectures before this College, and how he attempted to show that the symptoms, so-called, of cerebral congestion came neither from visibly forcible arterial action, nor from visibly great venous congestion of the vessels of the head.

Obviously, with questions at once springing up as to the relation of cardiac disease to the nutrition of the brain, through the cerebral circulation, it will save much repetition and reference, later on, if at the very outset the salient conditions of the intracranial circulation are brought under view.

In proceeding to examine the conditions of the intra-cranial circulation, one meets the gravest discrepancies as to the most elementary facts. For example, while Haller⁴ alleged that one-fifth of the whole mass of blood in healthy man constitutes the supply to the encephalon, and while Spehl⁵ found in the rabbit in the waking state one-eighth to be the amount of blood contained in the head at a given moment relatively to the total bulk of blood in the system, yet we find it stated in Foster's *Physiology*⁶ that in the rabbit only about one per cent. of the total blood is at any one time in the brain, and that the blood supply to the human brain must be small. Making some allowance for the difference between the amount of blood in the rabbit's head at a given moment, and that in its brain only, there is still an enormous discrepancy between the estimate of 1 per cent. in the rabbit's brain, and the estimate of 12½ per cent. in its head, which latter share indeed, for the rabbit, does not offer any incongruity with the Hallerian estimate of one-fifth of the total blood as the supply for the relatively more developed, more preponderant, and more active human encephalon.

Leaving this subject of the share of the total blood contained in the cranium, we pass to the question whether, so long as the brain remains the same in size, the amount of blood within the cranium is, or is not, a fixed and definite quantity, an invariable amount. That, under all circumstances, it is an unchanging amount appeared to be evident from the theoretical considerations that the skull is a closed cavity, a complete sphere, the total bulk of whose contents, removed from the more usual conditions as to atmospheric pressure, must at all times be the same, and loss of the fluid portion of these be prevented, and therefore that, so long as the brain is neither shrunken, nor compressed, nor enlarged, the amount of intra-cranial blood must remain the same. Experiments by Kellie appeared to give reinforcement to this view, experiments widely accepted, and of which the reported

¹ Cited by Dr. M. Fothergill, *Jour. Mental Sci.*, October, 1874, p. 395.

² *Body and Mind*. By Henry Maudsley, M.D.

³ *Lancet*, April 16th, 1887, p. 689.

⁴ Dr. W. B. Carpenter's *Physiology*, p. 529.

⁵ *L'Encephale*, January, 1887.

⁶ *A Text Book of Physiology*, 4th edition, 1883, p. 645.

results were that, on bleeding animals to death (their skull intact), the usual amount of blood was found, *post mortem*, in the cranium, and in strong contrast with the exsanguine state of the rest of the frame.

It is unnecessary here to refer in detail to the numerous experiments and observations which, since then, have clearly shown that physiological changes occur in the brain circulation, and that the amount of blood in the visible parts of its meninges, or making exit from its sinuses, varies constantly, and in a very considerable measure; of these observations I need only mention that on the vastly different states of the circulation of the brain, and the amount of its arterial supply, in the waking as compared with the sleeping state.

But still the skull has remained to some extent a closed cavity, and there still existed a necessity for an unchanging amount of its total contents, and still has there been a disinclination to admit the existence of quantitative pathological changes in the circulation, that is to say, of amounts of blood not within the limits of physiological fluctuation, but springing wide therefrom on the line either of deficiency or of excess.

In this relation much has been made of the peculiarities of the intra-cranial circulation, and of the provisions for placing checks on excess, or grave deficiency, in the amount of blood supplied to the brain; and much has been made, also, of any great change in the blood-pressure on the walls of its vessels, and of the impossibility of any change whatever in these, except through the medium of the blood-vessels entering or leaving the skull, or through the medium of the cerebro-spinal fluid. These same checks, also, are concerned in the mechanism preventive of ill result from alteration in the pressure in the brain, whether from changes in atmospheric pressure, or in posture of the body, or in the force and activity of the blood circulation. So, also, are they intimately connected with the structural arrangements whereby the erect posture of man is made possible, and whereby the blood supply is kept up, and kept up so richly, too, at the lofty elevation of the brain.

The checks on over-active entrance of blood to the cranium, and on too great a blood-pressure in the vessels of the brain, are, chiefly, that the cardio-inhibitory centre in the medulla oblongata is stimulated, that the heart in this way is slowed, and thus the incoming overflow of blood is automatically stayed, and the balance of local circulation maintained. Moreover, that an increased supply of blood is stimulating to the brain is shown by experiments, for example, those of Lépine,⁷ in which stimulation of the anterior part of the cerebrum (of dogs) influences the heart-beats, and in so doing operates through the vagus, for on dividing one vagus no change followed stimulation of the opposite side of the brain, whereas stimulation of the same side of it lessened the frequency of heart and pulse. And, as Dr. Moxon pointed out, in man there is a supplemental contrivance whereby, when blood is streaming too freely, and under too severe pressure, into the brain, the finger-like vascular process, the cornu of the choroid plexus of the fourth ventricle, composed of thick tufts of blood-vessels, lodged in the lateral offset of the ventricle, and swollen by the incoming tide of blood, promptly presses on the adjoining and tense nerve-roots of the vagus, retarding the action of the heart, and thus shutting off the overplus of blood which would otherwise continue to arrive within the cranium. That these plexuses are so promptly swollen by the extra inrush of blood is due to the fact that they receive their arteries directly from the great vessels immediately the latter enter the skull; hence they swell up, and promptly press on the pneumogastric nerve roots.

Another way in which a check is placed upon too great an influx of blood is connected with the fact that a change of pressure in or on the brain is necessitated by every change in the intra-cranial circulation. When, in active states of molecular movement and function on the part of the brain, there is more rapid blood-movement and increased intra-capillary pressure, the swelling of the brain in volume is checked, not merely by the unyielding walls of the cranial vault, but also by compression of the pial veins. Associated, as shown by Dr. Cappie⁸ with increased tension in the brain itself, with increased tension to which all the cranial contents are subjected, this compression of the veins places a brake on the over-activity of circulation, and tends to bring it to a stop. Placed between the onward driving forces of the heart, arteries, and capillaries, on the one hand; and, on the other, the locking or backward driving force of atmospheric pressure on the

blood in the sinuses, and thence on their tributary veins; and subjected with every expansion of the brain to pressure on the side of their walls, lessening and tending to obliterate their lumen, the veins of the brain meninges occupy a position exposed to stress. If the forces on one side sink, those on the other rise; for example (taking an illustration converse of the preceding) if influx of blood fails, the forces preventing efflux are enhanced, and of these the chief has now become the atmospheric pressure, the suction action of the sinking brain on the blood in veins and sinuses tending to fill them, and thus to bring about a venous fulness compressive of the brain surface.

By experiment, Grashey⁹ also showed that, under certain circumstances, an increase of the arterial blood-pressure retards the circulation in the skull; that, inasmuch as the blood-pressure in the brain-capillaries is greater than in the large cerebral veins, with increase of the brain pressure comes compression of the large cerebral veins rather than of the capillaries, as also a choking and retardation of the blood stream. Another provision for relief of disorder of the cerebral blood movement is the so-called "derivative" circulation of the head, a side channel, so to speak, whereby some relief is afforded when the intra-cranial circulation is embarrassed and sore pressed.

