Mania and Melancholia. By JOHN MACPHERSON, M.B., M.R.C.P.E., Medical Superintendent, Stirling District Asylum, Larbert.

The attention of those interested in mental diseases has lately been directed towards theories of the causes and origin of these diseases. In two recent works,* widely differing in scientific scope and aim, though respectively instructive and powerful, theories of the genesis of melancholia and mania based upon the latest psychological and physiological knowledge have been advanced. To my mind, these theories, though containing much statement that is incontrovertible, stop short of conclusive, satisfying argument. At the same time, I was much surprised to read the following remarkable passage in a review of Dr. Mercier's book in the pages of the last number of this Journal:—† "It is well to have a devout follower of Hughlings Jackson and Herbert Spencer, or, perhaps, one ought to have said a follower of Darwin and of evolution, giving his views upon mental order and disorder. . . . We ourselves are still inclined to believe in the unknowable." Is the clinical and scientific work of the past few years, based upon the writings of, to put them in their proper order, Herbert Spencer, Darwin, and Hughlings Jackson, to be undone and disregarded, and are we to calmly fold our hands and wait with the reviewer for a new revelation? It will be strange, indeed, if any future theory of "mental order or disorder" can exist without having to reckon with the theories of Herbert Spencer and of evolution.

Whatever views may be held on the subject of speculative theories in other branches of medical science, there can be no question as to their value in the study of mental diseases which occupy the border land, so to speak, between the palpable and the impalpable.

I commence, then, by considering, speculatively, these two forms of mental disease, mania and melancholia:—

I.—*From the chiefly psychological point of view.*

The origin of the two psycho-clinical factors which distinguish mania and melancholia from each other, viz., pleasure and pain, has been accounted for variously, the most

* "Text Book of Mental Diseases," by Dr. Bevan Lewis; "Sanity and Insanity," by Dr. Mercier.

† "Journal of Mental Science," Vol. xxxvii., p. 149.

currently accepted theory being that pain is the result of inaction and of hyperaction, while pleasure is produced by an intermediate state in which there is neither underaction nor overaction.* For instance, intense heat and intense cold both cause acute suffering, while a moderate warmth is pleasurable, and conduces to a physical well-being. Inaction of any organ, such as of the stomach in extreme craving for food, is painful; conversely, overaction due to the swallowing of too much or unsuitable food may also be painful; and we thus see that there are two kinds of pain, negative pain due to inaction, and positive pain due to overaction. Between these two extremes there is a wide range of indifferent and pleasurable states of feeling produced by the moderate action of the organism and by moderate stimuli from the environment. Further, inaction and negative pain imply a decrease of nervous energy or tension, while overaction or positive pain implies too rapid or too violent increase of nervous energy or tension. Between the two extremes, again, a moderate degree of nervous energy must be taken to mean the production of pleasurable or indifferent states of feeling.

The same variety that exists among sensations does not exist among emotions. There are really only two kinds of emotion—emotions of pleasure and emotions of pain—and the varieties of each only differ from each other in degree. Whatever sensory impressions produce mental depression, whether impressions having their origin without the organism or impressions of internal origin, painful emotions resemble each other closely, in fact, are in their nature indistinguishable; the same is true as regards pleasurable emotions.

In order fully to elucidate the significance of this important fact, it is necessary to reduce all cerebral phenomena as far as possible to terms of motion, and all cerebral physiology and anatomy to levels of evolution. When a ray of light falls upon the retina or a wave of sound on the tympanum the molecular motion of the impact is transmitted along the sensory nerves to the cerebrum. This afferent function is as essentially motor in its nature as any voluntary muscular act induced by efferent impulses from the brain. Histologically, then, the nervous system may be divided into recipio-motor, libro-motor, and dirigo-motor elements.†

* Herbert Spencer, "Principles of Psychology," Vol. i., p. 273.
† Herbert Spencer, *op. cit.*, Vol. i., p. 49.

