Neurotransmitters

Diversity – More than 100 compounds known to act as neurotransmitters. Each acts on distinct receptor(s), producing distinct postsynaptic responses.

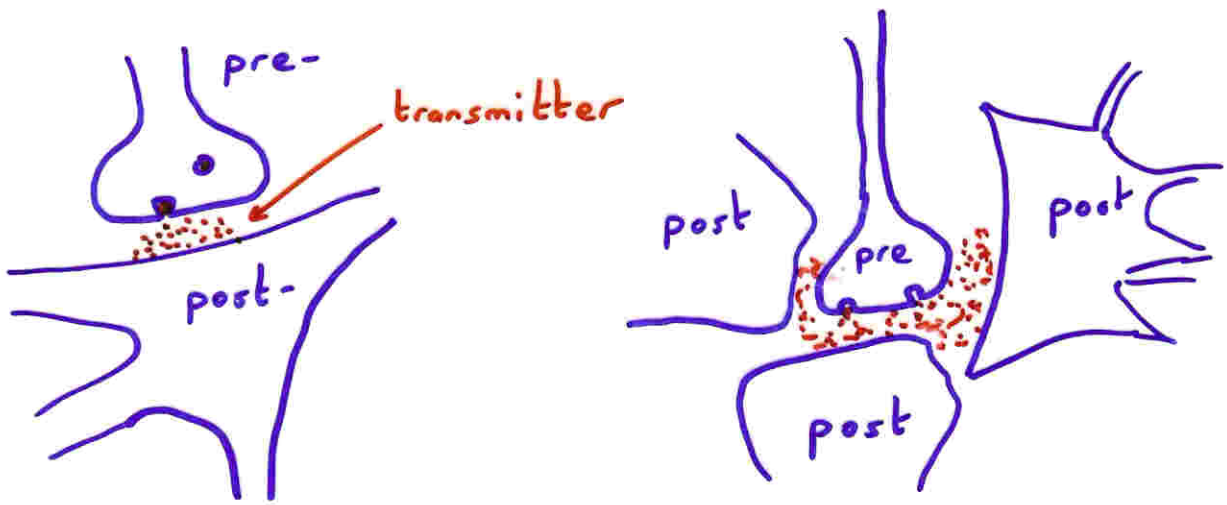
Criteria to define substance as a neurotransmitter

1. Must be present in presynaptic terminal
2. Must be released by presynaptic depolarization
3. Specific receptors must be present on postsynaptic cell.

Box A pg. 99

Localization of neurotransmitter action

Different to hormones - that are released into the bloodstream to affect distant organs - neurotransmitters act on single, or a few postsynaptic cells.



Recent identification of NO as a gaseous neurotransmitter blurs this distinction, as it diffuses readily to affect many cells.

Categories of neurotransmitter substances

Large molecule neurotransmitters

- Neuropeptides (usually 3-100 amino acids)

Small molecule neurotransmitters

- Acetylcholine
- Amino acids (e.g. glutamate, GABA)
- Catecholamines (e.g. dopamine)
- Indolamine (serotonin)

[for exam you don't need to know details of chemical structures and synthetic pathways]