On the other hand, the automatic mechanisms for checking the exit of blood from the brain are chiefly the arrangement of the cerebral and meningeal veins, which never accompany their arteries, ascend against the force of gravitation to the summit of the brain, pass forward, many of them, and enter the superior longitudinal sinus against the backward flowing stream, this opposition of currents in the sinuses and in the veins tending strongly to retard the venous flow, and make the venous side of the intra-cranial circulation leisurely, or even stagnant; and, in fact, the blood appears to issue from the sinuses only under pressure in the veins; while, if in active and strong states of the circulation the lock becomes too stringent here, relief is afforded by escape of blood through the inferior longitudinal and straight sinuses at the base of the brain, and out of the way of the lock just mentioned (Moxon). Of atmospheric pressure we have already spoken.

Moreover, the choroid plexuses soak up, as it were, and account for, much of the incoming blood for the time, thus assisting in another way in giving easement. And in doing this they displace portions of the cerebro-spinal fluid, forcing it down from the ventricles of the brain to the subarachnoid space of the spinal cord; this upward and downward flow of the cerebro-spinal fluid, according to some, playing an important part in making changes possible in the blood supply to the brain. For a discussion of the automatic checks on great changes of the intra-cranial circulation involves a consideration of the mechanisms whereby variation of the blood-supply is permitted in health. Some hold that this is chiefly effected by the upward and downward play of the cerebro-spinal fluid, and by the changes of high and low tide in the lymph channels and lymph spaces of the brain, especially those that are subadventitial and those that are perivascular. When the brain is active, when the incoming tide of blood attracted to it swells it up and it expands, the hypothesis has been that room is made for the dilating vessels and for the larger amount of arterial blood they contain (and contain under increased pressure, perhaps), by the absorption of the lymph circulating in the finer passages, and pericellular, perivascular, and subadventitial lymph spaces, in proportion as the blood-vessels bathed in it dilate; and that the choroid plexuses press the cerebro-spinal fluid out of the ventricular spaces of the brain into the subarachnoid of the cord.

Nevertheless, it is not altogether clear to my mind why the spinal cord should be deemed to be prepared to receive without embarrassment or disorder two or three or more ounces of cerebro-spinal fluid over and above the usual quantity, and at a moment's notice, on the behest of the brain; those who tell us all about the backward and forward flow of the cerebro-spinal fluid have not provided for this exigency, or explained how the spinal cord adapts itself, without more ado, to the altered circumstances; they have not pointed to any mechanism in the cord whereby, in a moment, it may rid itself of the inundation. Perhaps the large and soft-walled veins of the meninges of the cord and of the bodies of the vertebrae easily permit outflow of blood under the pressure of cerebro-spinal fluid; or it may be that when the brain circulation is extremely active, that of the cord is less so; for when the amount of blood sent to the brain is increased during intellectual activity, the amount going to the arm is lessened, as tested by the plethysmograph; for, during intellectual activity,

⁷ *Gazette des Hôpitaux*, No. 90, 1875.

⁸ *Brain; a Journal of Neurology*, vol. ii, p. 373.

⁹ *Allgemeine Zeitschrift für Psychiatrie*, Band xli, 1885, p. 707.

whilst the volume of the brain increased, Mosso¹⁰ found diminished calibre of the arteries to the forearm, together with a more frequent, smaller, pulse in them, and now catacrotic instead of anacrotic, as it had been; a change not due to respiratory influences. During mental attention and activity E. Gley¹¹ found the number of heart-beats increased, and the carotid artery and its pulse becoming dicrotic, whilst a contrary state of the radial pulse existed; effects attributed to vasomotor influence. Thus it may be that if the cerebro-spinal fluid is forced from brain to cord, the concomitant conditions of lessened blood-supply to the cord enable the vertebral canal to accommodate the increased amount of cerebro-spinal fluid by an automatic arrangement. But be this as it may, there are two lines of discrepant view on the subject: the importance of the cerebro-spinal fluid, or its operation as above described in providing for easement and for considerable variations of the cerebral circulation, having been upheld by Majendie, Burrows, Carpenter, Hilton, Moxon and others; whilst, on the other hand, this importance and operation of the cerebro-spinal fluid have been called in question (amongst others) by Prof. Foster, Dr. Cappie, and M. Franck. Some of these affirm that changes of the brain circulation are provided for by the venous sinuses of the skull; that these form reservoirs of the blood—temporary reservoirs for extra blood in times of emergency—and that when the blood-pressure is increased in the brain the blood flows with greater freedom away from the sinuses and out of the skull; so that when the brain is anæmic, as in sleep, the sinuses become correspondingly and compensatorily fuller of blood; thus the amount within the bony cranium remaining the same, a much larger share of it than in the waking state is now external to the brain, a smaller share within the brain itself.

In the young and healthy, rapid and extreme changes in the position of the head may take place without any evil or inconvenient result; but in old age, when the vessels become altered and their elasticity is impaired, when their vasomotor apparatus is worn out or deranged, when the meninges become thick and tough, the choroid plexuses sodden, or stony, and the brain is less elastic, similarly sudden and marked changes in the posture and relation of the head occasion giddiness or syncope.

That marked changes are constantly occurring in the brain and in its circulation appears to be shown also by the fact that, if the brain is exposed, it and the quantity of blood in it rise and fall with the respiratory movements—the brain rising in expiration, falling in inspiration; and also rise and fall with each beat of the heart and the interval before the next; as well as rise and fall in a slower manner than with respiration, doing so in response to various influences, such as changes in mental activity, in relative position of head, movements of limbs, respiratory modifications.

Inspiration also assists to unload the sinuses, promoting a rush thence to the thoracic vessels and heart. Without entering upon the complex causation of the respiratory undulations just mentioned, we may notice M. François Franck's¹² observation, that when the heart is arrested the pressure on the sinus remains equal to the general encephalic pressure, the veins swell, especially in the deep parts, and particularly in the cranial cavity, so that the arterial anæmia is replaced or counterbalanced by venous congestion. Yet against this view is the result of Spehl's¹³ experiments on rabbits, in which the blood in the head during the chloral sleep was diminished, being now only 8.7 per cent., instead of 12.5 per cent., as in the waking state.

All the above facts, including those concerning the existence of checks on wide variations of blood-supply and blood-pressure in, and tension of, the brain surrounded by various structures, go to show that considerable variations may exist in the supply, in the distribution of that supply, and in the pressure under which it circulates. And pathologic states show this increase or diminution, as the case may be. Observe not merely the exudation but hyperæmia of inflammation within the cranium; observe the intensely gorged, congested—passively, if you like, but gorged—blood-vessels in cases dying in epileptiform seizures; observe the blanched brain of the lunatic dying of purpura hæmorrhagica, or of other maladies attended with rapid or severe loss of blood—and you will admit pathologic hyperæmias and anæmias of the cerebrum.

