up and down or in both directions giving off collaterals and finally terminating in the gray matter of the same or the opposite side. The shortest fibers of the proper fasciculi lie close to the gray matter, the longest ones are nearer the periphery of the proper fasciculi and are more or less intermingled with the long ascending and descending fasciculi which occupy the more marginal regions of the spinal cord.

Each sensory neuron, with its ascending and descending branches, giving off as it does many collaterals into the gray matter, each one of which may form a synapse with one or several correlation neurons, is thus brought into relation with many correlation neurons and each one of these in turn, with its ascending and descending branches and their numerous collaterals, is brought into relation, either directly or through the intercalation of additional correlation neurons, with great numbers of motor cells in the anterior column. The great complexity of these so-called simple reflex mechanisms, in the least complex portion of the nervous system the spinal cord, renders them extremely difficult of exact analysis.

The association or correlation neurons are concerned not only with the reflex mechanisms of the spinal cord but play an equally important role in the transmission of impulses from the higher centers in the brain to the motor neurons of the spinal cord.

The complex mechanisms just described are probably concerned not so much in the contraction of individual muscles as in the complicated action of groups of muscles concerned in the enormous number of movements, which the limbs and trunk exhibit in the course of our daily life.

Sensory Pathways from the Spinal Cord to the Brain.—The posterior root fibers conducting the impulses of **conscious muscle sense,** tendon sense and joint sense, those impulses which have to do with the coördination and adjustment of muscular movements, ascend in the fasciculus gracilis and fasciculus cuneatus to the nucleus gracilis and nucleus cuneatus in the medulla oblongata (Fig. 759).

In the nucleus gracilis and nucleus cuneatus synaptic relations are found with neurons whose cell bodies are located in these nuclei and whose axons pass by way of the internal arcuate fibers, cross in the raphé to the opposite side in the region between the olives and turn abruptly upward to form the medial lemniscus or medial fillet. The medial fillet passes upward in the ventral part of the formatio reticularis through the medulla oblongata, pons and mid-brain to the principal sensory nucleus of the ventro-lateral region of the thalamus. Here the terminals form synapses with neurons of the third order whose axons pass through the internal capsule and corona radiata to the somatic sensory area of the cortex in the post-central gyrus.

Fibers conducting the impulses of **unconscious muscle sense** pass to the cerebellum partly by way of the fasciculus gracilis and fasciculus cuneatus to the nucleus gracilis and nucleus cuneatus, thence neurons of the second order convey the impulses either via the dorsal external arcuate fibers directly into the inferior peduncle of the cerebellum or via the ventral external arcuate fibers which are continued from the internal arcuate fibers through the ventral part of the raphé and after crossing the midline emerge on the surface of the medulla in the ventral sulcus between the pyramids or in the groove between the pyramid and the olive. They pass over the lateral surface of the medulla and olive to reach the inferior peduncle through which they pass to the cerebellum.

Other fibers conducting impulses of unconscious muscle sense pass upward in the dorsal spinocerebellar fasciculus, which arises from cells in the nucleus dorsalis. The posterior root fibers conducting these impulses pass into the fasciculus cuneatus and the collaterals from them to the nucleus dorsalis are said to come almost exclusively from the middle area of the fasciculus cuneatus. They form by their multiple division baskets about the individual cells of the nucleus dorsalis, each fiber coming in relation with the bodies and dendrites of several cells. The axons of the second order pass into the dorsal spinocerebellar fasciculus of the same side