



FIGURE 8.2 Steps in the life cycle of synaptic vesicles: (1) Na⁺-dependent uptake of transmitter (XMTR) or XMTR precursors into the cytoplasm, (2) synthesis of XMTR, (3) delivery of vesicle membrane containing specialized transmembrane proteins by axoplasmic transport on microtubules, (4) production of transvesicular H⁺ gradient by vacuolar ATPase, (5) concentration of XMTR in vesicles by H⁺/XMTR antiporter, (6) synapsin I-dependent anchoring of vesicles to actin filaments near active zones, (7) releasable vesicles docked in active zones near Ca²⁺ channels, (8) depolarization of nerve terminal and presynaptic bouton by action potential, (9) opening of Ca²⁺ channels and formation of regions of local high [Ca²⁺] ("Ca²⁺ microdomains") in active zones, (10) triggering of exocytosis of docked vesicles comprising quantal units of XMTR released by overlapping Ca²⁺ microdomains, (11) nonquantal leakage of XMTR through vesicle membrane fused with plasma membrane and exposure of vesicle proteins to synaptic cleft, (12) recovery of vesicle membrane by dynamin-dependent endocytosis of clathrin-coated vesicles, (13) fusion of coated vesicles with endosomal cisternae, (14) formation of synaptic vesicles from endosomes. Also shown are postsynaptic receptors with multiple XMTR binding sites and extracellular XMTR-degradative enzymes in synaptic cleft.