In reference to this subject of the relative amounts of arterial and venous blood in the cranium, and the alternate ebb and flow

of the amount of each, are experiments showing the relation of active cerebral hyperæmia or anæmia—of changes in the blood-pressure within the skull—to degrees of free outflow of venous blood from the cranial sinuses, and its return to the heart. Thus Gärtner and Wagner¹⁴ found that, whilst the calibre of vessels remains the same, the higher the pressure under which it circulates the more blood must stream through them; and thus, without any change in the calibre of the vessels, a larger amount, per unit of time, may circulate under a higher pressure, and a correspondingly larger amount keep outflowing from the sinuses of the skull. Compress the aorta above the diaphragm, thus raise the blood-pressure, and in a parallel way the quantity of blood issuing from the cerebral veins and the sinuses is augmented. On the other hand, compress the ascending vena cava, and with the lowered blood-pressure the outflow from the veins and sinuses immediately sinks; and, indeed, when the blood-pressure sinks to 30 to 40 millimètres of Hg., "the efflux of blood from the brain quite ceases." Now, under irritation of sensory nerves, strychnine poisoning, asphyxia, etc., contraction of blood-vessels of various organs occurs, together with rise of blood-pressure; but that the cerebral vessels do not thus contract, under similar circumstances, appears from the fact that the outflowing amount of blood from the brain sinuses, instead of lessening, actually increases then, and in direct proportion to the increase of blood-pressure induced by the experiment. Whereas, on the contrary, the outflow from the sinuses would be lessened if the brain vessels contracted, or at least their contraction would proportionately subtract from the effect of the increased blood-pressure. And direct electrical stimulation of the often so-called "motor area" of brain cortex ("kinæsthetic centres" of Dr. Bastian¹⁵) appears to cause, not brain anæmia by contraction of vessels, as usually supposed, and hence convulsions, but, active hyperæmia of the brain, and this sometimes independently of an increase of the blood-pressure, although the latter usually assists in the result. Intimately bound together in this relation are the local vasomotor changes affecting branches of the circle of Willis, and the local molecular activity of portions of brain tissue. Let definite parts or centres be roused by any unusually active incitations of psychic or of somatic origin, and instantly the circulation thereto becomes, at a leap, more active and the blood-supply richer.

INFLUENCE OF CARDIAC DISEASE ON MENTAL STATE AND PRODUCTION OF MENTAL SYMPTOMS.

The chief factors of the brain circulation being the heart's action, the vasomotor apparatus of brain, the molecular functional activity of brain, and the atmospheric pressure (opposing return from skull, whose contents are partially withdrawn from its influence), it is evident that cardiac disease may play an important part in modifying that blood-supply and the cerebral functions. And the shrewd forecast of the late Sir G. Burrows,¹⁶ as to its frequent connection with insanity, has been justified by actual observation.

Speaking of the mental disease with which so frequently an accentuation of the aortic sound is allied, Professor Rudolf Arndt¹⁷ said that it often takes origin when degeneration of the heart has followed its overstrain, and here the mental disorder, grounded in a disposition of the affected individual, is to be taken as an expression of general disease rather than as a brain disease, strictly speaking.

The influence of heart diseases in the production of brain affections is chiefly to bring about functional disorders of the brain, including insanity. Although Dr. R. Law and Dr. Wm. Stokes¹⁸ held that, independently of arterial disease, which Rostan connected with white softening of the brain, the latter might be brought about by heart disease, yet I have never seen a case of such "exsanguineous softening" fairly attributable to cerebral anæmia the effect of cardiac disease; for in all cases where disease of the vessels locally was insufficient to account for the circumscribed softening, I have found embolism, or hæmorrhage, exudation, or new growth. But whatever their connection with cardiac or other disease, these several forms of local gross cerebral lesion may originate mental derangement, chiefly with dementia. An examination of this department of the relations of cardiac to mental disease would occupy too much time, does not fall within the scope of these lectures, and will now be dismissed for good.

¹⁰ Cited by Gley.

¹¹ *Thèse de Paris*, 1881. *Revue des Sciences Médicales*, T. xix, 1882, p. 35.

¹² *Gazette des Hôpitaux*, March 28, 1882, p. 294.

¹³ *Loc. cit.*

¹⁴ Cited in *Brain*, July, 1887, p. 281.

¹⁵ *Brain: a Journal of Neurology*, April, 1887.

¹⁶ *On Disorders of the Cerebral Circulation*, etc., 1846.

¹⁷ *Deutsche Medicinische Wochenschrift*, June 25th, 1881, p. 359.

¹⁸ *The Diseases of the Heart and the Aorta*, by Dr. Wm. Stokes, 1854, p. 360.

How, then, may cardiac disease either modify the symptoms of pre-existent insanity, or of that which appears about simultaneously with itself; or give origin to the mental disease, play the part of a chief factor of the psychical malady? A question of difficulty and complexity. Combined as they usually are in operation, the several elements may be disentangled in some examples. They are as follows: 1. The heart-disease may act by disturbing the balance of the general circulation in various ways and degrees. 2. Similarly, it may act by disordering the intracranial circulation (this includes its effect on the local vasomotor mechanisms). 3. It may operate by leading to a change in the composition of the blood within the cranium; or 4, of the blood generally. 5. It may act by the pulmonary disorder it induces, and the morbid impressions and sensations resulting therefrom, so that eventually some of the effects arising are of pulmonary origin, or partly so. 6. Through the nerves it may become a source of peripheral irritation, and influence cerebral functions reflexly, by sympathy, inhibiting some forms of activity, deranging others.

Let the above statements should bear a dogmatic impress, I must add that as yet they are not actually demonstrated and generally accepted facts. Some, indeed, while admitting a change of balance of general or of local circulation in heart disease, changed blood-pressure within the vessels, and altered quality of the blood therein, yet deny any effect, worth mention, of these on the production of mental symptoms, and hold that the original endowment of the nervous system, and the previous mental qualities, govern the state of psychic functions during the existence of heart or renal disease, of changes of pressure and circulation. Nevertheless, as regards the first two of the above-mentioned results of cardiac disease, and factors of mental, the preceding discussion shows their importance in determining the state of the brain, and therefore in producing disorders of it. In relation to this come cases¹⁹ with feeble circulation and with cerebral vessels imperfectly filled, in which the mental state or the sensory brain functions varied with the oscillations of arterial anæmia of the brain, according as the subject was in the erect or in the horizontal position; as where one, feeble-minded, apathetic, and peevish whilst in the erect position, became intelligent, lively, and conversational in the recumbent; or the student, mentioned by Burrows, who, owing to defective bulk of blood in the cerebral vessels when sitting up, could study only in the recumbent position; and Witkowski²⁰ found two patients with aortic stenosis, lie abed with head low: whereas other persons with congested head, held it stiff and high erect, as in a case of mitral insufficiency with swollen red head, most carefully balanced. Then from the asylum ward come cases in which maniacal excitement is often cleared up, and disquieting delusions abated or dispersed, by moderate doses of digitalis, as shown in my paper²¹ on the subject; and I need only mention vertigo and syncope as active cerebral symptoms often connected with defective or disordered encephalic arterial supply.