In the performance of a reflex motion in a highly evolved nervous system the whole of the afferent impulse does not pass from the recipio-motor cell to the dirigo-motor cell, but a part of it passes upwards to a higher recipio-motor cell, thence to a higher dirigo-libro-motor cell of the same level, thus forming a higher arc charged with a surplus fraction of the nervous energy of the reflex act. This higher arc then becomes inhibitory or acceleratory in its relation towards the lower arc, in accordance with the new doctrine of Interference which has now greatly modified the old theory of Inhibition,* and it would seem in the highest levels to form the physical basis of the consciousness of the action. Where action is perfectly automatic feeling does not exist,† though where action is partly voluntary partly automatic it can be at any time represented in consciousness. Thus, for instance, the organic actions which have their centres in the medulla and pons are not ordinarily present in consciousness, whereas the partly-automatic partly-voluntary actions which have their seat in the motor cortex are capable at any time of becoming vividly conscious. There is a constant tendency for actions to become automatic, and consequently unconscious, and there is, therefore, an ever-increasing tendency for higher levels to become subordinate to still higher levels. This invasion of ever higher levels by automatism while consciousness ascends in proportionate advance is the true explanation of nervous evolution. It is maintained by some recent writers, pre-eminently by Dr. Mercier, that consciousness is the sum of the coenæsthesiæ, that is, of stimuli constantly received by the cerebrum from every part of the organism and from the environment through the organs of sense.‡ To render such a statement at all intelligible it is necessary to go a step further, and to assert that the coenæsthesiæ are collected into and united in one locality of the brain by means of centripetal nerve fibres. By a process of exclusive reasoning, we are almost compelled to relegate this locality to the region in front of the Rolandic area.

In a paper like this it would be out of place to enter into arguments to show reasons for supposing that the prefrontal lobes are the centres of conscious intelligence; their later evolution and the facts just stated regarding the functional evolution of the nervous system give countenance

* Lauder Brunton, "Pharmacology and Therapeutics," p. 167.
† Herbert Spencer, *op. cit.*, Vol. i., p. 478.
‡ "Sanity and Insanity," pp. 88 and 89.

to such a theory. The experiments of Ferrier* show that removal of the frontal lobes produces dissolution of the faculties of attention and observation. The pathology of secondary dementia, in the profoundest cases of which great atrophy of these lobes is found, goes far to prove it. I may also quote Dr. Hughlings Jackson, whose writings overflow with the idea,† as well as the opinion of Dr. Ross, who, in his work on the nervous system, goes so far as to locate the higher cognitions and emotions in the orbital convolutions of these lobes.‡

The nervous system is thus seen in the light of a mechanism for the transmission of molecular motion along certain tracks and under certain conditions. These conditions are the continual superimposition of controlling arcs culminating in consciousness. The continuous passage upwards of fractional currents arising from innumerable arcs forms a state of mind. There are two classes of currents, painful and pleasurable, and the preponderance of one or other arouses a corresponding mental state. The normal mental state is a neutral compound in which the aggregate of perpetually nascent pleasurable feelings is fused with the aggregate nascent painful feelings. This state of mind may be compared to white light, which, though composed of numerous colours, is colourless, while pleasurable and painful moods of mind may be compared to the modifications of light that result from increasing the proportions of some rays or decreasing the proportions of others.§ The painful impression conveyed along a recipio-motor nerve, say, either of sight or hearing, passes from the sensory area to the conscious area (whether it is strong enough to cause a reflex discharge or not) as an upward escape from its current, and produces a painful emotion. This emotion of pain is, as I have already indicated, almost identical with every other painful emotion in its character. It is vague, undefinable, and, like the visceral sensations, inchoate. This psychological phenomenon has been explained by Mr. Herbert Spencer to be due to the fact that neither emotions nor visceral sensations cohere readily with one another.‖ It tends still further to resemble previous painful emotions, in so far as it stirs up kindred groups of feelings, as Mr. Darwin puts it

* "Functions of the Brain."
† See, *e.g.*, "British Medical Journal," Vol. i., 1890, p. 704.
‡ "Diseases of the Nervous System."
§ Spencer, *op. cit.*, Vol. i., p. 602.
‖ *Op. cit.*, Vol. i., p. 187.

