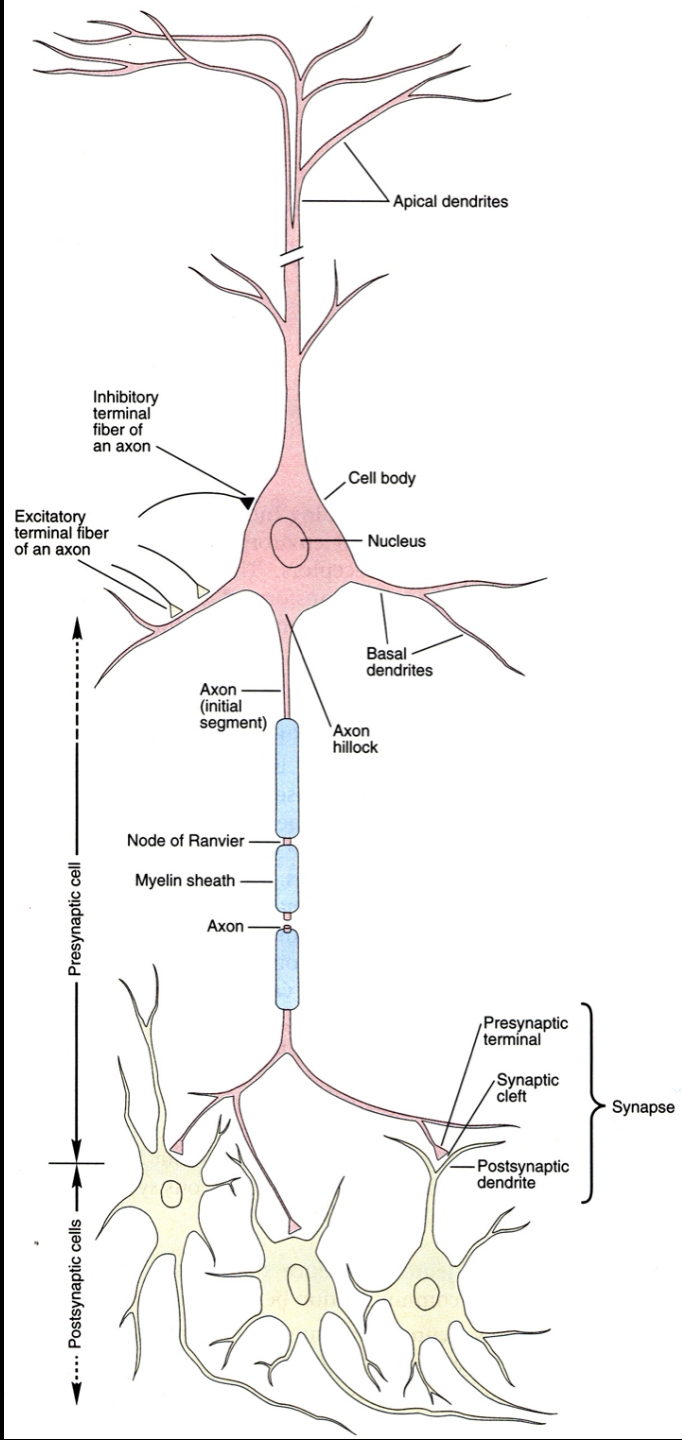


What is a synapse?