Then, as regards the third of the factors enumerated, what has gone before demonstrates that in disordered conditions of its circulation parts of the brain may be poisoned by venous blood, relatively too venous, and relatively too long stagnating in the veins and sinuses, and dammed backward upon the capillaries. As regards the fourth and fifth of the factors, also, we need only draw attention to the frequent disorder and imperfection of respiration, or even pulmonary disease, secondary to cardiac disease, and the interference with normal hæmatisis thereby engendered, and therefore defective nutrition of the brain, as well as the mental effects of morbid impressions coming from such pulmonary disorder or disease.

The sixth manner in which heart disease may occasion or modify mental symptoms is one which has been almost entirely ignored, but which I deem to be of great efficacy. When we consider the painful impressions, the distress, the physical anguish, the extraordinary variety of abnormal sensations, that may arise in cardiac disease, the closely, urgently pressing nature of many of these, the vague discomforts, the oozing away of strength and courage and nerve, the easy access to the brink or depth of syncope; we shall see in all these a fertile field for the growth of depressed or hypochondriacal feeling and ideas of a delusive character. That peripheral local morbid states often directly occasion definite mental symptoms, and even particular

delusions, I have had many necroscopic proofs; and, had I space, might relate many cases in illustration of that thesis, and might select abdominal and other cases, in order that what I shall say hereafter about the heart might exhibit conspicuously a parallelism with these other pathological facts; but space fails me. Moreover, this doctrine is not a new one. Thus, the wide employment of "sympathetic insanity" as a general etiological term, was largely built upon occurrences similar to those long ago spoken of by Brown-Séquard,²² and others, as insanity by reflex effect of irritation of centripetal nerves.

One may describe the above methods of action of the graver maladies of the heart; more difficult, nay often impossible, is it to apportion to each one its place and rôle in particular cases, or in the several forms, of cardiac disease.

With disabling heart disease, and especially if thereupon pulmonary disease supervenes as a secondary result, or even independently, come a general disturbance of the balance of the circulation, and impeded return of blood to the right side of the heart, including impeded return of blood from the cranial cavity, and all the more so as here comes into play the closed nature of the skull. And not only is the venous blood in the sinuses and large cerebral and meningeal veins brought to a state tending to stagnation, but it also acts backward towards, and upon, the arteries, in this course giving rise to irregular circulation, local retention and blood-stasis, poisoning of the parts with retained effete products of tissue-metabolism, and to changes in the pressure of the blood upon the vascular walls, and in the tension of the brain. Lung disease greatly enhances this condition of the intracranial circulation, a condition which also is accompanied with arterial cerebral anæmia, which we have seen the aforementioned changes tend to produce. And this being the state of affairs, should there now be also histological changes in the walls of the cerebral blood-vessels, their partial occlusion starves the brain substance, their diminished elasticity further aggravates the stasis and promotes gravitation of blood. Of the evil effects of persistent passive congestion of the membranes and brain substance I need not tarry to speak. Yet the heart disease, in some forms particularly, and eventually in all, of itself directly, often mechanically, occasions a defective arterial supply to the brain, with or without venous congestion, and in the train of this arterial anæmia (and venous congestion) follow all the changes in the circulation and nutrition of the brain to which I have referred, but which I need not recapitulate. And utterly mistaken are those who in the diseased or healthy state of the brain vessels, respectively, would seek the complete solution of the seeming mystery that one case of heart disease is attended by mental symptoms, and one, apparently similar, is free therefrom.

Notwithstanding the effect of emotions on the heart, and the frequent effect of heart disease on the spirits of the sufferer, and that some have attributed mental symptoms, and even the production of insanity, to chronic heart disease, yet others have denied the existence of any such influence by cardiac affections, or, if not denying it, have minimised its importance and effect, holding, rather, that when they co-exist, the heart disease is secondary to the mental. And of those who do admit that influence, nearly all have described the clinical results in brief and general terms, as applying to chronic heart disease, in a wide sense, have failed therefore to distinguish the mental effects flowing from its different forms. Thus, Solfanelli²³ opined that while hypertrophy affecting the left side of the heart is connected with more active, and valvular disease with more passive, hyperæmia, and its results; and while cerebral anæmia will arise from aortic-valve stenosis, and cerebral venous congestion, and oedema will follow upon mitral regurgitation, yet a correspondence fails to be observed between the variety of heart disease and the form of insanity found accompanying it.

Those who have brought forward large statistics on heart disease in the insane have drawn the clinical facts from one set of cases, the necroscopical from another set, and the latter from records entirely or largely made by others. Not only are there discrepancies between the facts adduced by the several observers; and not only do the conclusions drawn from the living fail to harmonise with those drawn from the dead, in the statistics of each observer; and not only have some pathologic rela-

¹⁹ Burrows, Combe, Abercrombie.

²⁰ *Allgemeine Zeitschrift für Psych.*, Band xxxii, p. 353.

²¹ *Journal of Mental Science*, July, 1873, p. 183.

²² *Lancet*, July 27th, 1861, p. 70, and *Physiology and Pathol. of Centr. Nerv. Syst.*, pp. 166, 185.

²³ *Archivio Italiano per Mal. Nerv. et Al. Ment.*, cited *Journ. Ment. Sci.*, April, 1875, p. 140; and by Witkowski.

tions and factors been lost sight of, in their figures, but also when these observers turn to the clinical features of the insanity produced by heart disease, or the modifications wrought thereby, their statements are not drawn from the cases and statistics preceding, which, indeed, so far as they go, would lead us to very different conclusions.

Of insanity where heart disease is the chief factor it has been said that hypertrophy of heart goes with exalted conditions, dilatation with depression; or, again, that aortic-valve affections mostly occasion excitation; whereas, on the contrary, mitral affections lead to melancholia chiefly; while states of excitement are often attended by temporary murmurs originating at the aortic valve. Yet most or all of the existing statements on this particular relation of heart disease to insanity are vague, general, indiscriminate, insecurely based.

The clinical and pathological sketches to follow are entirely from cases under my care, and many of them so for years, and of which I made both notes and necropsies. A few other cases are utilised, of persons who are living, or did not die under my care, or on whom a necropsy was not made. Thus the clinical and the pathological facts are drawn from the same cases and by the same observer, and, it is believed, are sufficient in numbers to elucidate the different relations to insanity of the several forms of cardiac and aortic lesion; and, moreover, are reported without bias, prejudice, or preconception.

Acute affections of the heart may be the source of mental disorder, as the insanity observed in some cases of rheumatic endocarditis by Burrows and others, or as in cases of ulcerative endocarditis in the childbed state, causing derangement taking the form of puerperal mania.²⁴ But I am about to speak of something other than the delirium or other mental symptoms occasionally observed in the acute and febrile affections of the heart—of something other than its functional affections, or even than its milder organic changes; for not only is it more difficult to trace the effects (if any) of functional disorder or mild organic disease on the mental state, and not only are these producible by many causes, and easily engendered by the mental disturbance itself, and by states such as lithæmia and renal inadequacy—thus rendering them less suitable for our purpose—but also in omitting them there are two further advantages; the one an avoidance of being overloaded by a throng of cases of little use for our present purpose; the other, that by selecting only the severe cases of organic disease the necropsy is conclusive as to the cardiac condition, and therefore we can be spared that recital of the physical signs and somatic symptoms of the heart affections which would become almost necessary in dealing with functional cases and mild organic ones. And still another reason is that it is not part of my scheme to furnish a new and ostensibly complete set of statistics as to the proportions, percent., of the several forms of insanity affected with this or that cardiac condition or lesion—a matter of secondary interest from our point of view.