in his definition of the third law of associated and serviceable habits. "When the sensorium is strongly excited, nerve force is generated in excess, and is transmitted in certain definite directions, depending on the connections of the nerve cells and partly on habit."* The discharge of molecular nerve energy tends to pass along the lines of least resistance, and it may be taken as an axiom that the lines of least resistance lie towards the organized nerve tissue which forms the physical basis of allied groups of feelings. In the case of depressed emotion, therefore, the lines of least resistance to nervous energy would be in the direction of arousing the emotions of fear and terror. These emotions are so organized in the life of animals that conduct under their influence can only be described as automatic. The chief psychological result of their action on the organism is to produce introspection by throwing into prominence the personality of the organism and the danger threatening it to the exclusion of almost everything else. As Dr. Bevan Lewis puts it, there is an increase in subject consciousness, and a corresponding decrease in object consciousness.† We thus come to recognize that "there must be a psychological no less than a physical continuity throughout the length and breadth of the animal kingdom." ‡

What has been asserted as to pain holds equally good of pleasure. A pleasant perception yields a pleasant emotion, in precisely the same way as a painful perception yields a painful emotion. While the perception may be clear and defined the emotion is always vague and undefined, and on account of its very vagueness resembles generally every other pleasurable emotion. It tends also to arouse kindred emotions of pleasure. Thus the pleasurable emotion caused by the acquisition of wealth arouses that of self-esteem.

All pleasurable emotions, like all painful emotions, tend towards enlarging the personality of the individual, towards an increase of subject consciousness with a corresponding decrease of object consciousness. When the painful and pleasurable feelings are properly balanced, proportionately admixed, and reflected on the screen of consciousness, the ordinary every-day conscious personality of the individual is attained. In this connection there are one or two important considerations to be mentioned. (1) In a

* Darwin, "Expression of the Emotions," p. 30.
† "Text Book of Mental Diseases," p. 116.
‡ Romanes, "Animal Intelligence," p. 7.

healthy individual the pleasurable feelings are vastly more numerous than the painful feelings for the normal organic actions are attended by pleasure. (2) On the other hand the painful sensations are more intense than the pleasurable, consequently their channels are more permeable, they easily pass into consciousness, and readily arouse kindred emotions. (3) It follows as a corollary to the two preceding propositions that when nervous pressure falls to a low ebb, as at certain hours of the day or night, or in certain conditions of the organism or of the environment, the faintly permeable tracks, though more numerous, offer more resistance to the passage of the molecular nervous motion. The more permeable painful paths afford a greater facility for the transmission of nervous energy; therefore, when nervous pressure decreases, the balance is disturbed, and the painful feelings tend to predominate.

It has now been shown how, by an access of painful or of pleasurable emotions, the *ego* is prominently augmented in consciousness. The bearing of this fact upon insanity is very important. We have seen that a painful perception causes a painful emotion. That depressed emotion in its turn arouses the elements of the emotion of fear, and the latter emotion has, through innumerable generations, become one which disturbs the judgment by diverting, for purposes of self-preservation, the circulating nervous force which is necessary for the maintenance of the association of ideas and conduct. Similarly pleasurable emotions increase subject consciousness at the expense of judgment by dissipating through numerous channels molecular nervous energy, and by arousing kindred emotions of a less intense order, and raising them to an importance which is unreal. Comparisons resulting from long experience are thus disturbed. Therefore, it may be generally stated that *emotions always disturb judgment and that the more powerful the emotion is, the more serious the interference with the power of judging.* This is verified by what we actually find to be the case in insanity. The first stage of all insanities is characterized by a more or less powerful emotion; the second stage by an affection of the inter-relational elements of mind.

