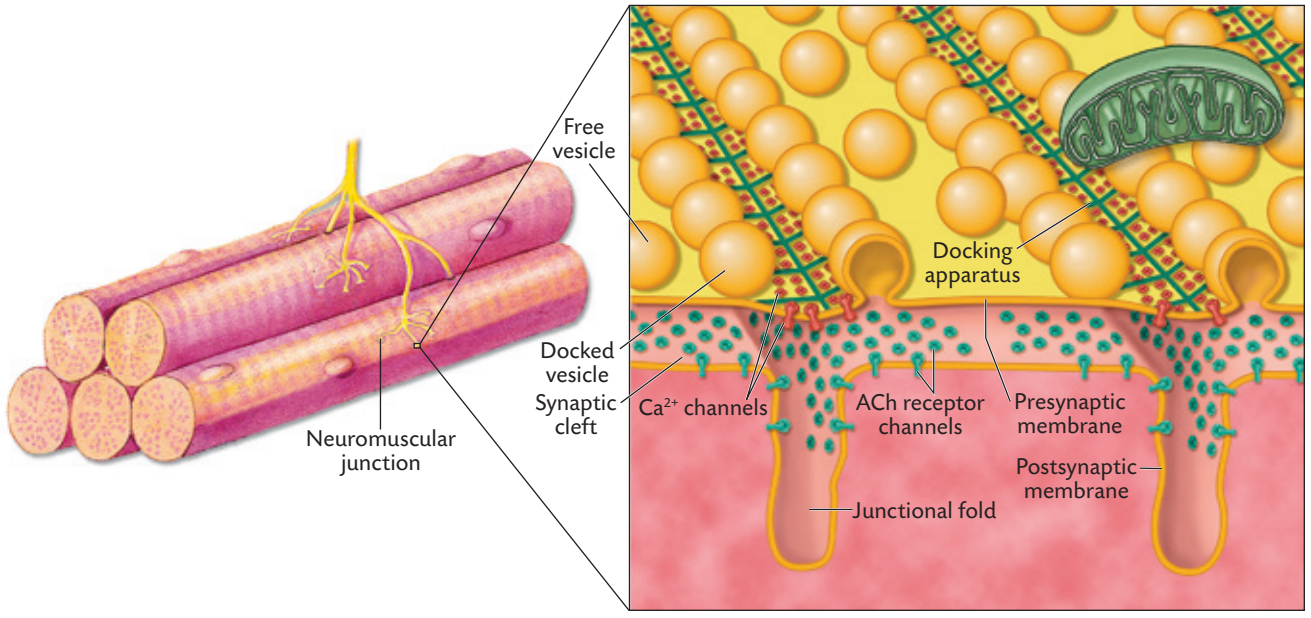

Figure 8.6 Neuromuscular synapse. A narrow synaptic cleft separates the membranes of the motor nerve terminal and the skeletal muscle cell. The nerve terminal contains vesicles with the neurotransmitter acetylcholine, which may be released by Ca^{2+}-dependent exocytosis. Vesicles ready for exocytosis are docked in active zones, which are co-localized with voltage-gated Ca^{2+} channels. The postsynaptic membrane on the other side of the synaptic cleft possesses elongated folds aligned with the active zones. The acetylcholine receptor channels are concentrated along the shoulders of the postsynaptic folds, just opposite the active zones where acetylcholine is released. The acetylcholinesterase molecules are anchored to protein fibers in the matrix of the synaptic cleft close to the postsynaptic folds, where the density of receptor channels is highest.

ated in the muscle cell. When an action potential reaches a nerve terminal, only a few of the presynaptic vesicles undergo exocytosis, and the stores of vesicles are replenished as they are consumed. In the presynaptic membrane, carrier proteins transport choline from the synaptic cleft and into the nerve terminal, where choline is a substrate in the synthesis of acetylcholine.

The neuromuscular synapse has an intricate microanatomy in which the different protein molecules participating in signal transmission are optimally located relative to each other (Fig. 8.6). The presynaptic vesicles prepared for exocytosis are anchored to the membrane in specific areas called *active zones*. The voltage-gated Ca^{2+} channels are located adjacent to the acetylcholine-containing vesicles in these zones, thus providing the shortest possible diffusion path between the Ca^{2+} channels and the Ca^{2+}-binding proteins involved in the exocytosis. In the postsynaptic membrane, the density of acetylcholine receptor channels is greatest just opposite the active zones, thereby also ensuring the shortest possible diffusion path between the released acetylcholine molecules and their receptors. The folds in the postsynaptic membrane are directly below, and aligned with, the active zones. In the matrix of the synaptic cleft, the acetylcholinesterase molecules are anchored to protein fibers adjacent to the receptor channels. This stringent microstructure creates optimal conditions for rapid signal transmission.

The ratio between action potentials in the neuron and the muscle fiber is 1:1

The microstructure of the neuromuscular junction ensures rapid transmission

?

12 Name the postsynaptic receptors in the neuromuscular synapses.

13 What is an end plate potential (EPP)?

14 How is an end plate potential terminated?

15 Which properties of neuromuscular synapses ensure that the ratio between pre- and postsynaptic action potentials is 1:1?

16 Describe how a neuromuscular synapse is optimized for fast signal transmission.