Continually do we find mental symptoms cropping up in heart cases. For example, in Dr. Bristowe's²⁵ article on "Recurrent Palpitation of Extreme Rapidity in Persons otherwise Apparently Healthy" we find that even in some of these cases of purely functional affection with only incidentally present cardiac disease, or slight dilatation and hypertrophy secondary to the palpitation, he noticed an irritable, fidgety condition, and sense of being always in a hurry, or a feeling of being ill, faint, and weary, coincidently with the paroxysm of palpitation.

To illustrate the effect of heart disease on the mental state I need not confine attention to the insane. Their attendants and others occasionally furnish me with effective examples. One such will be mentioned under aortic regurgitation. A second case was that of one disabled elsewhere for attendant's work by a heart crippled by rheumatic fever, and to whom I gave the situation of porter. In his chest was always to be heard a loud churning of commingled murmurs, which sometimes became worse, the pulse, ordinarily above 100, running to a great frequency then; asthma-like attacks of dyspnoea being severe, the congestion and œdema of lungs adding to the distress; the face becoming blue and livid, and the lips more everted. Now at these times I noted a concomitant mental change imprinting itself on the man's visage, but chiefly manifesting itself by suspiciousness and a substitution of the usual cheerful, lively buoyancy by moroseness, withdrawal of self, and a mental attitude as of one standing on defence against unjust reflections upon, unjust feeling toward, himself—

an incipient morbid idea of the hostility of those around him, and the misinterpretation of their actions and motives, ending occasionally in his bringing to me some suspicious suggestion rather than definite accusation—suggestion which I was wont to ignore. Finally, the kidney becoming affected, he died albuminuric, but a few days before death confessed to me that, when in his "bad turns," he for years had had visual hallucinations or illusions, and that, as in dyspnoea lividity he spoke to me, he could see a man and dog at the foot of his bed (hallucination).

Still another attendant became changed in disposition and feeling, but was unaware of his heart disease until, on examination, I found left hypertrophy and double aortic bruit.

Nor can I forget the case of a medical friend with heart disease, chiefly of the aortic valve, so far as valvular, and a bruit in the aortic arch; whose life became overcast by restless anxiety. Oppressed by apprehensions and vague disquietude, and with his thoughts ever returning to revolve around his morbid sensations and vague mental and physical discomforts, his conversation kept recurring to his sensations, his disease, and his impending death, the constant themes with which by day and night he worried those around him. Mirth or pleasantry grated upon his feelings, circling around their sombre centre. Fidgety, restless, perturbed, anxious—a hundred times a day he would beg of me to feel his pulse, or seek the expression of my opinion on his state; and in the night, when sleep failed, he would rouse one up in order to seek suggestion of some new soporific plan, to be relieved of his dread; and to have his pulse again felt.

And here I may mention the case of a deteriorated, imbecile monomaniac, not in the following statistics; who, after several rheumatic attacks leaving damage of the mitral valve and of the lunate cusps of the pulmonary artery, had vast increase of what had previously been only a slight tendency to occasional, sudden, quasi-impulsive, transitory outbursts of excitement, violence, and destructiveness.

INSANITY IN RELATION TO FORMS OF CARDIAC DISEASE.

Passing to *Heart Disease and Insanity*, and the groups I have formed: all the cases were males. Once for all, it must be stated that under each of the following heads I have two objects in view, the one being to trace the clinical aspects of the insanity produced, or the modification of pre-existent insanity wrought, by the particular variety of heart disease; the other, conversely, being to indicate the several forms of insanity in the course of which each cardiac affection is most liable to appear; for both the cardiac and the mental may be deeply rooted in one and the same diathesis or diathetic tendency.

Mitral Valve Disease.—Three sub-groups. In the first and second sub-groups, mitral valve disease was the chief or predominant somatic condition, both clinically and pathologically; in all the sub-groups it was the chief or only cardiac abnormality. The twenty-nine mitral cases I bring forward are grouped as (1) marked regurgitation; (2) marked obstruction; and (3) comparatively slight or moderate mitral valvular disease. Of those in which mitral disease was severe, the sole or predominant cardiac condition, and of considerable influence on the fortunes of the case, six were examples of mitral regurgitation, seven of mitral obstruction. One might well anticipate that disease of the bicuspidates, whether giving rise to obstruction or to regurgitation of the blood stream, would practically be of the same effect on the nervous system, and therefore on the mental state; or if the bicuspidate disease is later in time than the mental, that there would be no special difference in the liability of the subjects of the several forms of mental disease to one or the other lesion—to stenosis, or incompetency, as the case might be; and that the modifying effect (if any) of either upon the pre-existent mental state would be the same; but the facts I have observed, and will mention, point to a different conclusion.

First Sub-group: Mitral Regurgitation.—Let me give a summary of the cases of regurgitation due to incompetency of mitral cusps. The patients were aged from 37 to 59, and on the average 47. At death, the insanity had lasted from a few weeks or months to twenty years. In some the cardiac affection supervened on mental disease, in some it preceded the latter. For reasons already specified I need not give the physical signs of the cardiac disease, so well marked in these cases, or the other somatic symptoms, although noting incidentally the comparative frequency of Cheyne-Stokes's respiration in this sub-group. The heart was enlarged in these cases, weighing on the average 17½ ozs. Av., the left ventricle be-

²⁴ Arch. für Path. Anat. und Phys., Band xx, p. 542.

²⁵ Brain, July, 1887, p. 161.

ing hypertrophied and dilated, the left auricle somewhat so, as also the right ventricle; the heart muscle was in some cases pale and slightly granulo-fatty, and its coronary arteries atheromatous. Even when least affected in structure the incompetent mitral cusps were also more or less thickened and unduly opaque. The other valves may be so also, the tricuspid, however, often escaping. We may find in the lungs congestion, pneumonia, hæmorrhage; the kidneys smallish (4 to 4½ ozs.), and slightly or moderately granular.

The heart disease in some of these cases preceded either melancholia or suspicious delusional insanity. In others the heart disease was subsequent to religious or to persecutory monomania, or to expansive, maniacal, hostile, irritable general paralysis, running an aberrant course in one with hereditary psychic degeneration. Of the two sets of cases, the more interesting is that of mitral disease preceding mental disorder and influencing its production and aspect.

When rheumatic fever has founded the chronic heart disease, and mental symptoms have been noticed for six months, one is emotionally depressed, melancholic, acknowledges morbid feeling in the head for a long while, as if the vertex was cut off and lifted up. To him it seems as if something "wrong inside him" says he is to be shot or hung; he believes it, and wishes to be opened at once for the benefit of medical science, by the discovery of the internal pathologic state. He fancies that imaginary voices address him; people turn round and speak to him; the Lord talks to him, and says he is to be shot; he feels wicked, and as if cast out by the Lord. At times his description is that he had felt as if the calvaria was off and the heart down. From the cardiac region he hears voices say, "It's a shame to keep him here;" but this he explains, in a sense unusual for asylum inmates, as meaning that he has become too wicked to be here, and therefore ought to be shot or killed. At one time the hallucinatory voices had suggested his sexual mutilation, and he confesses to past onanism; falling on his knees he tells of youthful sexual excitement, aroused by his presence in the bedroom to which his widowed mother often brought home a paramour. At times he had felt increased in height, lifted up, and as if he was not a natural being. Something seemed to be blowing on the top of his head; he felt as if a snake worked from right thigh to shoulder. Sometimes he perceived strange smells without external cause. These were auditory, tactile, olfactory, and visceral hallucinations and illusions.