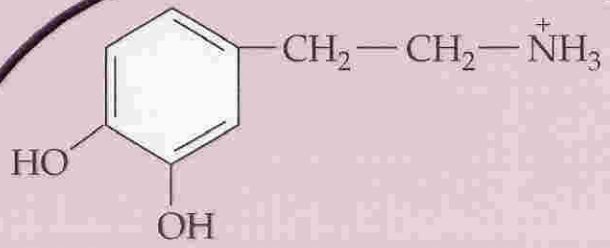
SMALL-MOLECULE NEUROTRANSMITTERS

BIOGENIC AMINES

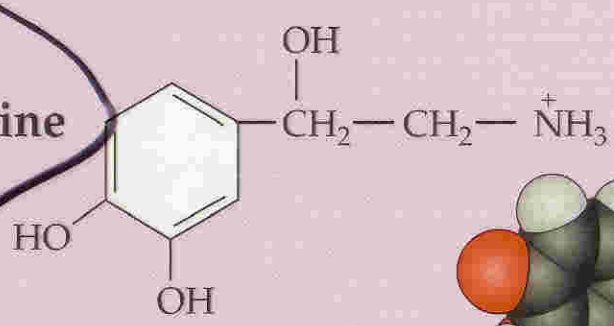
CATECHOLAMINES

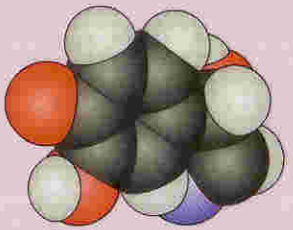
Example of what you DO NOT need to memorize for the exam!

Dopamine

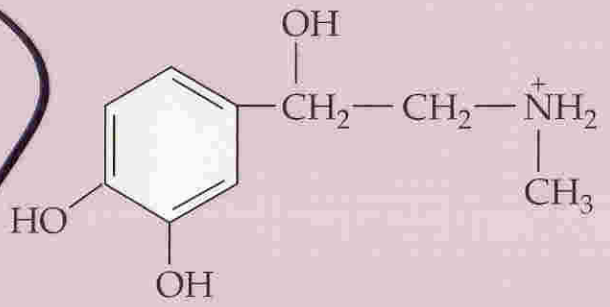


Norepinephrine





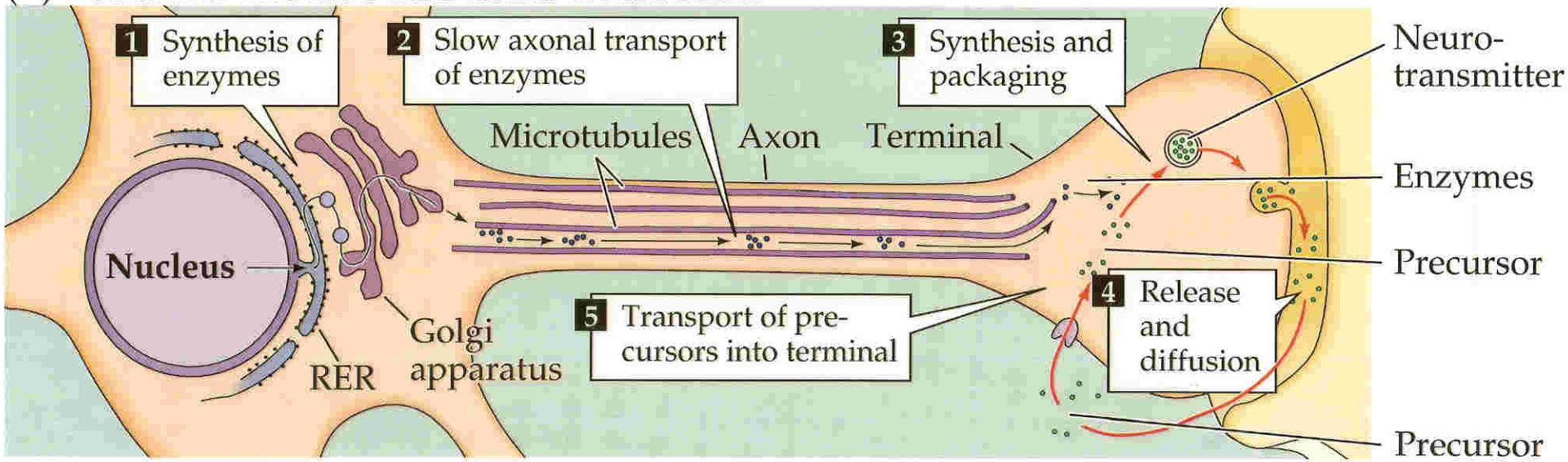
Epinephrine



NEUROSCIENCE, Third Edition, Figure 6.1 (Part 3)

