

by Tschirgew, who found that, after the division of all the nerves connected with the tendon, the reflex still continued. Westphal on the other hand does not consider the jerk to be produced by reflex action, but by direct stimulation of the muscle, and consequently a purely local phenomenon. He thinks it due to the vibrations set up in a more or less tense tendon which are transmitted to the muscle, and that these throw the muscle into contractions. The arguments in favor of his theory are that the time occupied to produce a knee-jerk is much less than is required for an ordinary reflex action, and that the movement persists after section of the tendon nerves. In regard to the time required, which is .03 or .04 of a second shorter than the interval of an ordinary reflex action, one point I think must be remembered, viz., that the muscle must be at the time in a condition of slight tension, and that in consequence less time would be required in order to make its action apparent than there would be if the muscle were lax, as is usually the case, when the time required for ordinary reflex action is measured. The difference between the two (about 1-25th to 1-33rd of a second) could, I think, be accounted for in this way. In regard to the second point, a true reflex act may, as Foster says, really begin in the muscle being started in it by the vibrations transmitted along the tendon. It may further be said against the theory of Westphal, that if the posterior roots be divided the movement ceases, although locally the muscle is entirely intact, and this, to my mind, is conclusive proof that his theory is erroneous. There is another explanation, however, which will bear closer examination than either of those advanced, viz., that this phenomenon is a purely reflex one, which originates in the sensory muscle nerves, is conveyed by them through the posterior roots to the grey matter, and reflected by the grey matter through the ganglion cells of the anterior horn and the motor nerve back to the muscle which contracts. This explanation has been founded on the work of Tschirgew, who proved that the sensory nerves of muscle terminate not in the muscular fibres but in the interstitial connective tissue between them. In this way it is easy to understand how the afferent impulse is produced by tension acting on these nerves. (Here was explained the reflex arc of diagram, and how suddenly increased tension sets up an afferent impulse.) Tapping the tendon only has the effect of suddenly increasing the tension, and in consequence setting up an afferent impulse in the sensory muscle nerves. The tendon *per se* has nothing whatever to do with the reflex action except to increase the tension of the muscle, as may be easily proven in any case where the excitability of the cord is increased, by simply placing