In the next case the coming on of mitral regurgitation was probably subsequent to the insanity. A religious monomaniac, who had settled down as a quiet, respectful, pleasant, industrious inmate, fell at last into physical and graver mental difficulties. With his cardiac and renal disease came, first, pulmonary engorgement, muco-aqueous expectoration, œdema of lower limbs; and, later on, marked albuminuria, defective vision, mental dullness, drowsiness; from congestion of lungs, at times dyspnoea or orthopnoea and cyanotic livid hue of face and hands, but the dyspnoea was in part renal. And so the case progressed, with recurring dyspnoeal attacks, a lessened amount of the now highly albuminous urine, mental heaviness and drowsiness. And during these latter and evil days, when the cardiac and renal diseases were telling upon him, the state of mind was modified; for, in contrast with his former mental characteristics, he had become depressed, very quiet, somewhat sombre, and showed a marked inclination to taciturnity and silence, as if the mental sky had become dull, leaden, oppressive.

Another monomaniac had had delusions as to poisoned food and persecution; hallucinations of sight and hearing, and a variable emotional state—now amiable and industrious, now sullen, moody, and menacing. That he was persecuted by men who annoyed him by blasphemy and by tramping about so as to get him to commit himself, that he was kept to be tortured, were some of the various delusions under the influence of which at times he became noisy, excited, threatening, or violent. Later on, he destroyed his bedding, declared he was tormented at night, especially by women and the Queen; therefore he threatened and planned to assault the officers of the asylum, or to smash windows, if not shifted away. Subsequently, becoming more quiet and sullen, he said he had no flesh on his bones, or those about him were "against" him, or that he was persecuted. The marked heart disease had now become manifest, and now, neither excited nor noisy, he was sullen, reserved, taciturn, of forbidding look, and the delusions were somewhat in abeyance. Later on he said the patients were "all against him; his testicles were eaten away, he was tormented;" everything not agreeable to him he looked on

as an injustice, an act of hostility to him, a punishment. Subsequently deaf and phthisical. Here the mitral disease appears to have modified the mental state; changing it from a chronic, paroxysmally excited, violent, destructive, and "threatening" state, to a more depressed, morose, sullen, taciturn one, yet combined with a quiet, tractable docility, in strong contrast with the former aggressiveness.

Another, a protracted erratic case of general paralysis, at first was extremely maniacal, irritable, full of hallucinations and delusions of exalted type. "Is Jesus Christ, has millions of money, is an Adonis, is all-powerful to strike or heal." Subsequently, with big ideas, he still at times was irritable, angry, quarrelsome, disdainful. Latterly, with marked mitral, also with aortic-valve, lesion, and in contrast with his previous state, he gradually became quiet, reticent, depressed, incoherent, childish, somewhat demented; but impatient, irritably waving his hands, and offering a ready resistance to management or manipulation.

Finally, the order of incidence of the two affections was not absolutely clear, although the total stated duration of the insanity was under ten months, but the heart disease obviously of some years' standing, in one who died after being only four weeks under care. The clinical aspects were: very fidgety and restless movements, muttering, incoherence, repetition of the same words, rambling statements, loss of mental perception and of memory, extreme dementia—a condition as of premature and intense senile decay of mind. Less marked examples of mitral regurgitation occur in the third sub-group.

Thus, where mitral regurgitation most evidently influences the production of insanity, or the modification of the clinical aspect of pre-existent insanity, the state is usually a sombre emotional dejection, or melancholic dread, with hallucinations or illusions and hypochondriacal symptoms; or else morose, sullen, taciturn states, with a marked attitude as of one subjected to annoyance or persecution.

Second Sub-group: Mitral Stenosis.—Varying from 30 to 79, the age at death, on the average, was about 47½, and the insanity had existed from two months to twenty-four years. The cardiac disease, in some preceding, in others supervening on, insanity, had in some an order of incidence not absolutely known with certainty. On the whole, pleuritic and pulmonary conditions had as much (or more) to do with determining the site of the apex beat as had the intrinsic cardiac lesions. Bronchitis, emphysema, pulmonary congestion, pneumonia, pleuritic effusion, hydrothorax, œdema of feet and legs, more generalised dropsy, albuminuria, subcutaneous œdema over base of a pleura; these conditions were apt to be found singly, or variously combined, or succeeding.

The average weight of the heart was 13.188 ozs. In all were degrees of constriction at the left ostium atrio-ventriculare, and of thickening, rigidity, deformity, or cohesion of mitral cusps. Part of the cases were of the "button-hole," and part of the "funnel-shaped," variety of mitral constriction.²⁸ Less change usually affected the other, and chiefly the pulmonary and tricuspid, valves. The left auricle was more or less hypertrophied and dilated; the left ventricle not markedly or not noticeably hypertrophied as a rule. In most the right chambers were hypertrophied, or hypertrophied and dilated. The heart muscle was usually flabby and friable. The coronary arteries atheromatous in several. Pericardial fluid often increased. Spleen, on the average, 7.375 ozs., usually of undue firmness, the capsule more or less irregularly thickened and opaque, occasionally scarred, pigmented, brownish. Liver, average 47.25 ozs.; "hepatic venous congestion" usual; often some "nutmeg-like" appearance; parenchyma firm, or even hard; capsule partially thickened or adherent to surrounding parts. The kidneys presented one or more of the following changes: granular surface, adherent capsules, cystic change; average weight, 4.85 ozs. apiece. In the lungs were one or several of these conditions, namely: bronchitis, emphysema, pleuritic effusion or old adhesions, apical cirrhosis, or even traces of former cured phthisis, bronchiectasis, carnification, or brown induration of lung at base, occasionally cheesy nodules or cheesy bronchial glands, calvaria dense in some, brain usually somewhat wasted, and meninges slightly thickened; fissures and gyri occasionally abnormal.

With regard to the mental state and its modification by mitral stenosis; the cardiac disease distinctly preceded the mental and influenced its production in one who had thrice attempted suicide before admission. His memory was impaired, and he had no

²⁸ Dr. Douglas Powell, *Lancet*, 1880.

recollection of his mental attack in India; but he was not merely stupid, simple, unable to take proper care of himself, and ignorant of the value of money; he was also irritable, suddenly, as if impulsively, violent and destructive when displeased; jealous of others getting better things or larger shares than he; made grievances of nothing; frequently transferred from ward to ward at his own wish, he was not contented in any; was excitable, quarrelsome, resentful, readily and impetuously made sudden attacks if he thought (delusion) that he was insulted or called names; excited about grievances, he imagined injustice; would not occupy or amuse himself, demanded his release; later, he made assaults under the influence of hallucinations of hearing. In anger he hurled his dinner away, smashed plates, threatened to and did commit sudden quasi-impulsive acts of violence. For a time he continued to attack others under the delusion that they annoy, push against, talk about, or even look at him. Finally, he became quiet, depressed, reserved, subdued, answering in monosyllables.

