

Critical Review.

VAGOTONIA.

BY ALFRED CARVER, BIRMINGHAM.

EVER since Beard's work on 'neurasthenia', neurologists have been endeavouring to separate out from the motley mass of nervous disorders which carelessly are included under this all-embracing term, various symptom-complexes each having a definite etiology, and to which therefore a more rational therapy might be applied. Janet first rescued psychasthenia from this diagnostic waste-paper basket, and later observations have already succeeded in further subdividing it. Freud also insisted upon the propriety of separating from neurasthenia a definite symptom-complex, to which he gave the name 'Angstneurose'. More recently Eppinger and Hess have attempted to separate out another definite neurosis, the manifestations of which they ascribe to increased activity, either absolute or relative, of the parasympathetic or extended-vagus system. This they have described under the caption of vagotonia. They consider it is a constitutional condition correlated to abnormalities of the endocrine and sympathetic system.

Before proceeding to a more detailed examination of this hypothesis, it will be well to call to mind briefly our knowledge concerning the vegetative or involuntary nervous system. This knowledge, mainly the result of researches by the Cambridge school of physiologists, is based upon anatomical, physiological, and pharmacological evidence. Anatomically and histologically the vegetative system cannot readily be distinguished from the sensorimotor system. Centrally their nuclei lie close to one another and are intimately connected by anastomoses. The principal difference lies in their peripheral make-up.

In the words of Gaskell, "The involuntary nervous system is built up on the same plan as the voluntary, with receptor, connector, and excitor elements. The marked difference is that the excitor elements have left the central nervous system and become peripheral, forming various ganglia throughout the body". Langley, for topographical reasons, divides these into ganglia of the first, second, and third order, and has shown experimentally that nicotine, which does

not affect the psychomotor nerves, blocks the passages of impulses through these ganglionic stations. The receptor elements of the involuntary system are in the same position—posterior root ganglia—as those of the psychomotor system, and, though functionally distinct, cannot histologically be differentiated from the latter. The anatomical difference in arrangement in the two systems corresponds to a difference in function. The sensorimotor system is designed for accurate local reflexes, while the involuntary system is adapted to produce widespread and diffuse effects. The vegetative system itself is divisible into two main groups: (1) The sympathetic proper, making central connections from the first dorsal to the third lumbar segment of the cord, and distally forming the sympathetic cord; (2) The parasympathetic system, connecting with the midbrain, medulla, and sacral region, but not coming into relation with the sympathetic cord. All vegetative organs are supplied by nerves from both of these groups. Anatomically the nerves of supply from the two groups are commingled, so that we must rely upon physiological and pharmacological means for their differentiation. So far as physiological differentiation is possible, investigation by electrical stimulation shows that in many organs the effects produced by stimulating the fibres of one group are opposed to those produced by stimulation of the others. Sherrington's law of reciprocal innervation of antagonistic muscles certainly applies to the involuntary system, as was originally demonstrated by Gaskell. In this sense the two groups may be considered as antagonistic in their action. Eppinger and Hess, however, assume an absolute antagonism between the two systems, and disregard all other evidence in favour of pharmacological results. This, as we shall see later, introduces certain inconsistencies and can only be accepted with reserve. It is generally conceded that adrenin acts solely upon the sympathetic system, and that its action is identical with stimulation of the sympathetic. No similar substance has been isolated from the body in connection with the parasympathetic system; but Eppinger and Hess postulate the existence of a hypothetical hormone (to which they give the name *autonomin*) having the same relation to the parasympathetic or extended-vagus as has adrenin to the sympathetic system. Although no such substance has been discovered, we possess in certain drugs such as pilocarpine, physostigmine, and muscarine a substitute for it. Generally speaking, these drugs produce effects experimentally similar to those obtained by stimulation of the extended-vagus system. Yet here we meet with one of the difficulties previously referred to; for these drugs stimulate also the sweat glands, which upon anatomical and physiological grounds would appear to be innervated by the sympathetic. Eppinger and Hess, however, prefer to rely on pharmacological tests,

