Reviews and Notices of Books.


This closely written, finely illustrated and logically arranged volume represents the culmination of a series of physiological researches prosecuted for fifteen years by Professor Magnus, largely in collaboration with a number of distinguished colleagues, to whom a handsome tribute is paid in the introduction. These investigations have long been familiar to the physiologist and neurologist in the pages of various scientific journals, but it is an immense advantage to have not merely a complete revision and representation within the limits of the volume under review, but also the addition of the most recent discoveries along the lines the author has set out for himself, and, in particular, the résumé of such applications of his physiological principles to clinical cases as have already been made.

The subject-matter of the monograph is, in a word, the study of the posture of the body, its maintenance, its response to stimuli that disturb it, its behaviour in normal and abnormal circumstances. Experimentation has served to demonstrate the extreme complexity of the mechanisms involved, and the patient analysis of the different factors and the allotting of specific functions to specific mechanisms is indeed a fascinating chapter in the history of experimental physiology. For the purpose of this investigation Professor Magnus has dealt largely with different types of animal ‘preparations.’ He has worked on the ‘spinal animal,’ the ‘midbrain animal,’ the ‘thalamus animal,’ and so forth, the suggested nomenclature being such as to indicate by the specific name of the ‘preparation’ that part of the brain which, being most anterior in the ‘preparation,’ still remains in physiological continuity with the parts behind. A further point of interest is that the author rather criticizes the more usual methods of the experimentalist, who works ‘from above downwards,’ observing the outfall of function when different levels are removed by degrees; he has preferred to approach his problems ‘from below upwards.’ He takes the ‘spinal’ animal, and studies its reflexes and reactions; he then works at the ‘midbrain’ animal, and sees what additional functions it is capable of executing; and again, he observes what further
functions can be demonstrated as existing, say, in the ' thalamus ' animal; he then argues for the localization of the mechanisms underlying these respective additional functions within the corresponding limits of the respective additional areas of the brainstem above the upper spinal cord. Proceeding in this way, Professor Magnus has adduced evidence not lightly to be traversed, assigning specific functions to specific levels of the medulla, pons, midbrain and diencephalon, and to centres within these levels that in some instances can be delimited in millimetres and half-millimetres. So fine has his experimentation become, so skilful his technique.

To prevent the reader from being ' lost ' among the trees of his wood the author has done well to recapitulate at the beginning and not at the end of his volume (one, and that not the least, of the varying evidences of freshness of approach in this model monograph). We cannot in a brief review indicate with any fullness the whole scheme of investigation, but must content ourselves with a summary.

In the different types of experimental preparation enumerated above certain reflexes can be demonstrated with precision.

I.—Static Reflexes.

(A) Standing Reflexes.—(1) The head influences the posture of the body by means of (a) tonic neck-reflexes on the limbs. When the position of the head in reference to the body is passively altered by being lifted, depressed, rotated, and so on, corresponding and specific changes take place in the limbs. (b) By means of tonic labyrinth-reflexes on the body musculature. When the head is so fixed that its relation to the body is unalterable, while it can be made to occupy differing positions in space, tonic reflexes are elicitable which modify in specific ways the musculature both of the extremities and of the neck and trunk. Naturally, the reflexes (a) and (b) may be in activity together, while the labyrinth may also exercise an effect on the body musculature via its influence on the neck muscles. (2) There are other direct and indirect factors influencing attitude or posture, e.g., through the ' telerceptors ' of eye, ear, and nose.

(B) Eye Reflexes of Compensation.—(1) Tonic labyrinth-reflexes on the eyes. For each position of the head in space there is a corresponding setting of the eyes in the orbits, which can be determined by the use, inter alia, of the rotating table. These positions are effected not only by the labyrinth, but also by (2) tonic neck-reflexes acting on the eyes; e.g., when the head is inclined to the left a tonic neck-reflex ensures a homonymous movement of the eyes to the right. As in other cases, (1) and (2) may act simultaneously. Further, with them may be compounded certain stato-kinetic reflexes (see below).

(C) 'Correcting' or 'Righting' Reflexes.—Animals whose midbrain is intact are capable of reassuming correctly a normal attitude, from which they may have been passively deflected. This capacity is purely reflex and is effected by (1) labyrinth- ' correcting ' or ' righting ' reflexes on the head. If a rabbit or a guineapig is held in the air in a normal position and the pelvis is then turned at right angles to the forward part of the body, the head remains correctly upright none the less. After labyrinth extirpation these
reflexes are abolished. (2) By body-‘righting’ reflexes on the head. If an animal with loss of both labyrinths is held in the air on its side, the head is similarly on its side. But whenever the animal is laid on its side on a table, the head assumes the normal vertical position. (3) Neck-‘righting’ reflexes can also be shown to exist, and (4) even though the head be held laterally body-‘righting’ reflexes may act on the body, enabling it to reassume a normal posture. (5) In dogs, cats, and apes a fifth set of reflexes exist, the visual-‘righting’ reflexes, for which an intact cortex is essential.

II.—STATO-KINETIC Reflexes.

In contradistinction to the first group, this second group depends for its elicitation on the stimulus of change of movement.