II.—*The physiological aspect.*

Regarding all nervous actions in terms of motion we are faced with the difficulty of understanding what probable

changes take place in the nervous system during the reception of painful or pleasurable feelings. I shall begin with painful emotions. As an illustration of the second of his laws of serviceable associated habits—the principle of antithesis—Mr. Darwin describes the appearance of a favourite dog when taken out for a walk. The dog trotted gaily in front, with his ears and tail erect, in a state of great nervous and muscular tone. Whenever he observed his master entering a hot-house, in which he was accustomed to spend much of his time, the animal's whole aspect changed. The expression was so ludicrous that it was known in Mr. Darwin's household as the dog's "hot-house face." "This consisted in the head drooping much, the whole body sinking a little and remaining motionless, the ears and tail falling suddenly down, but the tail was by no means wagged. With the falling of the ears and of his great chaps, the eyes became changed in appearance, and I fancied that they looked less bright. . . . Had not the change been so instantaneous I should have attributed it to his lowered spirits affecting, as in the case of man, the nervous system and circulation, and consequently the tone of his whole muscular frame."* There could hardly be a better description of nervous shock produced by depressed emotion. When Darwin wrote the last sentence of the paragraph I have quoted he could not have considered the rapidity of nervous action. As soon as the animal had perceived the unpleasant reality, nervous shock resulted as quickly, though less intensely, as it would have done in concussion of the brain from external violence.

M. Feré points out that different sensory stimuli affect consciousness differently. Thus the stimulus of heat, of light, or of electricity increases the energy of movement and shortens the reaction time. Darkness, in perfectly normal subjects, determines a prolongation of the reaction time to the extent of an excess of a quarter or even of a third of the normal. He justly concludes, "Cette modification de l'energie et de la rapidité des mouvements est en rapport avec des modifications de la circulation et de la nutrition. J'ai dejà rapporté des experiences nombreuses qui mettent en lumiere la relation qui existe entre l'état de la nutrition et l'activité de phenomenes psychiques."† Any explanation

* "Expression of Emotions," p. 62.

† "Note sur le physiologie de l'attention rendue à la Société de Biologie," 26 Juillet, 1890, p. 2.

of nervous action in such cases must be merely hypothetical. We know that the proportion of solids to fluids in the composition of grey nervous matter is twelve per cent., while in white nervous matter it is up to or beyond twenty-five per cent. The inference, as stated by Mr. Herbert Spencer,* is that the molecular change in the nerve-cell during nervous action is attended by chemical decomposition, while in the nerve-fibre the change only amounts to isomeric transformation of molecules. The theory is still further strengthened by the extensive blood and lymph systems which permeate the grey matter for the removal of its waste products and the reconstruction of its elements after decomposition. That under the strain of excessive action these waste products are enormously increased, and that the lymph connective elements increase *pari passu* for the purpose of removing them has been shown by Dr. Bevan Lewis.† Any disturbing agency then will cause a decomposition of cell contents and an isomeric change in certain nerve-fibres. An emotion of tolerable intensity produces a manifest physical result, a painful emotion produces one train of bodily symptoms, a pleasurable emotion causes equally distinct but different symptoms.

The physical symptoms, which follow a painful emotion, are as follows :—(1) A diffuse, partially unregulated discharge of nervous energy passes from the cerebrum to all parts of the body. (2) There is a vaso-constrictor action produced upon the arteries generally, excepting perhaps those of the abdominal viscera.‡ (3) There is inhibition of the heart's action. (4) The circulation of nervous energy tends to limit itself to the special emotional tracks, and to be transmitted to permeable kindred channels. (5) Owing to the inhibition of the heart's action and the vaso-motor influence upon the cerebral circulation, the removal of waste products from the grey matter of the nervous system, and the reconstruction of libro-motor elements can only be tardily and imperfectly accomplished, and there is thus a failure in the reproduction of nervous energy. Nerve fibre, as well as nerve cell, requires for its perfect working sufficient heat and nourishment, and there is thus a failure in rearrangement of molecules. Nervous energy will not travel continuously along a fibre, but interruptedly, owing to the necessity there is for appreciable time being given for the readjustment of

* *Op. cit.*, Vol. i., p. 21. † *Op. cit.*, pp. 83 and 84.
‡ Foster's "Physiology," Ch. iv., *lib.* i.

molecules after isomeric alteration. It is unnecessary to quote authority for the purpose of establishing the fact that the process of liberating molecular nerve motion from the central nerve system requires (*a*) a sufficient pressure of nerve force in the highest centres, and (*b*) a supply of pure blood, with sufficient *vis a tergo* for the removal of waste products. (6) The action of the emotion of fear upon the sphincters is more obscure, but it is most probably due to the primary diffuse nervous discharge inhibiting the lumbar centres, from which the sphincters receive tonicity.* This view is maintained by the fact that the relaxation is early in time, instantaneous, and very transient.