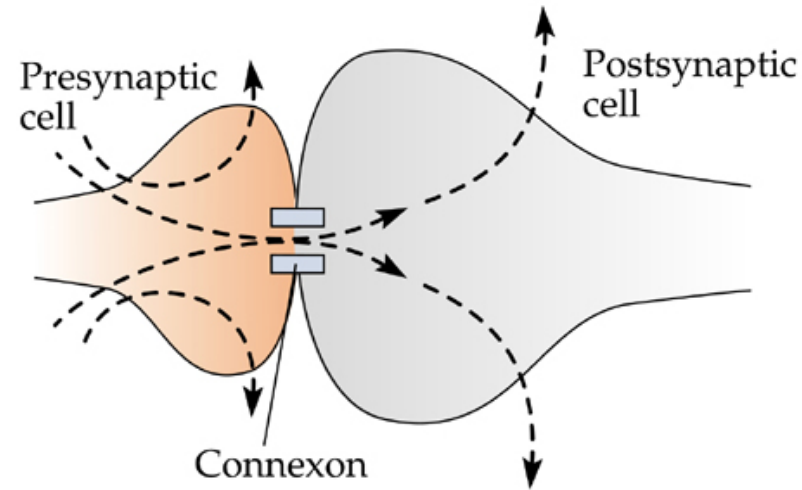
- A synapse is a site of close apposition between a neuron and a target cell, where an electrical signal in the neuron leads to a change in the probability that the target cell will give an action potential.
 - if the probability increases, the synapse is excitatory
 - if the probability decreases, the synapse is inhibitory



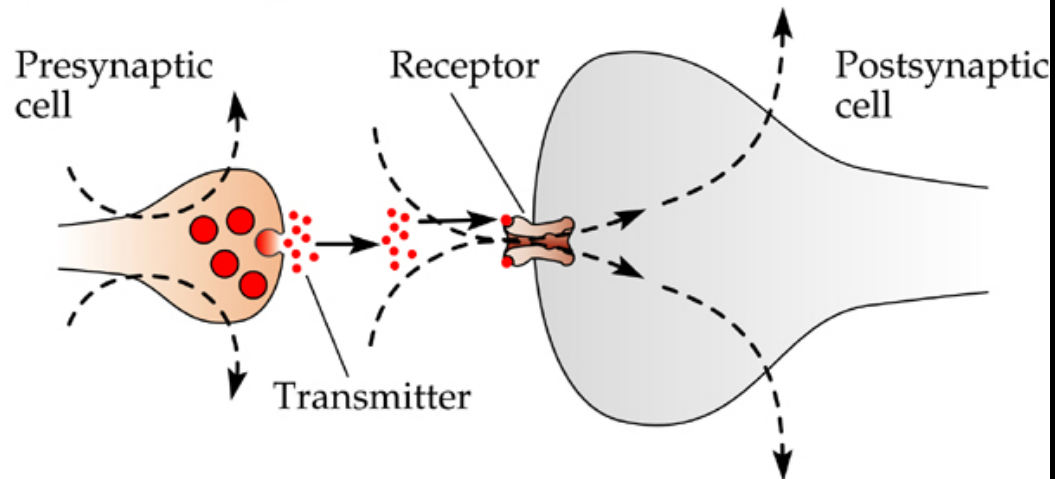
Kandel, Schwartz & Jessell, *Essentials of Neuroscience and Behavior*. Appleton & Lange, East Norwalk, 1995.

