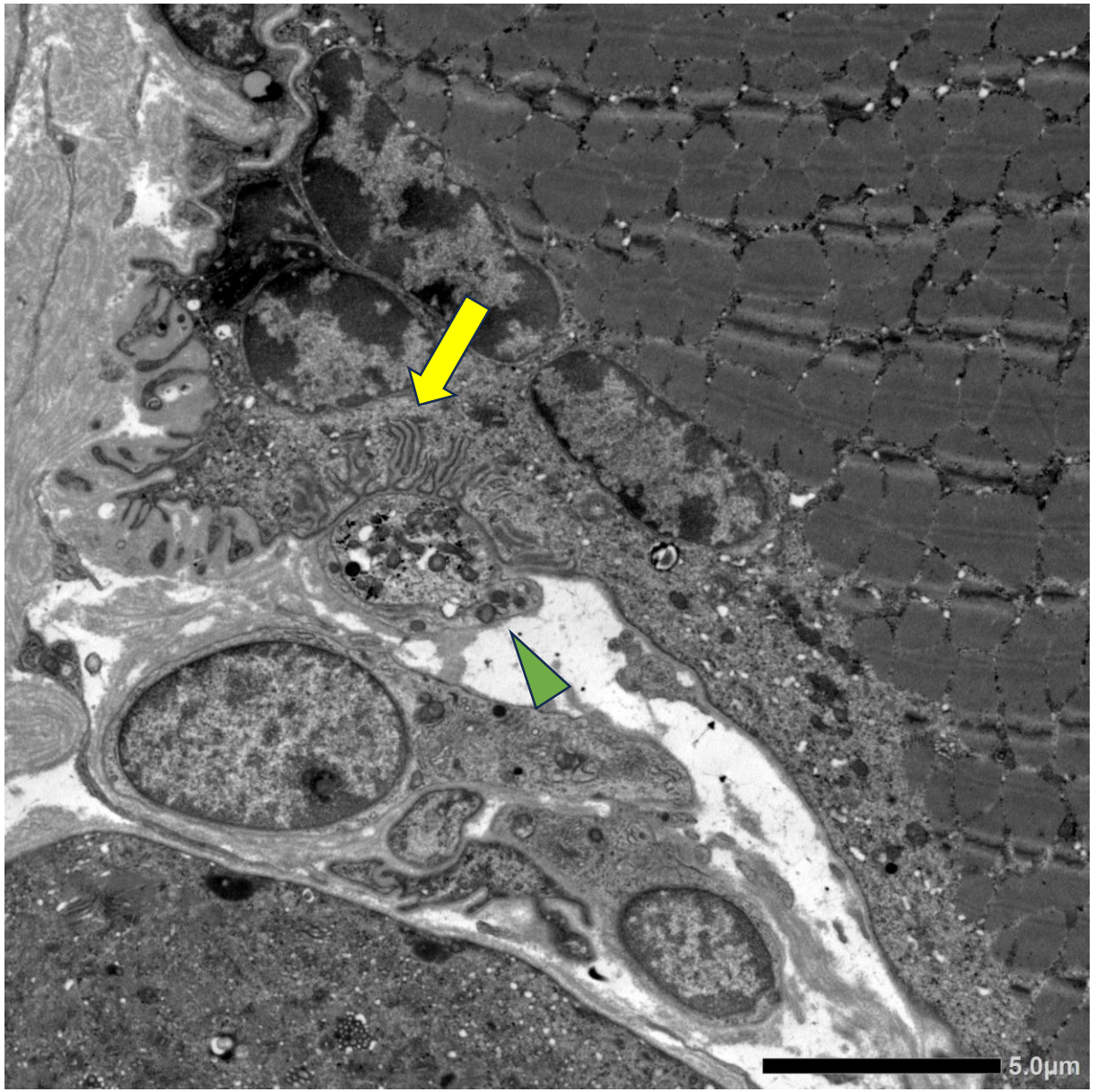
Neuromuscular junctions and muscle spindles

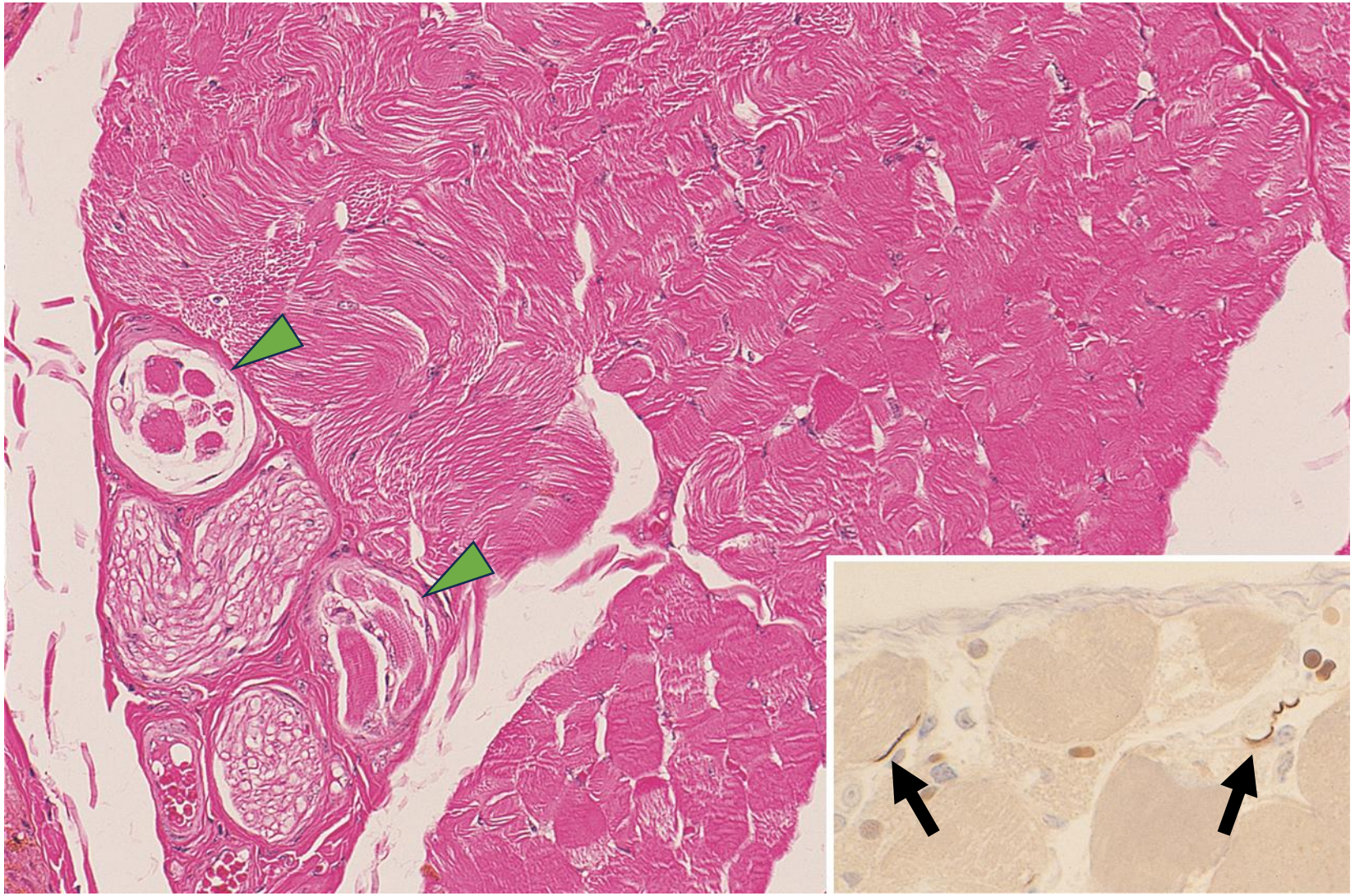
The neuromuscular junction is a chemical synapse between a motor neuron and a muscle fiber, allowing the motor neuron to transmit a signal to the muscle fiber. Synaptic transmission at the neuromuscular junction begins when an action potential reaches the presynaptic terminal of a motor neuron. Motor neurons release acetylcholine. Acetylcholine diffuses across the synaptic cleft and binds to