the brain, the rest of it is called in vertebrates the “ spinal cord,” in vermes and arthropods the “ nerve-cord.” The central organ not only receives neurones which converge to it from outside, but many of its own neurones thrust out their conductive arms from it as nerve fibres carrying nervous influence outwards to regulate the activity of glands and muscles. In the vertebrata the ingoing neurones for each segment and similarly the out-going neurone fibres arc collected into a segmental nerve. To the spinal cord these arc each attached by two roots, one dorsal, consisting of the afferent fibres, the other ventral, consisting of the efferent fibres.

*The Reflex.—*Analysis of function of this nervous system leads to what is termed “ the reflex ” as the unit of its action. The simplest complete reaction of the system is a reflex. There are many reflexes which are extremely complex, being built up of a number of simpler reflexes combined together. A reflex is a reaction started by the environment acting as a stimulus upon some nerve which communicates the excitement thus started in itself to other nerves by means of its connexions with these in the central nervous organ. The excitement so generated and transmitted finally travels outward from the central organ by one or more of the efferent nerves and through these reaches muscles or glands producing in them its final effect. The muscles and glands are from this point of view termed effector organs. The reaction is therefore “ reflected ” from the central organ. The nerve structures along which it runs in its tra- jectory are spoken of as a nervous arc. The whole purpose of the central nervous organ is therefore to bring afferent neurones into touch with efferent neurones. The whole purpose of reflex arcs is to bind one part of the organism to another part in such a way that what the environment is doing to the organism at one place may appropriately call forth or restrain movement or secretion in the muscles or glands possessed by the organism.

*Receptor Cells.—*There is one condition for the due performance of these reactions which is not provided by the nervous system itself. The afferent neurones arc not in most cases so constituted as to be excitable themselves directly by the environment—for instance, they cannot be stimulated by light. Their amenability to the environment, their sensitization to environmental agencies, is effected by special cells adjunct to their peripheral ends. These cells from organs are called *receptors.* They are delicately adapted to be stimulated by this or that particular agent and are classifiable into various species, so that each species is easily excited by a particular agent which is “ adequate ” for it, and is quite inexcitable or only excitable with difficulty by agencies of other kinds. Thus in the skin some receptors are adapted for mechanical stimuli (touch) and not for thermal stimuli, while others (cold spots, warm spots) are adapted for thermal stimuli and not for mechanical. As far as it is known each afferent neurone is connected with receptors of one species only. The receptors thus confer upon the reflex arcs selective excitability. Each arc is thus tuned to respond to certain stimuli, while other arcs not having that kind of receptor do not respond. The receptors, therefore, while increasing the responsiveness of the organism to the environment, prevent confusion of reactions (inco-ordination) by limiting to particular stimuli a particular reaction.

*Proprioceptors.—*The system of neurones is thus made accessible to the play of the external world acting on the body. And in addition to those receptors which are stimulated directly by the external world, are others lying within the mass of the organism itself, which are excitable by actions occurring in the organism itself. These are called *proprioceptors.* They arc distributed preponderantly in the muscles and structures functionally adjunct to muscle, such as joints, ligaments, fasciae, &c. The reactions induced in such motor structures reflexly in response to environmental stimuli tend therefore secondarily to be followed and accompanied by reflex reactions initiated from proprioceptors.

*Conduction.—*Thc process by which the excitement generated in the afferent neurone travels along the reflex arc is known as *conduction.* Conduction along afferent and efferent nerves differs in some important respects from that obtaining in the nerve centre, *i.e.* in the piece of the central nervous system connecting the afferent nerve with the efferent nerve. In a nerve- trunk the excited state set up in it by a stimulus travels along its fibres as wave-like disturbance at a speed of about thirty- three metres per second, and does not alter in intensity or speed in its travel. A nerve-trunk when excited (artificially) at some point along its length transmits the “ impulse,” *i.e.* the wave- like excited state in both directions, *i.e.* both up and down each fibre, from the point stimulated. This is true whether the fibre is afferent or efferent. The speed of travel of the nervous impulse along the nerve-trunk is practically the same whether the state of excitement, *i.e.* nervous impulse, is weak or intense. The nerve-trunk shows practically no delay in its response to an effective even though weak stimulus and its response ceases practically at once on cessation of the exciting stimulus. When excited by repeated brief stimuli the rhythm of the response corresponds closely with that of the stimuli, even when the frequency of the latter is as high as 100 per second. With momentary stimuli a response even so brief as *2σ* can be given by the nerve-trunk. Finally, nerve-trunk conduction is singularly resistant to fatigue, to impoverished blood supply, and to many drugs which powerfully affect reflex actions.

In conduction through the central nervous organ the travel of the nervous impulse exhibits departure from these features. Its intensity is liable to be altered in transit. Its time of transit, especially if it be weak, is much longer than for a similar length of nerve-trunk. Its direction of transmission becomes polarized, that is, confined to one direction along the nervous path. The state of excitement engendered does not subside immediately on cessation of the stimulus, and may outlast the stimulus by many seconds. The rhythm of response to a rhythmic stimulus does not change in correspondence with change in the stimulus-rhythm. A response, however brief the stimulus, is probably never shorter than 50 in duration.

These are striking differences, and morphological study of the structural features of the central organ does not at present suggest how they for the most part arise. It seems certain, however, that in the central organ it is that part which consists of so-called grey matter which forms the place of their occurrence. There the spread of the impulse from one nerve-fibre to others seems clearly due to the fact that each afferent fibre breaks up into branching threadlets which ramify in various directions and terminate in close apposition with other neurones. There has been much dispute as to whether the termination is one of contiguity with the next neurone or of actual continuity with it. The result of recent investigation seems to show that in the vast majority of cases contiguity and not actual homo- geneous continuity is the rule in the spinal cord. The point of nexus of one neurone with another is termed the synapse. If synapsis occurs by contiguity and not homogeneous continuity, it is fair to suppose that at it the transmission of nervous impulses must be different from that observable in the homogencous conducting threads of nerve fibres. The conduction must traverse something of the nature of a membrane. To the properties of synaptic membranes many of the features peculiar to conduction in the grey matter may be due, for instance, the feature of irreversible direction of conduction.

*Reflex Reactions.—*When the spinal cord is severed at any point the reflex arcs of the portion of the body behind the transection are quite cut off from the rest of the nervous system in front, including the brain. The reflex reactions elicited from the thus isolated region cannot therefore be modified by the action of the higher nervous centres. It is important to see what character these reflexes possess. The higher centres in the brain exercise powers over the motor machinery of the body and in doing so make use of the simpler nervous centres that belong to the segments severally, that is the local nervous centres existing for and in each body segment itself. In the head the local centres arc overlaid by higher centres which cannot by any simple severance be separated from them. By studying, therefore, the powers of the cord behind a complete