The Static and Kinetic Systems of Motility. (*Arch. of Neurol. and Psychiat., October*, 1920.) *Hunt, J. Ramsay.*

In this presidential address to the American Neurological Association, Hunt develops the hypothesis that in motility there are two components, each represented throughout the entire efferent nervous system by separate neural mechanisms, mutually co-operative yet physiologically and anatomically distinct: a kinetic component concerned with movement proper, and a static component concerned with tonus, posture, and equilibrium.

Two such distinct kinds of motility are observable even in lowly organisms. We may contrast the rapid rhythmic kinetic movement of cilia with the static aspect of the changes in shape of an amœba. In some invertebrates the two forms of motility are subserved by separate muscles; the shell of a bivalved mollusc is made to close by a rapidly acting striated muscle, and is kept closed by a slowly acting non-striated muscle. In higher animals both functions are united in the same muscle-fibre, and in man all gradations may be observed, from the lowest type of non-striated to the highest type of striated fibre. The striated fibre contains two substances, both contractile, one being the disc mechanism, which executes the quick movement or twitch, and the other the sarcoplasm, which yields a more plastic form of contraction, permitting an alteration of length without a corresponding change of tension. Each muscle-fibre has a dual innervation—by a medullated nerve-fibre whose motor end-plate furnishes the stimulus for the disc mechanism, and by a non-medullated accessory sympathetic fibre controlling the sarcoplasm. Reflex action is dependent on a peripheral kinetic system terminating in the disc mechanism; reflex posture on a peripheral static system terminating in the sarcoplasm.

Extending from brain to muscle are two great motor systems, one subserving a palæo-kinetic and the other a neo-kinetic function. The corpus striatum is the palæo-kinetic centre for the control of automatic and associated movements, and the Rolandic area is the neo-kinetic centre for dissociated movements of cortical origin. The thalamic portion of the palæo-encephalon is associated with the cortex by afferent and efferent tracts, by which palæo-kinetic motility may be directly controlled from the cortex (cortico-thalamo-strio-spinal system). In contrast with this is the neo-kinetic system—a direct path from the Rolandic cortex by way of the pyramidal system to the anterior horn cells of the cord, and thence to the disc mechanism.

The central mechanism for the control of reflex tonus and of the sarcoplasmic function of the muscle-fibre is the cerebellum. Just as we have recognised palæo- and neo-kinetic systems, so we find also palæo- and neo-static systems. The palæo-static system takes origin in the older nuclei of the vermis, the neo-static in the dentate nuclei of the cerebellar hemispheres. Their efferent paths proceed by the superior peduncles to the red nucleus, and thence descend as separate systems in the spinal cord (palæo-rubro-spinal and neo-rubro-spinal systems), and so to the sarcoplasm of the skeletal muscle-fibres.

Paramyoclonus multiplex, myokymia, and fibrillary twitchings are spasmodic phenomena referable to the kinetic spinal mechanism; myasthenia gravis is a paretic manifestation. The clonus of spastic paralysis is of neo-kinetic origin, the tremor of paralysis agitans palæo-kinetic. Huntington's chorea and epilepsy are both kinetic, the former being striatal, the latter cortical. All forms of myotonia are sarcoplasmic, referable to the static system, as is also the tonic rigidity of tetanus. The coarse movements of intention tremor are an effort of the kinetic system to compensate the loss of the postural or static functions of the sarcoplasm.

In addition to such various somatic expressions of kinetic and static function, we find indications of a similar division of function in the mental sphere; we may mention catalepsy, catatonia, and certain hyper-kineses of psychic origin. It is therefore possible to trace the evolution of the static and kinetic systems of motility from the lowest to the highest levels of the neural mechanism. SYDNEY J. COLE.

On Deep Localisation in the Cerebral Cortex. (*Journ. Nerv. and Ment. Dis., April,* 1920.) *Van't Hoog, E. G.*

In 1909 Ariëns Kappers inferred from his studies in comparative anatomy that the neo-cortex has two functionally different zones: an outer or supragranular (layers 2 and 3 of Brodmann), associative and receptive; and an inner or infragranular (layers 5 and 6), predominantly corticofugal and commissural. Between is the granular layer (4), which is receptive, and consists of cells whose axons are too short to form corticofugal fibres. Layers 2, 3 and 4 are all receptive and associative, but whereas 4 establishes intracortical connections at a short distance, 3 establishes connections at a much greater distance. Kappers suggested that 4, as matrix of 3, might merge with the latter. After separation of the cortex from the subcortical centres, the upper layers retain some capacity for growth but the lower layers atrophy (Nissl, 1911). In the infragranular pyramids the corpus callosum has its origin (van Valkenburg, 1910).

[In 1907, Dr. G. A. Watson, of Rainhill Asylum, working on Insectivora, had already pointed out that the infragranular layer has projection and intraregional associative functions. The still earlier pathological and ontogenetic studies of Dr. J. Shaw Bolton on the human species (1900, 1903) have also important bearings.—S. J. C.]

If with a small animal we compare a large animal of a nearly related species (for example, the lion with the domestic cat), we shall expect to find in the larger animal—if Kappers' inference is correct—a very pronounced increase of the supragranular cell-layers; for not only is there, with an increase in body-bulk, an increase both of receptor and of effector functions, but, as was explained mathematically by Dubois, receptor functions increase with bulk more than do effector. Van't Hoog has measured the thickness of the cell-layers in the postcentral region of the cortex in pairs of species of apes, semi-apes, cats, bears, dogs, ungulates, rodents and marsupials—the species being so selected as to contrast a large with a small representative of each group. His drawings, diagrams and tables are very impressive. His measurements show that in the larger animal of each pair there is not only a much greater increase of the supragranular layers than of the infragranular, but also an absolute decrease of the granular layer; there has been a development of pyramids from, and at the expense of, the subjacent