nicotinic acetylcholine receptors on the sarcolemma of the muscle fiber. The binding of acetylcholine to the receptor can depolarize the muscle fiber, eventually resulting in muscle contraction.

The muscle spindle is distributed in every skeletal muscle. The delicate sensory receptor informs the central nervous system about changes in the length of individual muscles and the speed of stretching. With this information, the central nervous system computes the position and movement of the extremities in space to maintain posture and stable gait. Such responses also play an important role in regulating the contraction of muscles, by activating motor neurons via the stretch reflex to resist muscle stretch.

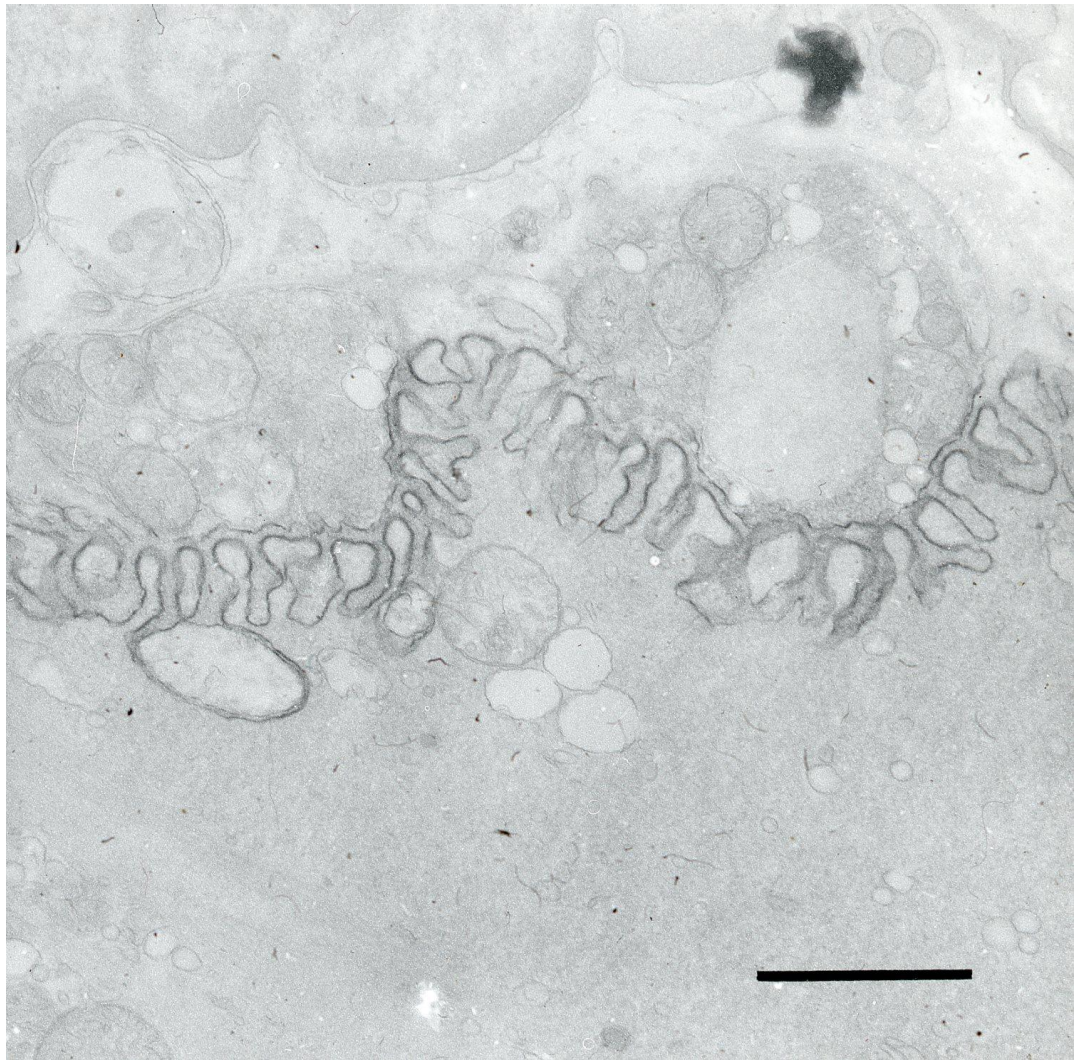
EM study for neuromuscular junction in normal striated muscle. Arrow indicates a postsynaptic membrane with deep convolutions called as junctional folds (arrow). The junctional fold is located just adjacent to the nerve terminal. EM-1



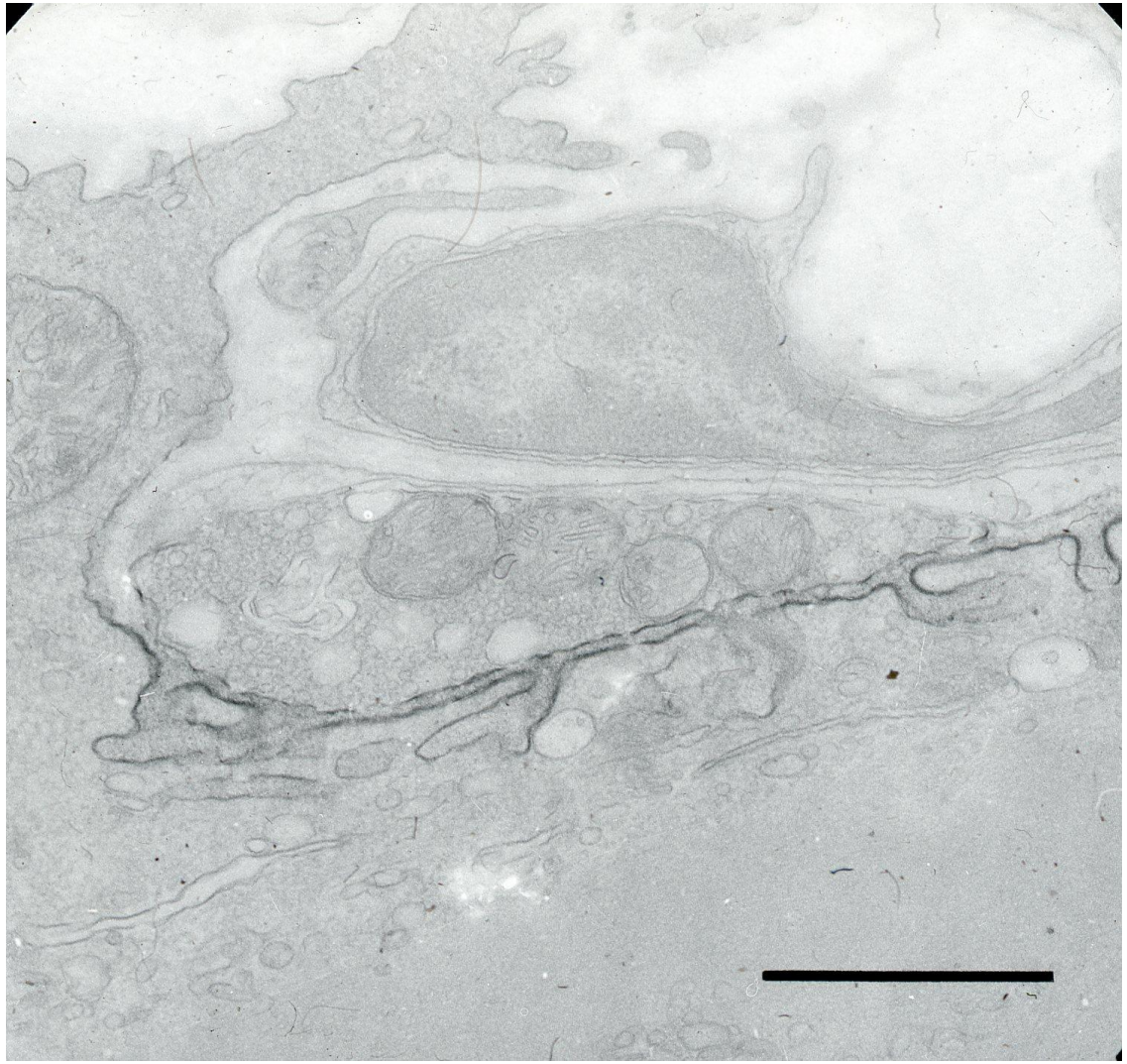
