

merely mechanical or non-mental response is needed; and the more complex the mental operation the more time is necessary. Such may be termed the physiology of deliberation.

So much, then, for the rate at which molecular movements travel through nerves, and the times which nerve-centres consume in performing their molecular adjustments. We may next consider the researches which have been made within the last few months upon the rates of these movements themselves, or the number of vibrations per second with which the particles of nervous matter oscillate.

If, by means of a suitable apparatus, a muscle is made to record its own contraction, we find that during all the time it is in contraction, it is undergoing a vibratory movement at the rate of about nine pulsations per second. What is the meaning of this movement? The meaning is that the act of will in the brain, which serves as a stimulus to the contraction of the muscle, is accompanied by a vibratory movement in the grey matter of the brain; that this movement is going on at the rate of nine pulsations per second; and that the muscle is giving a separate or distinct contraction in response to every one of these nervous pulsations. That such is the true explanation of the rhythm in the muscle is proved by the fact that if, instead of contracting a muscle by an act of the will, it be contracted by means of a rapid series of electrical shocks playing upon its attached nerve, the record then furnished shows a similar trembling going on in the muscle