Synapses in the Nervous System

(A) Electrical synapse



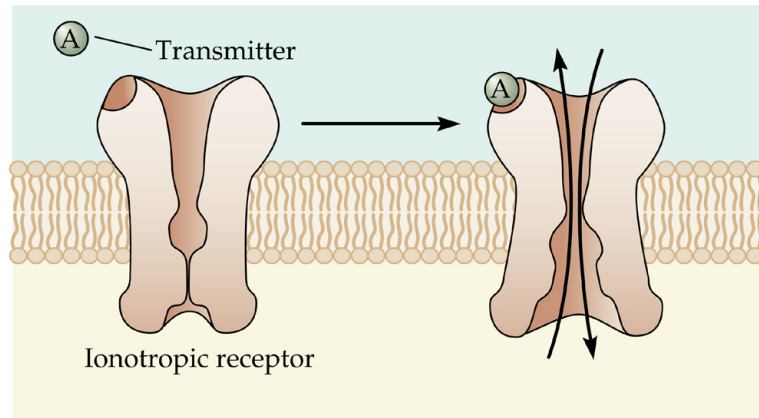
(B) Chemical synapse



Two Kinds of Receptors

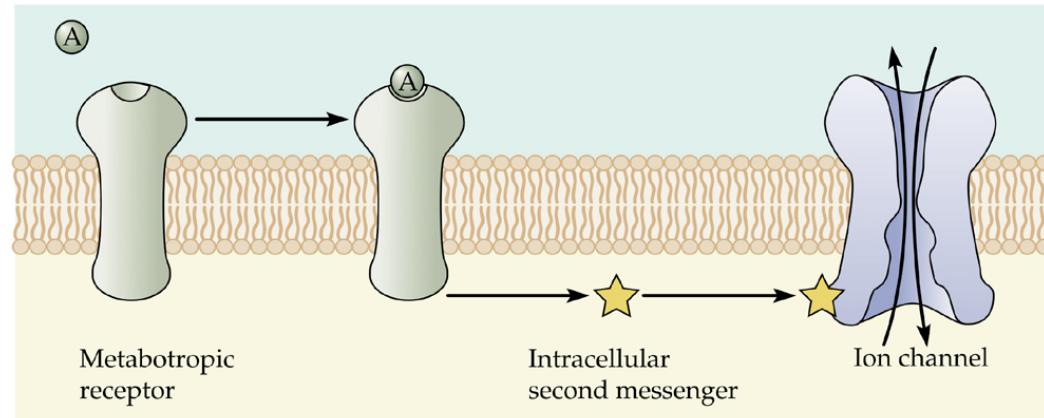
Ionotropic and Metabotropic

(A) Direct transmitter action



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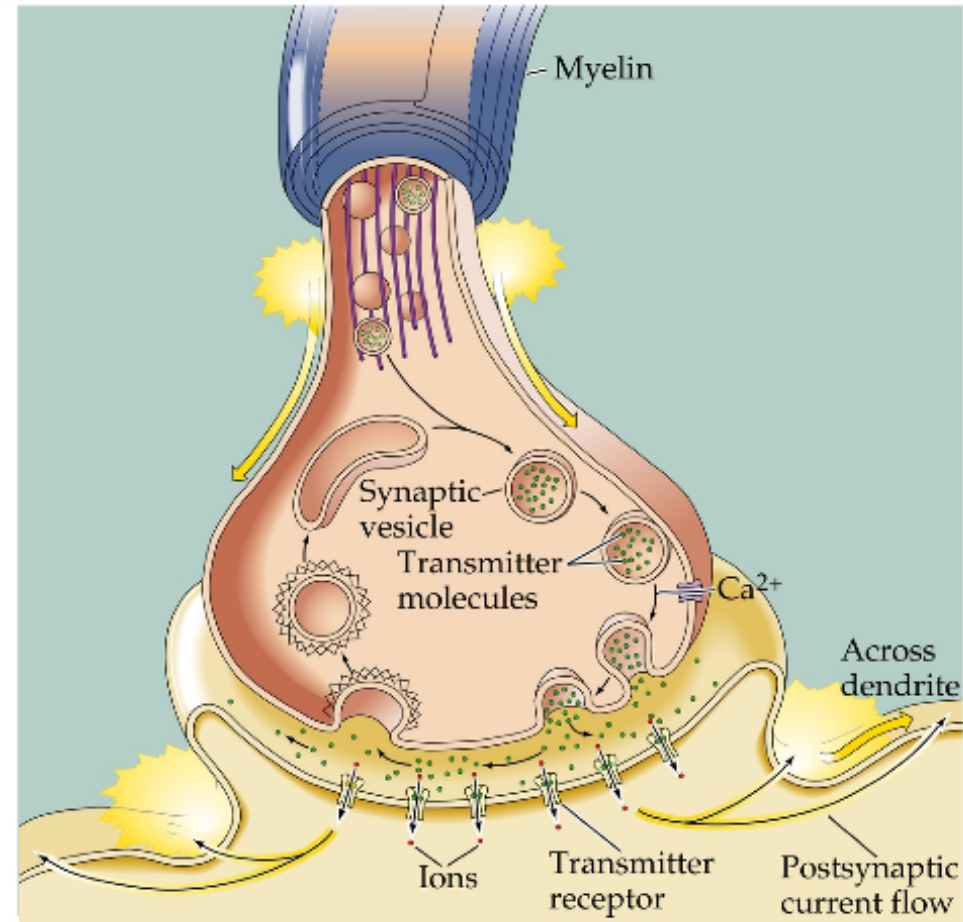
(B) Indirect transmitter action