EM study for neuromuscular junction in normal striated muscle. Arrow indicates a postsynaptic membrane with junctional folds. A nerve terminal with synaptic vesicles (arrowhead) is closely located on the junctional folds. EM-2



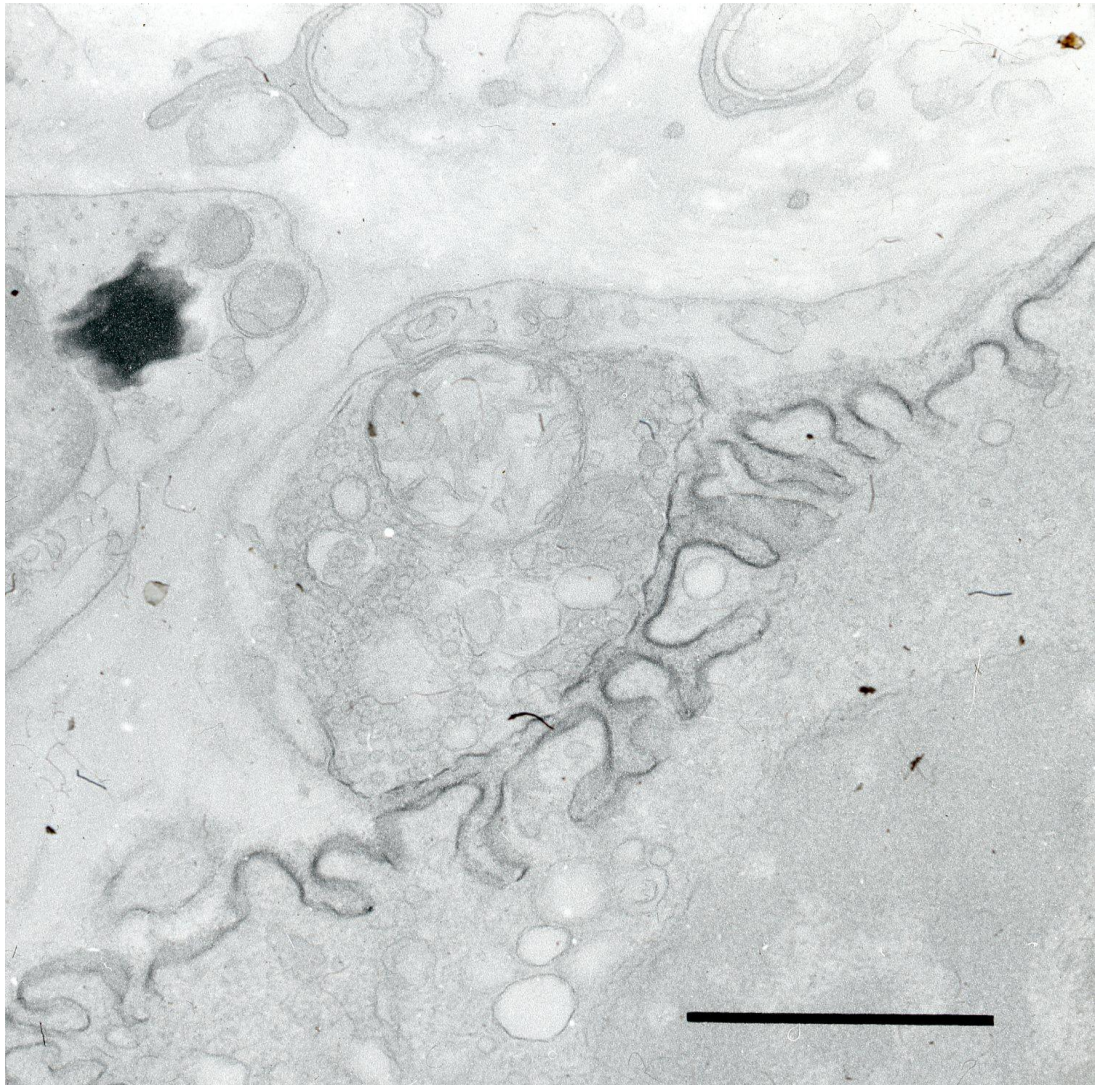
Histology of normal striated muscle. At the periphery of the muscle fascicle, muscle spindles are distributed and closely associated with nerve fibers (arrowheads). Inset demonstrates the neuromuscular junction (arrows) visualized by biotinylated alpha bungarotoxin probe.