The concomitant physical symptoms of pleasurable emotion are in most respects nearly opposite to those of painful emotion. They are briefly (1) a diffuse discharge of nervous energy from the centres; (2) a vaso-dilation of the arteries; (3) an increase in the number and the force of the heart's beats; (4) a vastly wider circulation of cerebral nerve energy, owing to the fact that pleasurable associations preponderate so greatly in the coenæsthesia. (5) The foregoing conditions afford the greatest facility for the reproduction and transmission of nervous force to all parts of the organism for the removal of the waste products of nervous metabolism, and for the nutrition and building up again of the discharging libro-motor elements. These conditions constitute the cause of the physical manifestations of the emotion of pleasure—the muscular tone, the energy, the bright complexion, the glistening eye. They also enable us to understand better the antithetical states caused by the emotion of pain or of fear.

III.—*The pathological aspect.*

An emotion is generally regarded as morbid when it is (1) of extraordinary intensity; (2) when it arises without what is known as adequate cause, that is, without any originating circumstance in the environment; (3) when it is indefinitely prolonged.† These three characteristics of morbid emotion generally coexist.

First, with regard to depressed emotion, I have already dwelt on the fact that low, nervous tension produces depressed feelings. Therefore any cause that affects the reproduction of molecular nerve energy or that interferes with the transmission of that force will cause melancholy.

* Foster, *op. cit.*, p. 880. † *Vide* Clouston, "Clinical Lectures," p. 30.

We know that each of the two forms of emotion has its complementary vaso-motor change, and that so long as the emotion lasts there will be a tendency for the vaso-motor condition to persist. Physiologically the order of the causative events in the production of the physical and other symptoms of emotion are—(*a*) perception, (*b*) emotion, (*c*) vaso-motor and cardiac affection, (*d*) nutritive changes. Pathologically it is very important to observe that it is necessary to assign a different order to the causes of events. They should rank thus—(*a*) nutritive changes, (*b*) emotional condition, (*c*) vaso-motor and cardiac affection, (*d*) secondary nutritive changes. There are four manifest ways in which nutrition can affect cerebral action—(1) either the blood is insufficient in quantity, or (2) it is deficient in nutrient qualities, or (3) it is toxic, or (4) there is auto-toxicity due to the imperfect metabolism existing between the cerebral cells and the albumen of the blood and the consequent formation of poisonous compounds. Examples of the first two conditions, insufficiency of blood supply and deficiency in its nutrient qualities, have long been recognized as promoters of weak and defective cerebral action as well as of depressed emotional conditions. They are, moreover, commonly induced as secondary nutritive changes in prolonged cases of insanity. The third and fourth conditions demand more attention.

Toxicity of the blood is probably much more commonly than is supposed a factor in the production of depressed feelings. The introduction into the circulation of nervous depressants such as hyoscine, belladonna, and nicotine, causes immediately a lowering of nervous and muscular tone. The lowness of spirits and prostration which is experienced in the ordinary forms of blood-poisoning and in fevers is evidence of a similar kind. There is no more suggestive form of mental depression than that which results from jaundice. There are many individuals otherwise sane in whom the advent of a severe bilious attack, with pigmentation of the skin, causes delusional melancholia. It is very important to remember what has been pointed out by Murchison, that cerebral symptoms of hepatic origin do not depend upon the amount of skin pigmentation, that they do not necessarily occur in cases where the blood is loaded with all the elements of the bile for long periods, and that they sometimes occur in diseases of the liver where little or no visible pigmentation is present. It must, therefore, be con-