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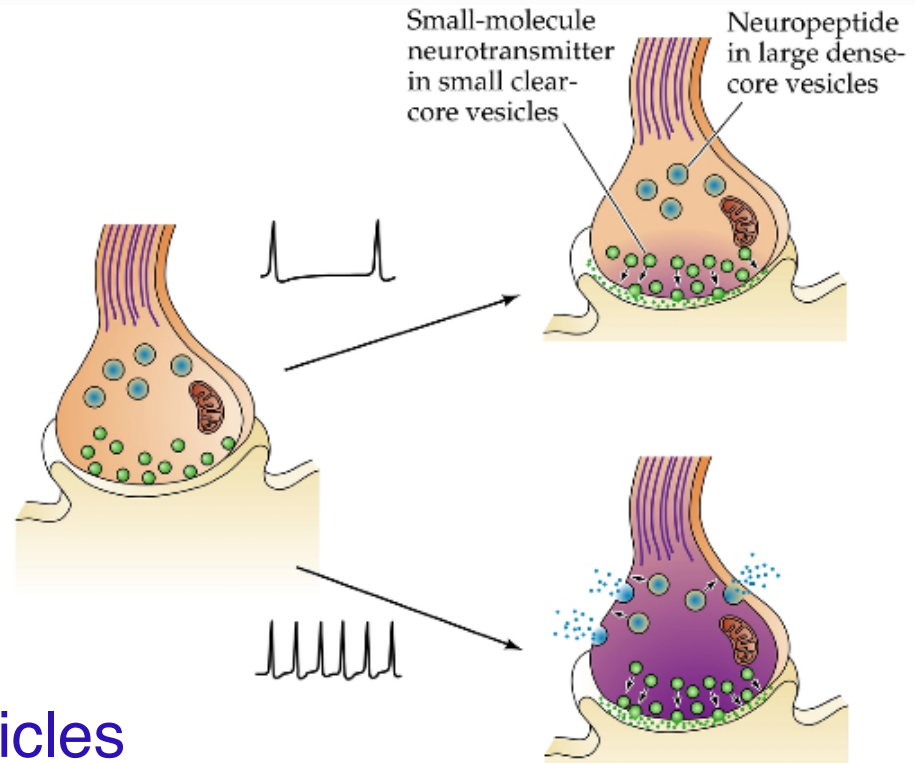
Sequence of Events at a Chemical Synapse