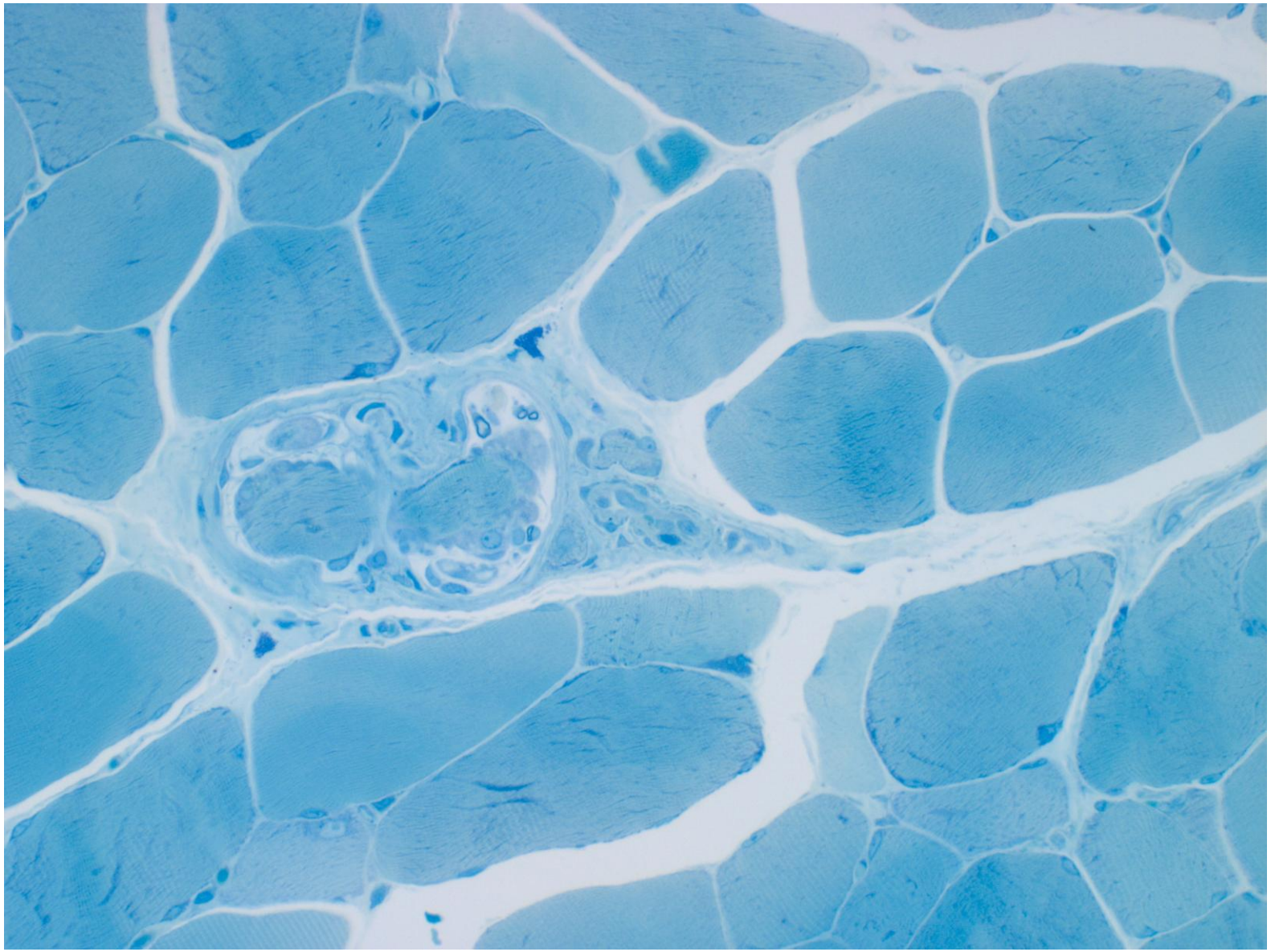
Immunoelectron microscopic visualization (1) of the postsynaptic junctional folds. Biotinylated α-bungarotoxin shows a high affinity to the α-subunit of the nicotinic acetylcholine receptor, which is located at the postsynaptic membrane. Alpha-bungarotoxin is a 74-amino acid peptide extracted from the venom of *Bungarus multicinctus* (an elapid snake or Taiwanese krait).