and point out that adrenin abolishes the secretion of the sweat glands. In further justification of their attitude they quote the work of Frölich and Loewi, and of Biedl, which points to a general antagonism between the two parts of the vegetative system. This work also shows that, while adrenin apparently acts equally on all sympathetically innervated organs, drugs taking the place of their hypothetical automin have a markedly selective action upon different branches of the 'vagal' system. Thus, for example, pilocarpine acts particularly upon secretory fibres and but slightly upon the heart. The acceptance of the pharmacological test as supreme also introduces difficulty in the matter of the vasodilator fibres and some other minor points, but on the whole the several functions of the systems as determined by this method correspond to those obtained by the physiological.

With regard to the fundamental hypothesis of 'tone' in the autonomic system, we know that the output of adrenin into the blood is constantly maintained, and exercises a tonic influence upon sympathetically innervated organs. Now Eppinger and Hess argue that although there is no proof of the existence of a specific analogue to adrenin, yet certain physiological and pathological evidence is conclusively in favour of the presence of vagus tone. The increase of cardiac action after paralysis or section of the vagus, together with much similar evidence, goes to support this hypothesis. They agree that tonus and irritability are not identical—thus physostigmine increases only the irritability of the vagus, while muscarine raises the tonus—but they draw no clear distinction between these two states. The hall-mark of the 'vagotonic' is that he shows manifestations attributable to a functionally high tone and increased irritability of the whole 'system of the extended vagus'. Eppinger and Hess go further, however, in postulating that the vagotonic has as an associated condition a decreased sensitiveness to sympathetic stimuli. They state explicitly that "increase of tonus in one system almost rules out an increase of tonus in the other". Later, we shall meet with inconvenient exceptions to this postulate. They find that, in general, individuals who show a great sensitiveness to adrenin are relatively tolerant of pilocarpine, and vice versa; hence "there must be a pharmacodynamic antagonism". It is with regard to the acceptance of this postulate of strict antagonism between the two systems that most reserve is called for. Not only are there individuals who show a high degree of sensitiveness to both classes of drugs—sympathicotropic or vagotropic—but the two systems may be thrown into activity together both in health and disease. Thus, physiological secretion of saliva is brought about by activity of the two systems, sympathetic stimulation producing a viscid secretion, parasympathetic stimulation a fluid one. From the pathological side, an increased activity of the

whole vegetative system is exemplified by most cases of exophthalmic goitre.

Clinically the picture of the vagotonic is as follows:—Typically the patient is young or below middle age. His appearance is that of a 'nervous invalid'. His skin is blotchy, changes rapidly from a flushed to a pale coloration, sweats readily, and has a greasy look. His extremities are cold, clammy, and cyanotic. He is under-nourished, but shows hyperplasia of the adenoid tissues. His lips are thick, his tongue is large and fissured, his palate is narrow and high-arched. He is constantly swallowing, because his salivary secretion is excessive. His respiration is shallow and irregular. These characteristics produce in the aggregate rather a curious picture, and one is not surprised that Eppinger and Hess can sometimes recognize a vagotonic as he enters the room. In spite of all the discomfort, not to say disability, which the above list of peculiarities might seem to imply, the patient's complaint is of something which does not appear to be connected with any of them. Most commonly the complaint is "a feeling as if the heart might suddenly stop". Another common complaint is a feeling of distention in the stomach soon after beginning a meal. Excessive sweating and a number of trivial neurotic symptoms may also be troublesome. Although the patient does not draw attention to many of the vagotonic signs present, these are easily disclosed by careful questioning and examination. They are all explainable in terms of increased activity of the parasympathetic; they are intensified by the diagnostic employment of pilocarpine, and relieved by the administration of atropine.