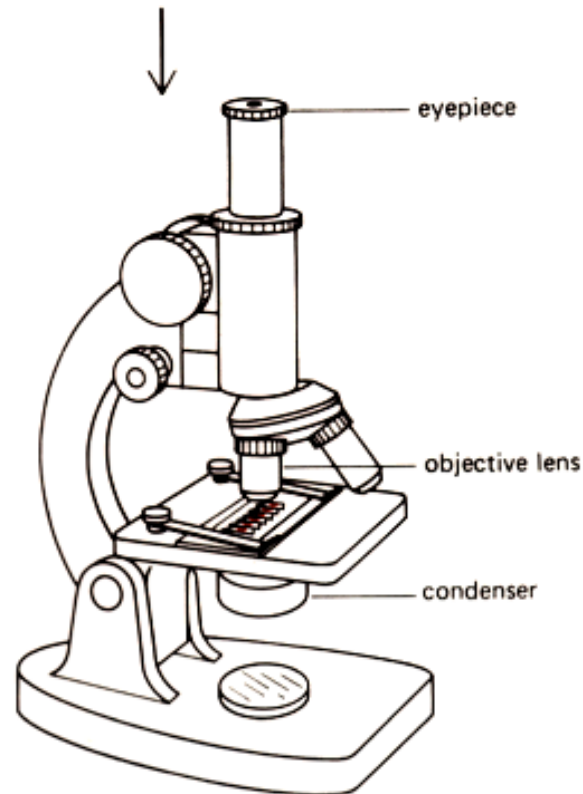
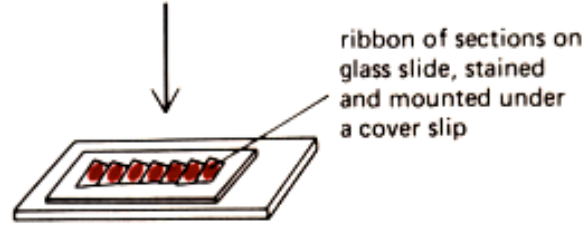
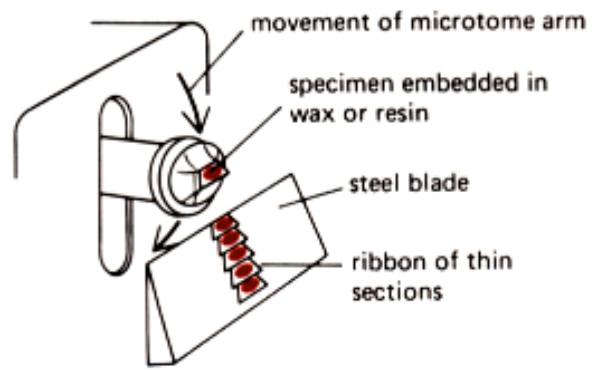
1. An action potential arrives in the terminal, which
2. activates voltage-dependent calcium channels.
3. Calcium enters the terminal and triggers protein mediated fusion of synaptic vesicles with the plasma membrane.
4. Transmitter is released into the synaptic cleft, and
5. binds to receptors on the postsynaptic membrane.
6. The channels associated with these receptors open, which allow ions to flow down their electrochemical gradient, exciting or inhibiting the cell.