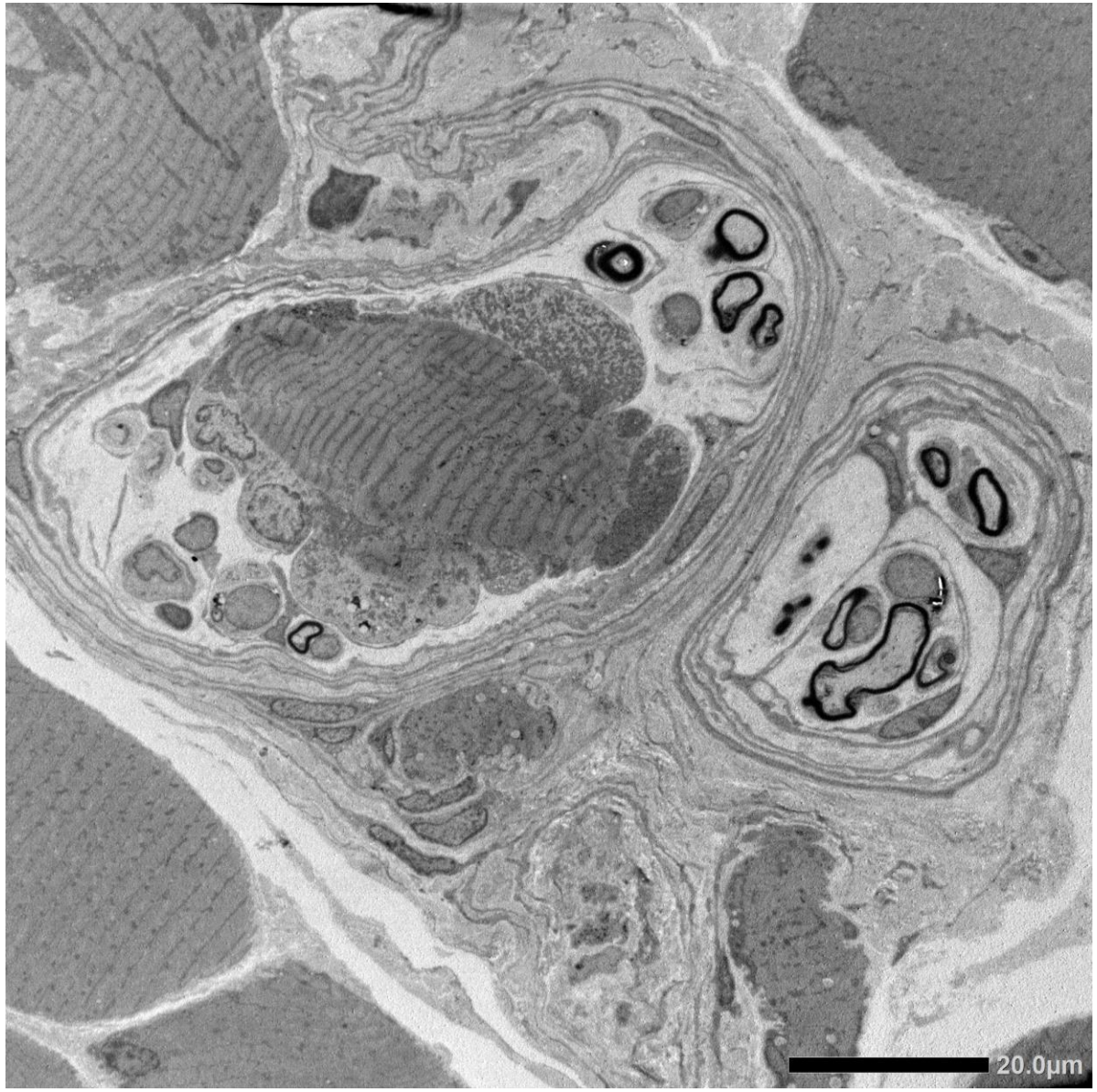
Immunoelectron microscopic visualization (2) of the postsynaptic junctional folds. Biotinylated α-bungarotoxin shows a high affinity to the α-subunit of the nicotinic acetylcholine receptor, which is located at the postsynaptic membrane.



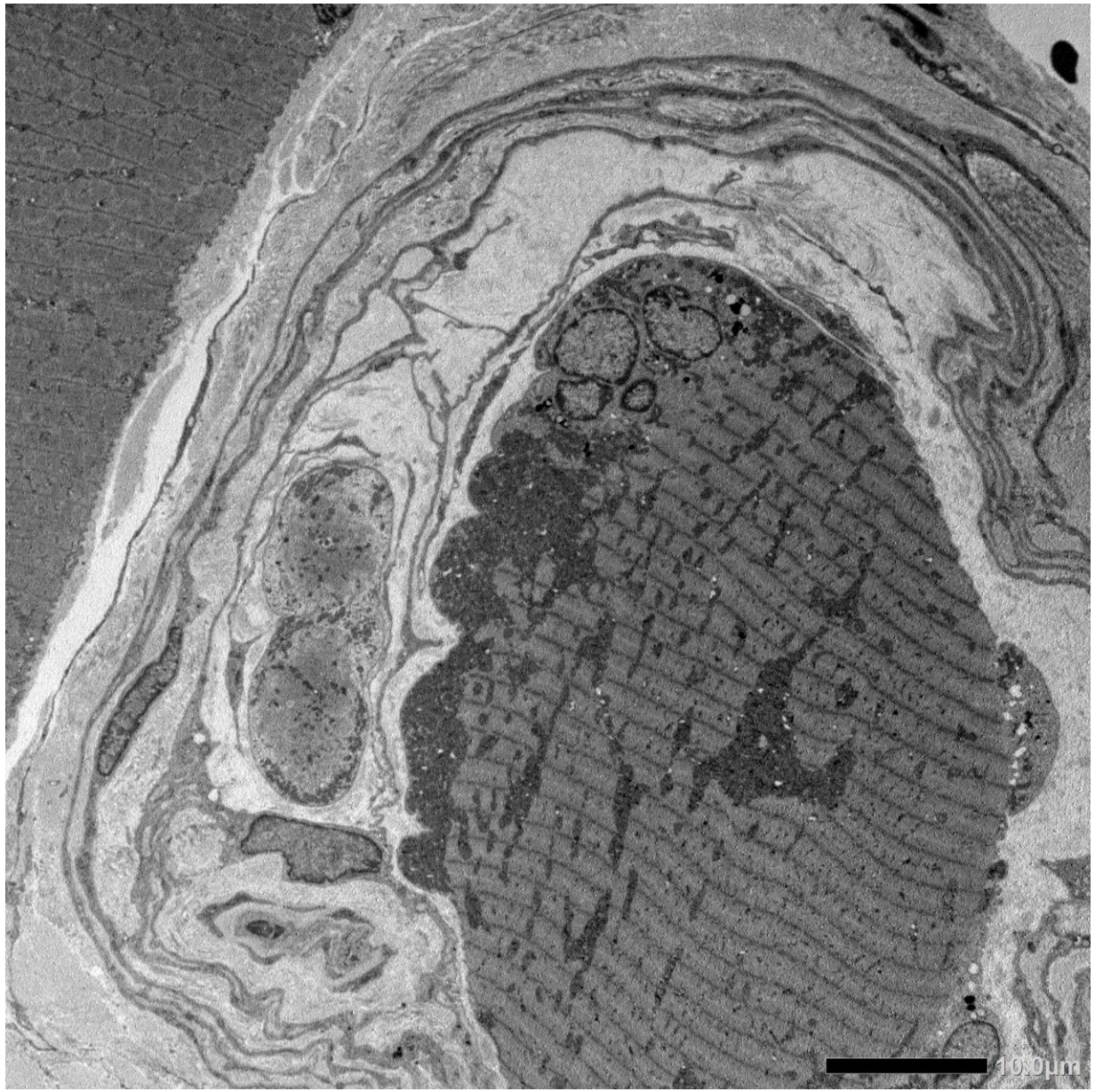
Immunoelectron microscopic visualization (3) of the postsynaptic junctional folds. Biotinylated α-bungarotoxin shows a high affinity to the α-subunit of the nicotinic