Another case, in which the cardiac affection long preceded the mental, comes here in order, but was aged and less characteristic. He had some active symptoms, being noisy, shouting "murder," and delusionally asserting that people came and assaulted him, that there was some criminal charge against him, that he had been out and robbed on his way to a bank, or had lost a cheque belonging to his employers. Moreover, he became suicidal, tried to get out of and smashed a window to go and throw himself over a bridge. Later he was petulant, irritable, struck at an attendant about to feed him, confused persons and places, was rambling and incoherent in conversation, imagined he had to pay for his maintenance, had just left his business situation which still depended on him, and was the subject of a criminal charge. Better for a time, but latterly worse, with vague depression, discontent, dissatisfied with his food and his position, occasionally rambling and odd in conversation; he talked of having been overdosed with chloroform. Subsequently, says he "is dying fast," his "brain is going," or he is "disturbed," has not slept for weeks or months, will soon be dead, and was troubled by the delusive notion that he must go to see a "dying sister and nephew." Latterly were delusions about his dying or being dead, dreams in which he saw corpses laid out, desire for death.

The order of incidence of the two affections was somewhat doubtful in a case of religious monomania with excitement, becoming querulous, and finally deteriorating, and the querulous maniacal elements continuing. At times, restless and excited, he asserted that he was St. Patrick and suffered on the cross, that voices from the other world spoke to him. Declaring his independence, and not brooking the slightest interference, he was quarrelsome and assaulted his companions. Later were notions that true angels tell him what to do; his fixation on a bed at Malta he took as comparable with the Crucifixion. Excessively querulous, he complained of his treatment and diet, and was inclined to fight. A marked stenoic mitral *bruit* was heard, and now came frequent pulmonary complications and dyspnoeal attacks. After the heart condition became worse he was querulous, morose, discontented, was growling, grumbling, making absurd complaints of being injured and treated in a hostile way by everyone, and absurd statements as to the imaginary bodily injuries inflicted upon him.

As in the last, so in another case, the funnel-shaped mitral constriction may have been congenital; otherwise, knowing them only in the later years, one would have said their heart disease probably appeared later than the querulous persecutory monomania. This one had delusions as to men being murdered and boiled to lard, and their skins tanned to leather; as to the army officers being against him; delusions of being annoyed, ill-treated, of everything being wrong, of the food being deleterious or stinking, or poisonous. But with these were occasional delusions as to his valuable clothing or wealth, as to his being proof against snares, sword, or gunpowder. Yet usually he was suspicious, querulous, discontented. Latterly, when more in trouble with heart and lungs, he said the food was dead men's lard, or made of dead men's yeast, that "bad stuff" was intentionally put in it, that voices told him he annoyed his comrades, that American interference compelled him to stop work, but that he had "raised £500." In low spirits, he yet became excited, noisy, and abusive if questioned, and had delusions of persecution. Latterly he declared he was poisoned, often refused food, and the delusions on this subject became predominant. Peevish and irritable, he insisted that the milk was poisoned, that his medicine burnt him

up, that the attendants smelt offensively. Even at the last, under delusions of persecution, he shouted about "blood-sucking" and about his being "tormented." Besides the heart disease there were caseous bronchial lymphatic glands, and some cheesy nodules in the lungs.

In a case in which insanity probably preceded the heart affection there were early despondency and desire to be killed, then usually querulous, but sometimes expansive, symptoms—sullenness, restlessness, irritability, mental confusion. Later he was noisy, quarrelsome, dissatisfied, querulous, and by his own wish transferred successively from ward to ward; at times were expansive ideas, such as that he was "next to God." Later, impaired in memory, he was confused, incoherent, now and then excited, threatening, and on those occasions refusing food and resisting interference. Subsequently hypochondriacal, baselessly asserting that he was ill, that his tongue hung loose, that his left eye was blind; and now, strange to say, came recollection and mention by him of his early long-past despondency and desire to be killed. Still later, absent in mind, confused, of defective memory, and repeating words and sentences with an odd smiling look, as of a chronic maniac. He died of an acute inflammation.

Of the above cases, the first, third, fourth, and in less degree the fifth, show this association of obstructive mitral disease with chronic insanity characterised by delusions of persecution, annoyance, injury, or hypochondriacal ones; and often hallucinations, at first with, and then superseding, expansive ideas, chiefly of the religious order; also with another group of symptoms—querulousness, irritability, ill-temper, discontent, grumbling moroseness, and peevish cross-grained cantankerousness. It is partly the symptoms of this latter group which grow worse in proportion as disabling mitral stenotic disease tells on the vital forces and the functions of the brain. And in some of these the cardiac, in others the mental, is the earlier malady; if preceding, the mitral stenosis appears to foster the production of symptoms of the kind described; if, on the contrary, apparently supervening, it seems to intensify the similar symptoms, and to assist in the supersession and gradual extinction, by them, of formerly co-existent symptoms of the expansive order.

In two less marked cases the order of incidence was unknown, and the mitral affection probably not of very much influence. One was mixed monomania, persecutory, expansive, hypochondriacal. Patient says he "is tried, accused of crimes, is annoyed, apparatus is applied to him, is the object of conspiracy; is persecuted by Orangemen's secret, or by a 'piercing wind with a voice,' which once he saw; it pains him all over; this is done to prevent proof of his grievances. To him the power of Orangeism, Freemasonry, and Devil are applied; he can be pained by others at their will; is worked on at night; Freemasonry is dragged from him, so is his nature, and the flesh is dragged through his body." Later, refused food, declared he would starve himself if not discharged, and should he starve the world would be destroyed; "Is Saviour of the World, has spoken to God;" becomes excited about his imagined persecutions. Here, there were also some cheesy and calcareous nodules in the lungs.

The other had been grotesquely irrational in demeanour and language, alternating between melancholic depression and agitation, with monotonous repetition of ejaculations on religious subjects. There were also delusions of conspiracy, and that his soul was lost, and that his food was poisoned, with obstinate refusal of it. Subsequently, *melancholia agitata*; still noisily repeating some words or phrases, and refusing food. Later, silent, reticent, depressed, unsocial, and refusing to be examined.

Comparing the most characteristic, respectively, of mitral regurgitant with mitral stenotic cases, broadly speaking the former show more tendency to melancholy, the latter to intense querulousness, and delusions of persecution, annoyance, injury.

The third sub-group of morbid mitral orifice or valve consists of those in which there was slighter mitral change and effect. For, in sixteen mitral cases the valve disease was comparatively slight, or somewhat overshadowed by important changes of other organs, or the valve change, although the chief cardiac abnormality found was not of grave import, and probably did not exercise any markedly noxious influence on the course or symptoms of the case in reality. However important these may be as showing the tendency and line along which disease works in some groups of persons, they are of comparatively little usefulness for our particular present purpose, inasmuch as their influence upon, or their relation to, the mental state of the patient, or to the con-

stitutional state or circulatory condition which favours the production of that mental state, was not very clear and distinct. Therefore, although they were analysed, I shall exclude the sixteen from further consideration, except to add that most of these cases of lighter mitral disease, although many of them were general paralytics, exhibited an inclination to depression, irritability, delusions of annoyance, danger, ill-treatment, persecution, or showed inclination to dementia. Emotional facility was marked in some. Only a few had occasional expansive delusions or exaltation.