cluded that these symptoms are due to toxicity, the result of the products of faulty albumen disintegration, in other words, to the presence in the organism of poisonous leucomaines. The knowledge which is daily increasing as to the production of ptomaines and leucomaines in the normal metabolism of the body cannot be very much longer disregarded by cerebral pathologists. The analogy existing between the action of drugs and that of ptomaines is suggestively forced upon our attention. The vegetable alkaloids, ether, chloroform, and the mineral acids, undoubtedly act upon the nervous system by their power to affect the metabolism of albumen. "We need not," says Mr. Herbert Spencer,* "suppose the anæsthetic or narcotic to have more affinity for the protein substances of nerve corpuscle or nerve fibre than for the other forms of protein substance which it comes in contact with; but its effect is comprehensible as resulting from the structural relation of nerve corpuscle and nerve fibre." May we not safely go a step further and assert† that the selective affinity of these substances for particular nerve centres is for the same reason due to the particular structural relation of nerve corpuscle to nerve fibre within these centres.

This leads up to the still more interesting, though more obscure, subject of cerebral autotoxicity. It was first put forward by Hughlings Jackson in the West Riding Asylum reports as a practical theory, which he practically verified by the results of his treatment of epilepsy. He argued that certain cerebral cells took on a faulty nutrition, whereby (as I understand it) they produced and assimilated a highly explosive compound of nitrogenous metabolism. No better substantiation of such a theory could in the present state of our knowledge be afforded than the cure of limited epileptiform spasms by the excision of such morbid cerebral cells.‡ Within the past six months startling confirmation of the presence of such an explosive material in the blood has been demonstrated by Mon. Ch. Feré.§ He has made experiments which appear to prove that the urine of epileptic patients excreted immediately previous to the fit produces convulsions when injected into the circulation of the lower animals. There is good reason for supposing that these toxic substances are the results of the product of faulty cerebral metabolism, and

* *Op. cit.*, Vol. i., 632.
† This is still further in accordance with the doctrine of Interference.
‡ See Victor Horsley's Article, "British Med. Journ.," Vol. i., p. 1286 (1890.)
§ "Note rendue à la Société de Biologie," 1890.

of the trophic interaction which exists between the nervous system and the ferment historzyme which Schmiedeberg has shown to exist in the blood for the purpose of decomposing albumen.* Just as the bacillus becomes poisoned by its own ptomaine, or the yeast plant by the product of its own fermentation, so the morbid brain cell is poisoned by the product of nitrogenous metabolism, and, as in epilepsy, the morbid cell itself suffers first and most severely. It is more than probable that each stage in the disintegration of albuminous compounds in the system is attended with the production of a leucomaine or ptomaine, more or less poisonous. Dr. Lauder Brunton has pointed out the extreme toxicity of peptones, and has shown that the feeling of ill-being, lassitude, and depression of spirits in certain cases of inaction of the liver is due to the passage of peptones into the circulation. We may suppose, indeed we have good reason for believing, that the proteid molecule has certain lines of cleavage, "along which it breaks when certain forces are applied, and that the resulting fragments have also lines of cleavage, along which they break under certain influences, and so on until the end products, urea, ammonia, water, and carbonic-acid gas, are reached; also that some of these intermediate products are highly poisonous compounds has been abundantly demonstrated." † Selmi,‡ in his researches upon the discovery of ptomaines in the secretions and excretions of patients labouring under distinct pathological symptoms, found that the urine of a patient labouring under progressive paralysis contained two poisonous bases, strongly resembling nicotine and coneine.

The symptoms produced upon the lower animals by the action of the ptomaines of the choline group so strikingly resemble certain forms of mental disease, chiefly melancholia and stupor, that I cannot refrain from referring to them. At the same time, I am undesirous of being supposed to be attempting to do more than indicate generalities. The choline group includes choline, neurine, betaine, and muscarine. They have the general chemical formula, $N(CH_3)3OH$. The only member of the group which is not actively poisonous is betaine. The two first named members of the group, choline and neurine, are invariably

* Lauder Brunton, "Pharmacology and Therapeutics," p. 76.
† Novy and Vaughan, "Ptomaines and Leucomaines," p. 289.
‡ Mem. to Academy of Science, Bologna, 1880.

found together when they exist in animal tissues. They are more or less readily formed by the decomposition of lecithin, and it is very significant that lecithin is most abundantly formed in fresh brain tissue.