acetylcholine receptor, which is located at the postsynaptic membrane.



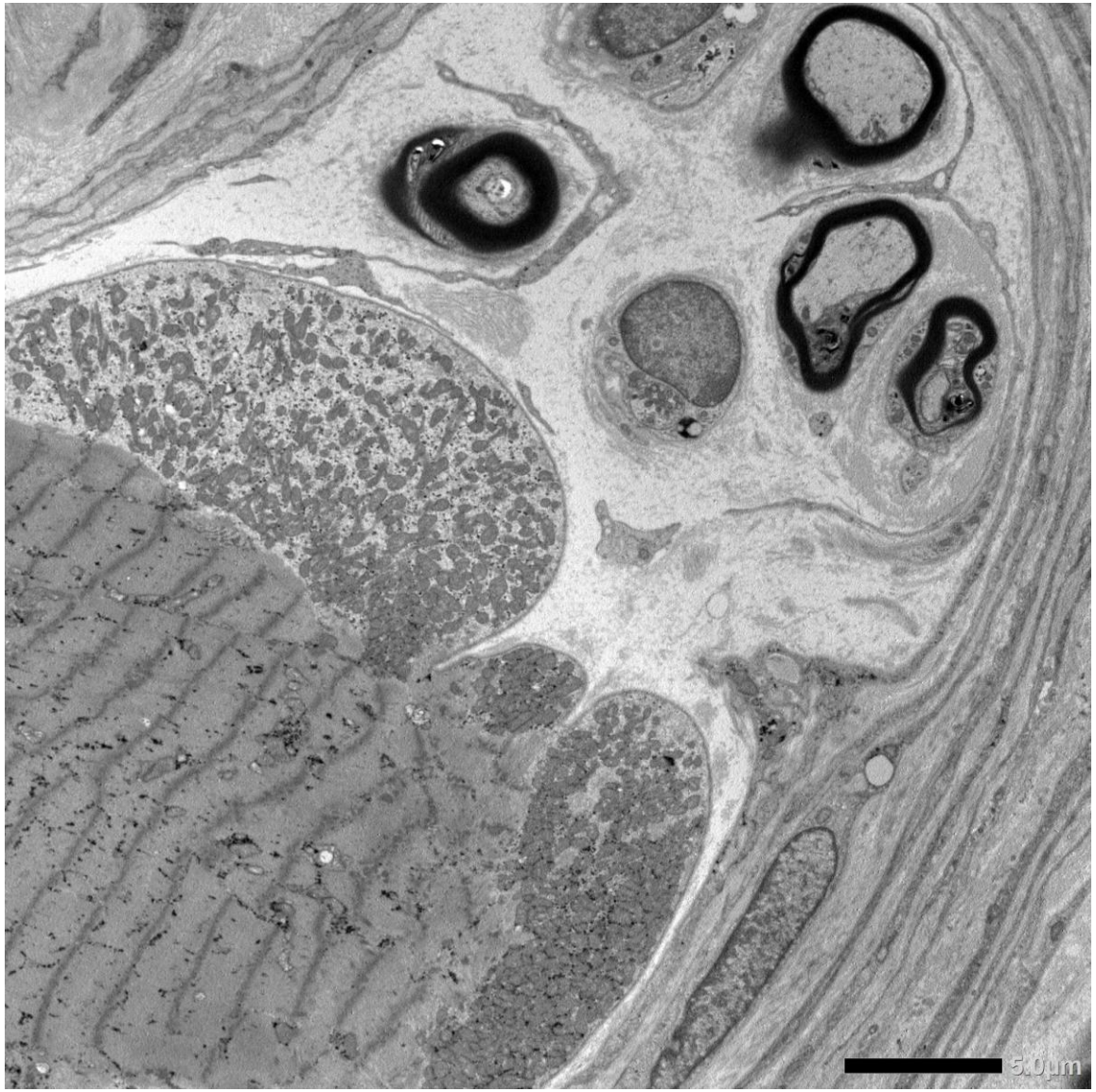
A muscle spindle of the normal striated muscle. Small-sized fibers are ensheathed and richly innervated. Toluidine blue (thick section for EM study)



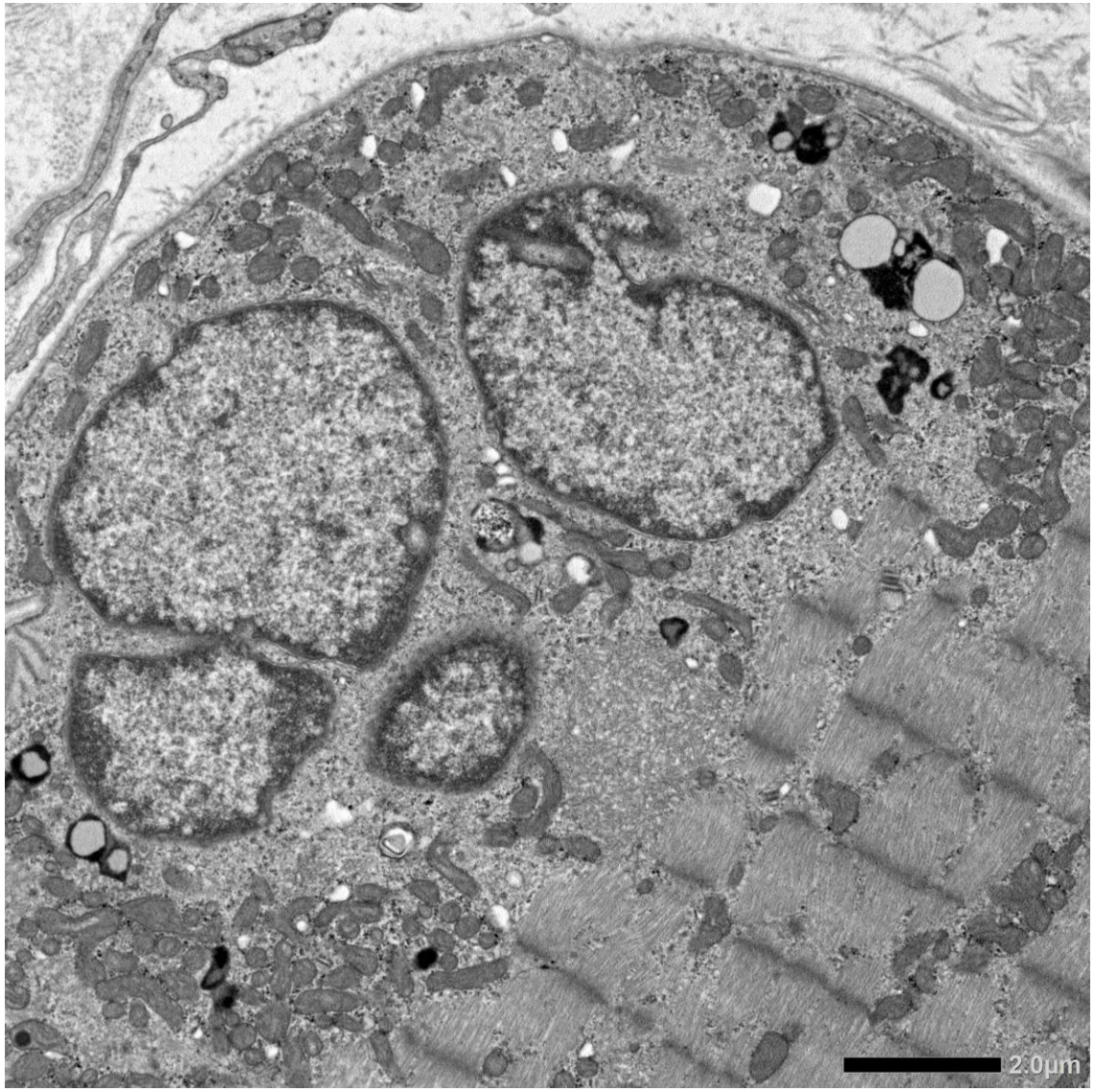
EM study for the muscle spindle of the normal striated muscle (1).
Small-sized striated muscle fibers are ensheathed and richly innervated.



EM study for the muscle spindle of the normal striated muscle (2).
Small-sized striated muscle fibers are ensheathed and richly innervated.



EM study for the muscle spindle of the normal striated muscle (3).
Small-sized striated muscle fibers are ensheathed and richly innervated.
Mitochondria are clustered at the peripheral part of the cell.



EM study for the muscle spindle of the normal striated muscle (4). Small-sized striated muscle fibers are ensheathed. Central nuclei are characteristic of the muscle spindle.