7.5

(B) SMALL-MOLECULE TRANSMITTERS



(C) PEPTIDE TRANSMITTERS

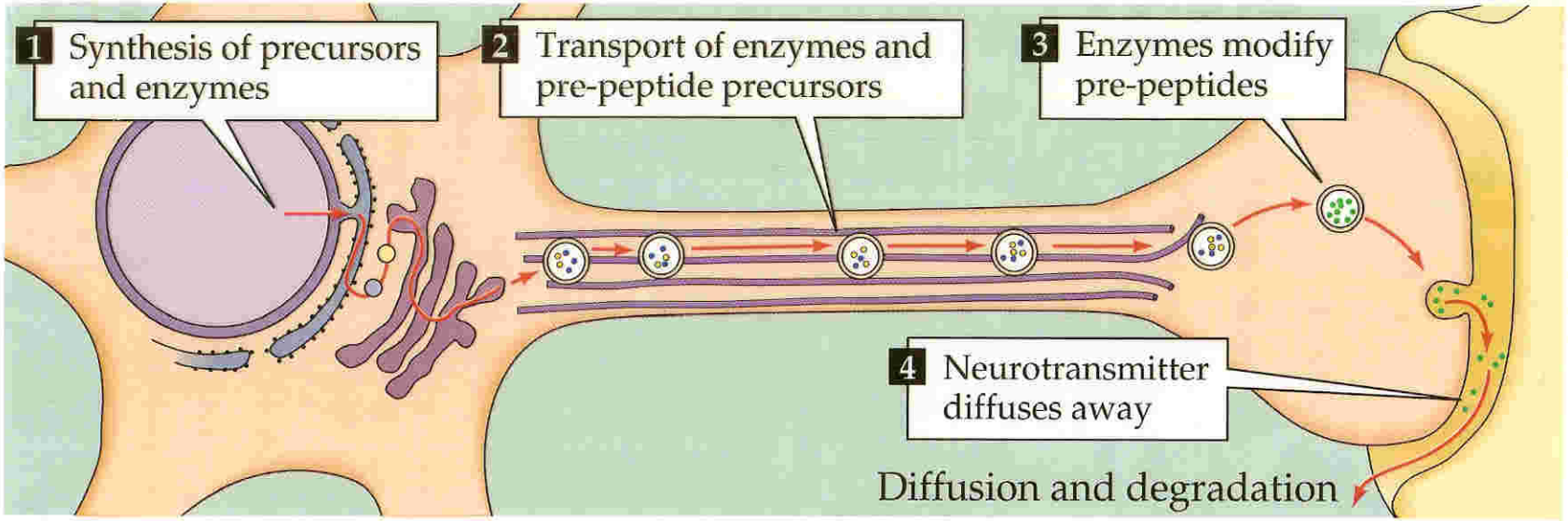
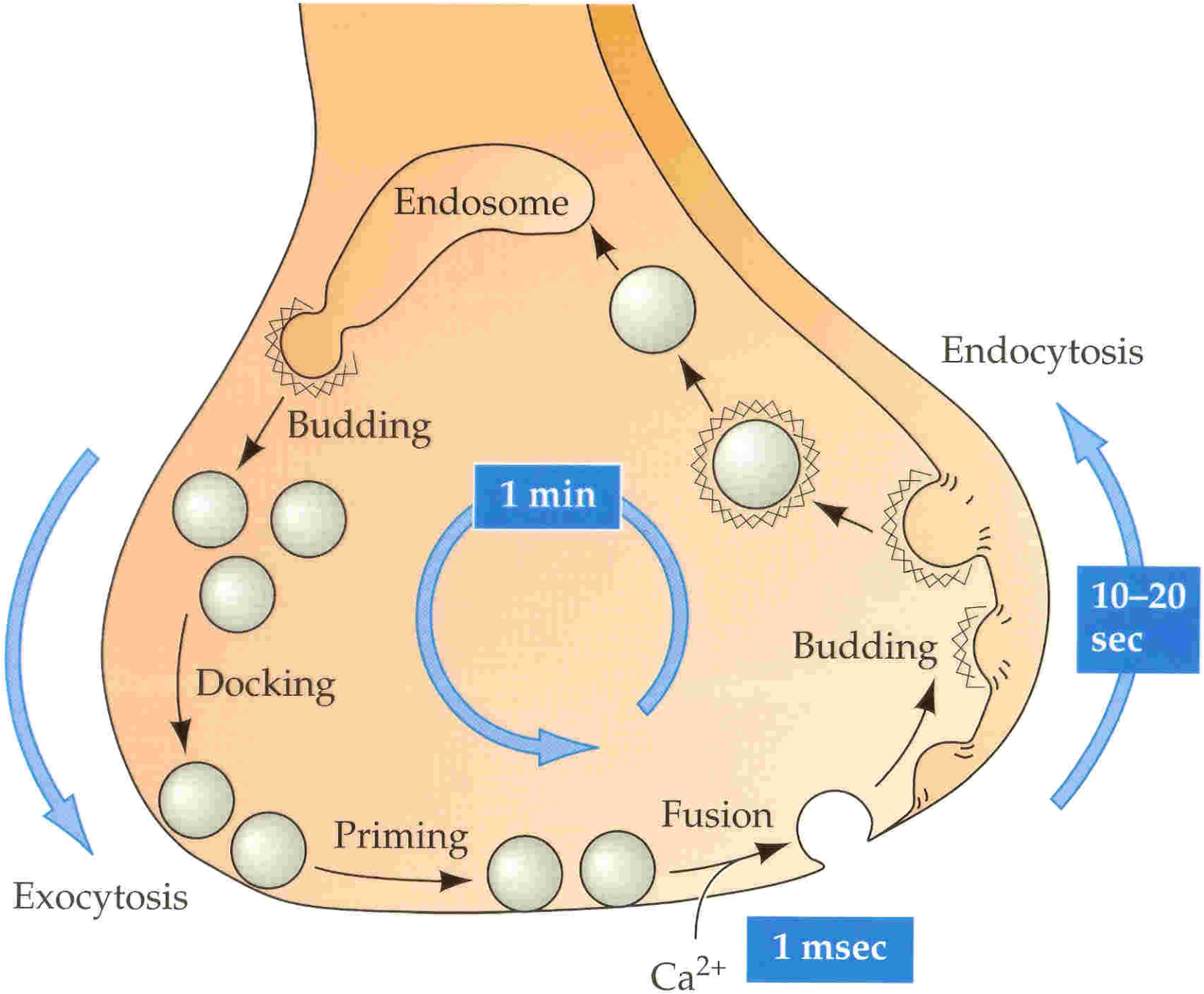