Occasionally one meets with patients who make complaint of more frankly vagotonic symptoms such as asthma. On the other hand, the experimental injection of pilocarpine may disclose, in apparently normal individuals, a latent hypersensitiveness of the 'vagal' system. When the history of such individuals is carefully gone into, one generally discovers that in childhood they suffered from convulsions, laryngismus stridulus, nocturnal enuresis, spastic constipation, or enlarged tonsils and adenoids.

All vagotonic symptoms being intensified by the administration of vagotropic drugs such as pilocarpine, it is only reasonable to expect that they will be diminished or cured by atropine. This expectation frequently is realized, and herein, even if for no other reason, the clinical recognition of vagotonia is justified. Eppinger and Hess urge that "the harmlessness of atropine demands that it be used more extensively", . . . especially "if, combined with those various obscure and troublesome complaints which, due to lack of anatomical basis, are called 'nervous', a patient is found with signs of a vagotonic constitution". If the postulate that vagotonia is associated with

sympathetic inhibition be remembered, we may also seek to combat the conditions by raising the tonus of the sympathetic system. This we achieve in certain cases, e.g., spasmodic asthma, by the administration of adrenin. Thus, whatever may be urged against the underlying hypotheses, their cautious provisional recognition is of value in clinical medicine. We cannot help noting, however, that in all the efforts to separate out from 'neurasthenia' symptom-complexes which depend upon actual neurosis, the psychic factor is not sufficiently taken into consideration. Even Freud, in his paper upon 'Angst-neurose' in 1895, described the "bestimmtem Symptomen-komplex" as an actual neurosis originating from physical tension, and having no psychogenesis. This idea has subsequently been modified, and though the concept remains a valuable one, it is now generally recognized that even where physical factors appear to be primary, psychic ones which cannot be neglected come into play. It is the overlooking of this fact which constitutes the most disappointing feature in the work of Eppinger and Hess, particularly that part which treats of vagotonia as a definite neurosis. True, when at a loss to account for certain phenomena inconvenient to their hypothesis, they are led to dismiss them as due to an associated psychosis, but they pursue this promising idea no further. So convinced do they feel that "the real etiology of vagotonia must be sought in some disturbance of internal secretion", that they entirely lose sight of the influence of the mind upon all secretion, though the researches of Pawlow and of Cannon, which are pertinent to their theme, should have saved them from this oversight.

So far we have been dealing with vagotonia as a definite neurosis; but Eppinger and Hess, in seeking to apply their hypotheses to the elucidation of other morbid conditions, wander over the whole field of medicine. They endeavour to explain in terms of the vegetative constitution those variations in symptomatology which are met with in other diseases. The picture of a pathological process receives, according to this view, its colouring from the type of vegetative activity predominant in the individual. Could this be successfully maintained, a great many of those characteristics of a particular course of a disease which at present are dismissed as dependent upon idiosyncrasy would receive a more scientific and practically valuable explanation, as due to a lack or excess of a definite nervous disposition of the organism.

We cannot follow Eppinger and Hess through the wide discursions which, in working out this idea, they permit themselves. But let us take *tabes dorsalis* as an example. How is it that in some tabetics visceral crises are so prominent, in others entirely lacking, while in yet a third group there is visceral analgesia? "It is not difficult to

show", state Eppinger and Hess, "that the crises themselves are signs of vagal irritation". The narrowing of the pupil at the onset of the attack, the subsequent gastric hypersecretion, the increased peristalsis and sweating, together with other phenomena, all point to this etiology. The entire absence of crises, then, is attributable to the presence of an underlying sympathicotonic disposition. Visceral analgesia, so complete as to mask severe abdominal lesions such as a perforated gastric ulcer, is to be accounted for by the assumption that paralysis and degeneration of the parasympathetic nerves have succeeded a state of irritation. Thus the variation of this symptom in tabes is due to a specific action of the toxic agent upon the parasympathetic system; and crises are prominent or absent according to the functional condition of the system. The attempt to apply these principles to Graves' disease gives rise to considerable difficulty, symptoms referable to increased activity of each part of the vegetative system being simultaneously present. Eppinger and Hess endeavour to overcome this difficulty by recognizing three types of the disease: (1) A pure vagotonic type, the symptomatology of which is explicable by assuming that hyperthyroidism is exerting its influence upon a vagotonic constitution. (2) A pure sympathicotonic type brought about by hyperthyroidism in a constitutionally sympathicotonic individual. Both these types, they admit, are rare. (3) Should the individual have been neither vagotonic nor sympathicotonic before the onset of the disease, the thyroid secretion, since it affects both systems, will cause symptoms of irritation to both. Eppinger and Hess seek to dispose of this admittedly weak point in their argument by acknowledging that during psychic disturbances over-activity of both parts of the vegetative nervous system may be demonstrated, and they therefore consider it legitimate to allow the same powers to disturbance of the thyroid.