ABSTRACTS OF THE MILROY LECTURES ON SOME GENERAL CONDITIONS WITH REGARD TO EPIDEMICS.

*Delivered at the Royal College of Physicians of London,
February and March, 1888.*

By ROBERT LAWSON, L.R.C.S.ED.,
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LECTURE II.—EPIDEMIC INFLUENCES (*continued*).

Small-pox.—The early part of this lecture was devoted to proving that small-pox, like fever, was under the influence of a pandemic factor which determined its development as an epidemic at some point in the first instance, and its subsequent extension to the northward in successive years. The illustrations given were mostly taken from the Indian returns, and such notices of its occurrence in Europe and America as gave specific information as to dates of commencement and decline of the disease, or statements of the deaths in particular years. Small-pox generally appeared in the southern part of Hindustan between the isoclinals 0° and 30° north in the first instance, and extended to the portion beyond the isoclinical 30° subsequently, varying in force in different parts of the country invaded in different epidemics, but still presenting a wave-like mode of progression in the same direction. Thus the epidemics reached a maximum in the Madras Presidency in 1868, 1872, 1877, and 1882; in the North-West Provinces and Bengal in 1869, 1873, 1878, and 1883; and in Punjab in 1870, 1874, 1879, and 1884. The want of information regarding Central Asia prevented the wave being traced further north; but in 1869 small-pox commenced at Marseilles, became epidemic in the north of France in 1870, in Holland and London in 1871, and in the north of England, Scotland, and Ireland in 1872; on the other side of the hemisphere, it could be traced in Teneriffe in 1870, and in the United States in 1871. The Madras epidemic of 1872, it was suggested, was part of the same wave which reached Western Europe and the United States in 1875.

Pandemic Waves.—Nothing, it was said, is known of the intimate nature of these pandemic waves, nor had any explanation been given as to why they should proceed from south to north. Further, the kind of fever developed, as it was assumed, under their influence varied very much at different periods, and this was enough to show that the pandemic wave of itself was insufficient to account for such varied results, and that recourse must be had to other factors connected with each locality for the time. With regard to intermittent and remittent fevers, the endemic sources of malaria must be all that was requisite in most cases; but with yellow fever and plague and some other fevers something else was necessary.

Yellow Fever.—An examination of the epidemics of yellow fever observed at Sierra Leone, where the ordinary fever is the remittent, led to the inference that the immediate exciting cause of the disease is generated by a special factor acting on a suitable locality in a place where the disease appears, and which is either absent or in abeyance during the intervening periods. And a more extended series of statistics showed that from time to time there is, over a varying extent of the earth's surface, an increased activity of the factors which lead to yellow fever, under the influence of which that disease becomes developed when local circumstances are suitable. Of these the most important were the state of the weather and the presence of a certain amount of moisture in the soil. Too much water or too little stopped the disease; thus at Sierra Leone, where the rainfall was heavy, the epidemics came in dry seasons; while at Goree and Senegal, where the climate was dry, the epidemics fell on years more than usually wet.

Plague.—A study of the reappearance of plague at various points where it had formerly been epidemic afforded some evidence as to the factors concerned in the production of the disease. Special reference was made to the cases of benign plague, described by Tholozan as preceding severe outbreaks of the disease. Though this sequence had not been proved to be invariable, it indicated the operation of a separate factor, concurring with the pandemic wave in those localities where that form of disease presented itself. It did not appear that plague was communicated from the sick to the healthy by contact, but that the danger really arose from remaining in an apartment occupied by the sick. Several authors who had personal experience of plague had described it as "a poor man's disease that never went upstairs" and the sufferers, in addition to deficient food, had inhabited apartments badly ventilated, and often in the most insanitary condition. Whether there were a specific factor required to excite the fully-developed disease, or whether that causing the benign form merely became intensified in certain localities, from circumstances existing temporarily, were points which must be left for future investigation, which the progress of bacteriology might hereafter facilitate.

ON A NEW METHOD OF STAINING SECTIONS OF THE CENTRAL NERVOUS SYSTEM.

By FRANK J. WETHERED, M.B. (LOND.), M.R.C.P.

I AM indebted to Dr. J. Pal, of the Pathological Institute in Vienna, for permission to publish a new method, recently introduced by him, for staining sections of the brain and spinal cord.

It is in reality a modification of the method first introduced by Professor Weigert, but differs from it in many particulars. Dr. Pal claims the following advantages for this modification: The picture produced is sharper in outline; the nuclei and nerve-cells can be separately stained, and the process is a more speedy one. Not the least advantage is that the treatment of the sections by a solution of the acetate of copper is entirely done away with. Having worked with both processes myself, I can fully confirm all that Dr. Pal states. Dr. Pal's method is as follows:—

The spinal cord or brain is hardened in Müller's fluid in the ordinary manner, and when ready is embedded in paraffin, and the sections cut into absolute alcohol. An aqueous solution of hæmatoxylin of the strength $\frac{1}{2}$ per cent. is then made by dissolving the hæmatoxylin by means of heat, and, after cooling, some alcohol is added. This solution must not be kept very long, or allowed to stand in the sunlight. Immediately before using, a few drops of a solution of carbonate of lithium are added; on the addition of this salt the solution assumes a violet red colour. Dr. Pal uses three or four drops of the lithium carbonate solution to 10 cubic centimètres of the hæmatoxylin. The sections are allowed to remain in this stain for about five or six hours, at the end of which time they should be of a bluish black colour; they are then thoroughly washed in water until no more colour comes out; if they do not appear to be deeply enough stained, a few drops of the solution of lithium carbonate may be added to the water in which they are washed.

The sections are next to be "differentiated;" for this purpose they are first placed in a $\frac{1}{2}$ per cent. solution of permanganate of potash for 15-20 seconds, and then for a short time into "Pal's solution," until the white and grey matters are plainly defined; this is generally completed in one or two minutes. If black specks are seen on the sections, or if the white and grey matters are not quite distinctly defined, the process is to be repeated. "Pal's solution" has the following composition: Oxalic acid, 1 part, sulphide of potassium (K_2SO_3), 1 part, distilled water, 200 parts.

After having been taken out of this solution, the sections are thoroughly washed in water, and the nuclei may then be stained in eosin or carmine, the stain which acts best being alum-carmine. After another washing the sections are dehydrated by absolute alcohol, cleared in oil of cloves or creasote, and mounted in balsam.

Stained in this manner, the medullated nerve-fibres are coloured blue, and stand out sharply on a white background, presenting a strong contrast to the red nuclei.

In order to bring out the nerve-cells prominently, after the specimens have been "differentiated" they are placed for a short time in picro-carmine, which should be only slightly alkaline, and, after being washed in water, the nuclei may be stained as before in alum-carmine.