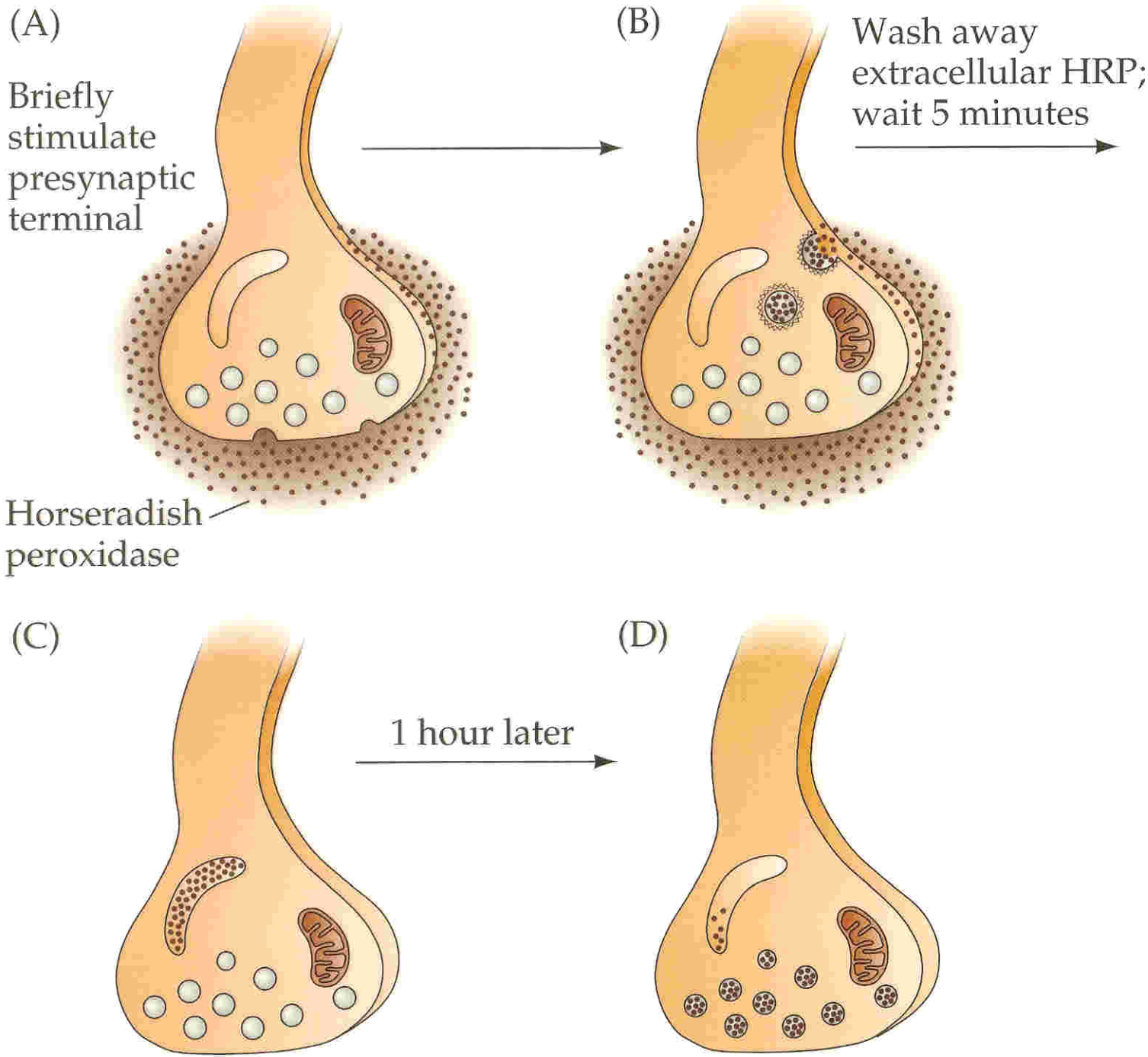
Figure 6.5 (Part 2) Synthesis, Packaging, Secretion, and Removal of Neurotransmitters