Here, however, we find ourselves in no-man's-land, and are reminded of the close association between Graves' disease and 'anxiety neurosis' to which reference has already been made. Stoddart affirms that the two conditions differ by only one, or at most two, symptoms, and that both conditions are curable by psycho-analysis. Crile asserts that he has never known a case of Graves' disease which was determined by physical factors unattended by psychic strain. It is precisely in this borderline region that the intimate interconnection between the vegetative, the sensorimotor, and the psychic levels of nervous systems is most insistently forced upon our attention. Thus a disturbance at the psychic level may show its effects not only at this level as psychasthenic phenomena, but may descend to the sensorimotor level as a conversion-hysteria, or to the vegetative level as diabetes, Graves' disease, or spasmodic asthma. At the vegetative

level the outlet may be either on the sympathetic or parasympathetic arm of the balance of chemical integration. Now Eppinger and Hess seem to say that, according as the symptom is on the one or the other arm of the vegetative system, the individual has a sympathicotonic or a vagotonic disposition. Actually, however, they do not suggest this, for they have approached their problem too much from the opposite aspect, and have tended to regard their patients merely as test-tubes in which certain pharmacological reactions may be observed.

Hitherto, psychological explanations of the neurosis have been, from the therapeutic point of view, the more helpful. But we may look forward to a time when, as a result of further advances in endocrinology and the study of vegetative neurology, the underlying physical factors in the psychoneurosis will be more clearly understood and therefore more vulnerable to our therapy. The attempt of Eppinger and Hess to throw light upon that obscure but enormously important factor which we call 'constitutional disposition' marks another, and it seems to us a suggestive and valuable, step in this direction.

BIBLIOGRAPHY.

- BIEDL, *Internal Secretions*, 2nd ed., 1914.
 CANNON, *Bodily Changes in Pain, Hunger, Fear, and Rage*, London, 1915.
 CRILE, *Man an Adaptive Mechanism; The Origin and Nature of the Emotions*, Philadelphia and London, 1915.
 EPPINGER and HESS, *Zeits. f. klin. Med.*, lxxvi, lxxvii, lxxviii; *Wien. klin. Rundsch.*, No. 47; *Sam. k. Abhand. Pathol. u. Therap. d. Stoffwechsel u. Ernährungsstörungen*, Berlin, 1910; *Nervous and Mental Disease Monograph Series*, No. 20, New York, 1915.
 FREUD, *Ueber die Berechtigung von der 'Neurasthenie' einen bestimmten Symptomen-komplex als 'Angstneurose' abzutrennen*, Vienna, 1895.
 FRÖLICH and LOEWI, *Arch. f. exper. Pathol. u. Pharmakol.*, lix.
 GASKELL, *The Involuntary Nervous System*, London, 1916.
 HIGIER, *Vegetative Neurology*, Eng. trans. by Kraus, 1919.
 LANGLEY, *Schäfer's Text-book of Physiology*, Edinburgh, 1900, ii.
 STODDART, *Mind and its Disorders*, 3rd ed., London, 1919.
 PAWLOW, *The Work of the Digestive Glands*, Eng. trans. by Thompson, 1910.