(A) Rotation Reactions.—(1) Head-turning reactions. When the animal is placed on a radius of a rotating wheel and rotated, say, to the right, the head inclines to the left; with cessation of the rotation an ‘after’-inclination to the right occurs. (2) Similarly, eye-turning reactions can readily be obtained, and (3) there is evidence of the existence of turning-reactions on the trunk and extremities (cf. Bárány’s pointing test).

(B) Reactions to Movements of Progression.—(1) The head, and (2) the limbs, are reflexly altered in position as the animal is, for example, moved upward or downward in the air or on a board. As a single instance, when it is held by back and neck and lowered in the air the forelimbs are extended as if in readiness for landing on its feet.

The localization of the neural centres for this multiplicity of postural reflexes has been worked out with patient assiduity by Professor Magnus and his collaborators, but the details cannot here be furnished. Suffice it to say, in general terms, that the areas for the ‘Stellreflexe’ (‘correcting’ or ‘righting’ reflexes) lie chiefly in the midbrain, and that for the others due integrity of various segments of the brainstem is essential.

Special interest attaches to the question of decerebrate rigidity, to which much attention has been devoted. It is proved that this state develops when the red nuclei or the rubrospinal tracts therefrom are severed from the parts behind them; the deduction therefore is, that the centres mentioned exercise a control over certain other, not yet known, centres situated farther back in the brainstem. The red nuclei are held to constitute the centres for (1) the labyrinth-‘righting’ reflexes; (2) the body-‘righting’ reflexes acting on the body; and (3) normal tone regulation in the skeletal musculature. Apparently it is the pars magnocellularis that is essential. Decerebrate rigidity is not dependent on section of the pyramidal tracts—an important conclusion, in view of the inaccurate opinion held by some that the symptoms of that state are pyramidal in type. Nor is it dependent on the cerebellum, superior cerebellar peduncles, or any tectofugal paths, or on the substantia nigra (in all probability).

Professor Magnus realizes frankly the fundamental differences between experiments on specific ‘preparations’ and clinical conditions of disease, where there can be no interruption of tracts and centres on a wholesale scale, where, on the contrary, there is, as a rule, only partial discontinuity. He cannot, therefore, help much when it comes to a decision as to the functional
quotas contributed by cerebellum, basal ganglia, and pyramidal tracts respectively, when they are all more or less in connection with mesencephalo-spinal centres. Only in one paragraph, it seems, is allusion made to the phenomena attributed to disease of the basal ganglia, and Professor Magnus is there content to point out that in the 'thalamus' animal he has seen neither contractures, rigidity, tremors, chorea, nor athetosis. In that animal, however, both the corpora striata and the corticospinal paths are severed from the parts farther back, a point of obvious significance. Only one or two experiments are mentioned which in any way reproduce, to a greater or less extent, the kind of ease the clinician frequently encounters. Thus a record is given of the effect of section of the rubrospinal tracts at Forel's decussation in rabbits and cats with normal pyramidal paths. There is not nearly so much rigidity as when the same operation is performed in 'thalamus' animals, in which the corticospinal (and striofugal) paths are already cut. This leads Professor Magnus to outline, with true physiological caution, a single 'Arbeitshypothese,' to the effect that the influence of the red nuclei is exerted directly on spinal cord centres; on the latter impinge also certain (unknown) paths from bulbar centres which occasion decerebrate rigidity (for that condition, once established, is abolished by section in the medulla), and have therefore an extensor distribution of tone. The rubrospinal paths are assumed to exercise a flexor distribution of tone. The spinal centres are thus supposed to lie under the control of flexor (rubral, mesencephalic) and extensor (bulbar) influences. Now we may remark that when only the pyramidal tracts are cut in the intact animal, there is little abiding alteration of tone, but such influence as they exert is flexor in character. In the 'thalamus' animal (pyramidal tracts cut) there is no alteration of tone till the decussation of Forel is severed, when maximal extensor rigidity ensues. (In this animal the corpora striata also are cut off from spinal centres.) As already indicated, section confined to rubrospinal connexion (in the intact animal) leads to very slight rigidity only. Thus the compounding of the two influences, released by section, is distinctly different from what would appear to be the summation of the two, considered separately—one of the numerous difficulties that both physiologist and clinician have to face. In regard to the cerebellum, Professor Magnus declares that we are still in ignorance of its 'positive' functions. It is clear, in fact, that much further experimentation is required to establish the relation of the corpora striata, motor cortex centres, red nuclei, and cerebellar centres, individually and collectively, to the tone of the spinal mechanisms. Nor, in this respect, is the contribution of the clinicopathological method to be lightly dismissed.

The monograph is a monumental study of a subject of vast intricacy and importance. It is a milestone on the highway of physiological knowledge. It will repay close and repeated perusal. Confirmation of Professor Magnus's experimental results will doubtless be forthcoming, since he has so lucidly pointed out the way; their application to clinical neurology and their significance for the interpretation of the findings of neuropathology will be a task deserving patient and critical investigation.

S. A. K. W.
Körperstellung?; experimentell-physiologische Untersuchungen über die einzelnen bei der Körperstellung? in Tätigkeit tretenden Reflexe, über ihr Zusammenwirken und ihre Störungen

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Notes

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