"It is equally well demonstrated that similar bases [to choline] do pre-exist in the physiological condition of the tissues and fluids of the body."*

Second, with regard to exalted emotion. The same series of causative events, which were described as occurring in melancholia, exist in mania, and as in the case of melancholia, the primary nutritive condition demands chief attention. If a product in the stage of disintegrating albumen, or a resultant or concomitant ptomaine or leucomaine of that disintegration, can produce epilepsy or melancholy, there is no reason why a similarly produced, but differently constituted, compound should not cause mental exaltation. We have the analogy of the power of the product of the yeast plant to cause intoxication and elevation of spirits. Certain alkaloids have also this power. There are two groups of ptomaines formed in the body during the normal metabolism of nitrogenous material: (1) The uric acid group, of which ten alkaloids have been separated and tested; (2) the creatinine group, which contains about six known alkaloids. The action of the alkaloids of these two groups may be said to range from muscle (cardiac) stimulants up to convulsants.

As to the character and effect upon the organism of ptomaines produced during normal nitrogenous metabolism we as yet know nothing, and we can only speculate.

A few words on the inferences to be derived from the modern methods of treatment. According to the foregoing theory the essential factors in the production of mental disturbance are: (1) The presence in the blood of an unnecessary proportion of unstable nitrogenous material; (2) a failure on the part of certain nervous elements to correlate properly in the process of metabolism of nitrogenous compounds; (3) a consequent auto-intoxication of nervous elements; (4) the establishment of a tendency in the cell towards morbid periodicity.

Modern treatment has been successful in modifying nervous disturbances by reducing the supply of highly nitrogenous food, and substituting a chiefly farinaceous dietary. In this way the morbid tendency of nervous cells has been

* Novy and Vaughan, *op. cit.*, p. 284.

limited. The autotoxic effect of peptones, with its train of disagreeable symptoms, ceases to occur when the patient is fed upon farinaceous food.

Dr. Hughlings Jackson has by the same means derived the greatest assistance in his treatment of epilepsy. The beginning and the end of cerebral cell degeneration, as described by Dr. Bevan Lewis,* in his recent work, is "fatty degeneration." It is not, I think, taking too much for granted to attribute these universal fatty changes to hyper-nitrogenous nutrition.

We cannot help discerning, though as yet dimly, that the neurotic constitution, owing, most probably, to defective trophic energy, is liable to be perniciously influenced by some of the numerous transformations to which nitrogenous material is subjected within the body. The points which I have endeavoured to sustain I shall now summarize under the following heads: (1) I have shown that perceptions and ideas, however varied in their origin and character, produce only two classes of emotion, viz., emotions of pleasure and emotions of pain. (2) That these two emotions cause, physiologically, two antithetical trains of bodily symptoms, especially distinct vaso-motor changes. (3) That an emotion, whether morbid or natural as regards origin, always tends to disturb judgment. (4) That as depressed feeling or exalted feeling can, by the use of drugs, be artificially produced by affecting the metabolism of albuminous material within the organism, there is ground for supposing that nutritive changes initiate the symptoms which we recognize as constituting morbid mental depression and morbid mental exaltation. (5) We know that poisons developed within the system in certain morbid conditions have the power, at any rate, of producing mental depression and mental excitement. (6) There is authority for believing that certain ptomaines produced within the human organism have the effect, when injected into animals, of causing convulsions or stupor or depression of spirits or stimulation of the muscular and vascular system. (7) There is abundant clinical experience in favour of the fact that highly nitrogenous nutrition invariably tends towards exacerbation and recurrence of the mental neuroses.

* *Op. cit.*, pp. 471 *et seq.*