

the co-ordinating power which is secured by this principle of reflex action.

Of course we may wonder how it is that the nerve-centres, which preside over reflex action, not being endowed with consciousness, know what to do with the stimuli which they receive. The explanation of this, however, is that the anatomical arrangement of ganglion and nerves in any particular case is such as to leave no choice or alternative of action, if the apparatus is called into action at all. Thus, to begin at the bottom of the series, in the *Medusæ* the simple ganglia are distributed all round the margin of the animal, and respond by reflex action to the stimuli which are applied at any other part of the surface. This has the effect of increasing the rate and the strength of the swimming-movements, and so of enabling the animal to escape from the source of danger. Now, although this is a true reflex action, and has an obvious purpose to serve, it does not involve any co-ordination of muscular movements. For the anatomical plan of a jelly-fish is so simple, that all the muscular tissue in the body is spread out in the form of one continuous sheet; so that the only function which the marginal ganglia have to perform when they are stimulated into reflex action, is that of throwing into contraction one continuous sheet of muscular tissue.

Hence we may infer that in its earliest stages reflex action is nothing more than a promiscuous discharge of nervous energy by nerve-cells, when they are excited by a stimulus passing into them from their attached nerve-fibres.* But as animals become more highly organized, and distinct muscles are by degrees set apart for the performance of distinct actions, we can readily understand how particular nerve-centres are likewise by degrees set apart to preside over these distinct actions; the nervous centres then perform the part of triggers to the particular muscular mechanisms over which they preside—triggers which can only be loosened by the reception of stimuli along their own particular lines of communication, or nerves. Thus, for instance, in the star-fish—animals which are somewhat higher in the zoological scale than the jelly-fish, and which have a more highly developed neuromuscular system—the ganglia are arranged in a ring round

* For a full account of reflex action in *Medusæ*, see *Phil. Trans.*, Croonian Lecture, 1875; also *Phil. Trans.*, 1877 and 1880