NEUROSCIENCE, Edited by
Purves, Augustine, Fitzpatrick, Katz, LaMantia, and McNamara

(E)



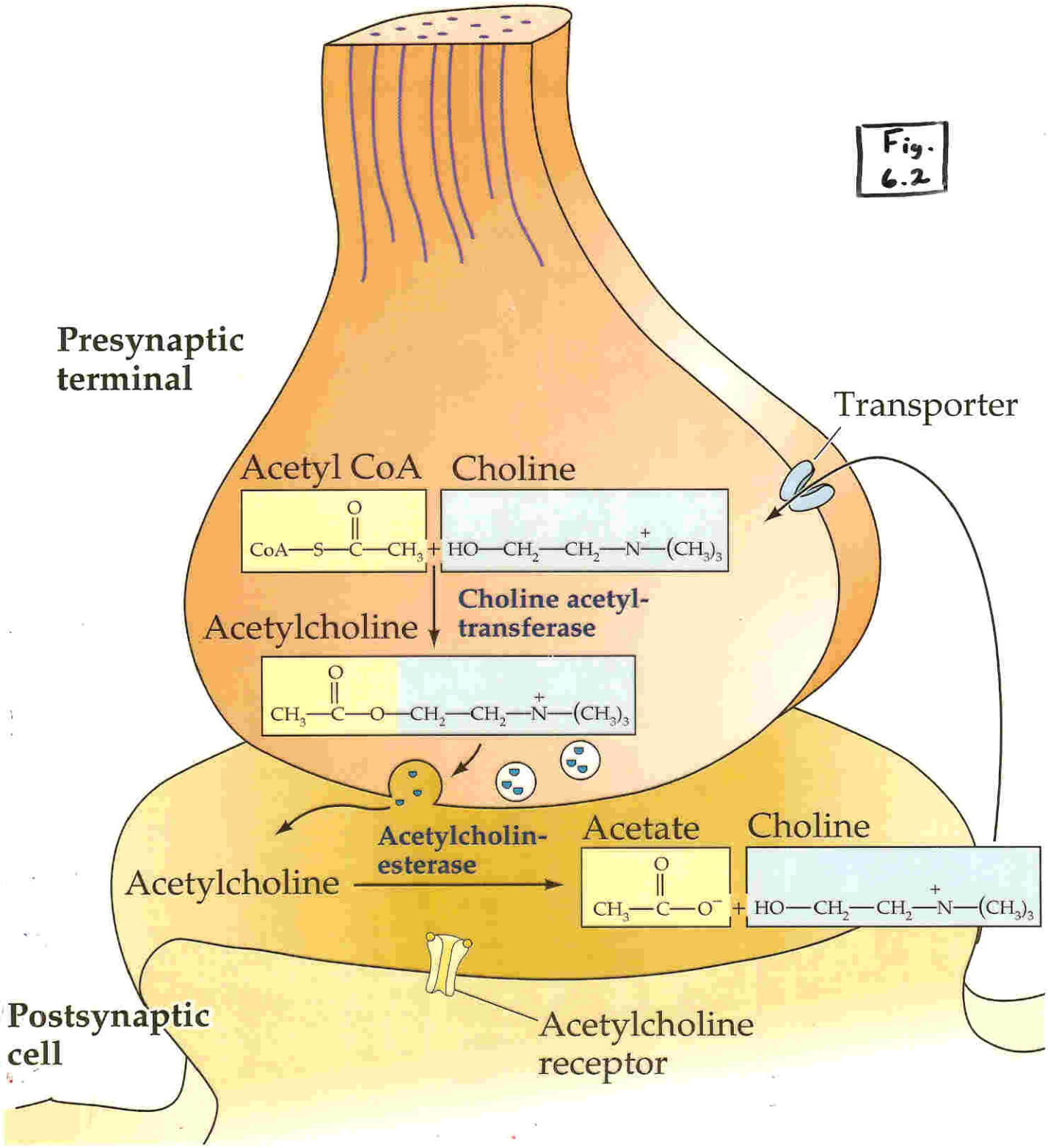
NEUROSCIENCE, Third Edition, **Figure 5.9 (Part 2)** © 2004 Sinauer Associates, Inc.



NEUROSCIENCE, Third Edition, **Figure 5.9 (Part 1)**

7.8

Fig. 6.2


Presynaptic terminal
Transporter
Acetyl CoA
Choline
CoA—S—C—CH3 + HO—CH2—CH2—N+—(CH3)3
Choline acetyl-transferase
Acetylcholine
CH3—C—O—CH2—CH2—N+—(CH3)3
Acetylcholin-esterase
Acetylcholine
Acetate
Choline
CH3—C—O− + HO—CH2—CH2—N+—(CH3)3
Postsynaptic cell
Acetylcholine receptor

Termination of transmitter action

Action of ACh on postsynaptic receptors is rapidly terminated by acetylcholinesterase enzyme breaking down ACh.

Many other transmitters (e.g. glutamate, glycine, GABA) are not broken down in the synaptic cleft. Termination of their action is by active transport back into nerve terminal or glia. Peptides just diffuse away.

Many drugs used for treating psychiatric disorders work by acting on transporters or enzymes that synthesize or degrade transmitters in the nerve terminal.

E.g. Prozac blocks reuptake of serotonin.