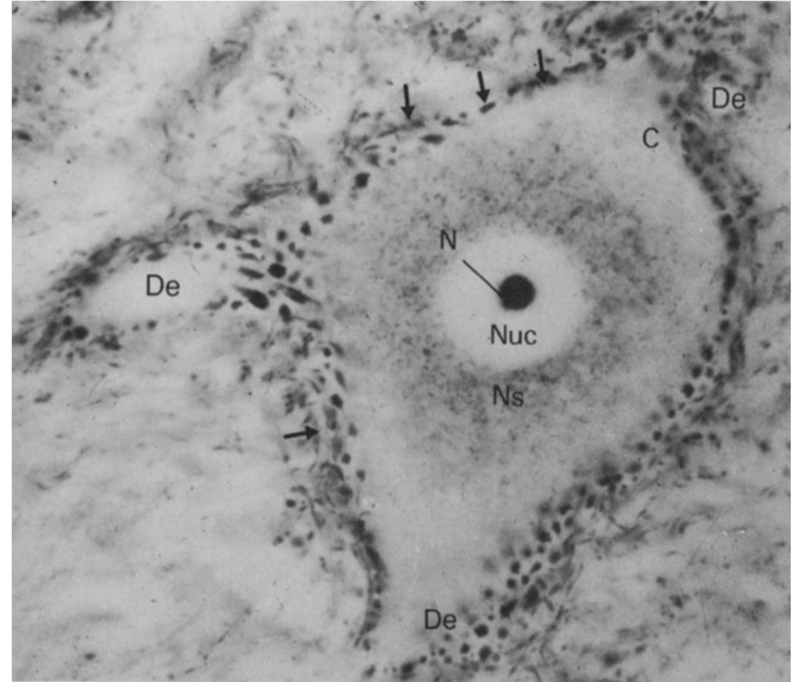
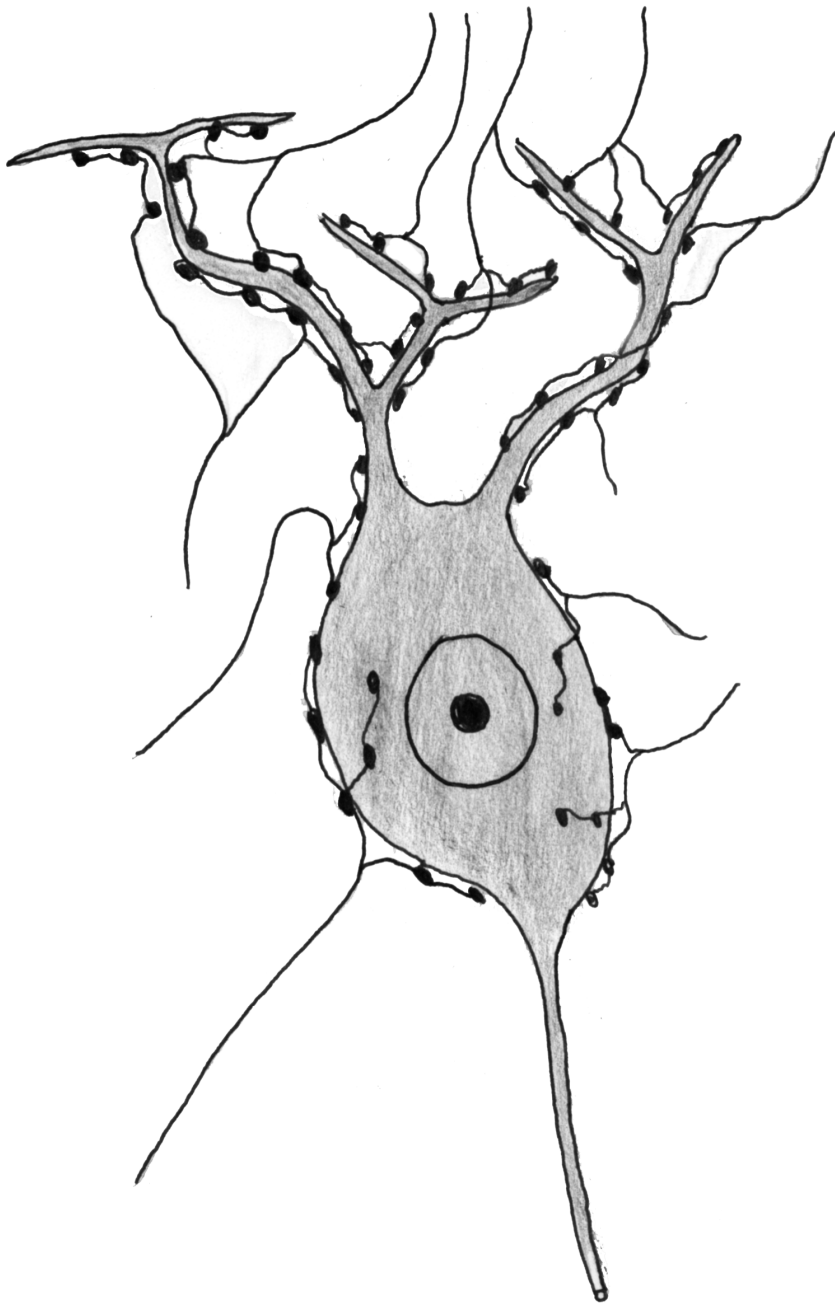


Transmitter release occurs via multiple mechanisms

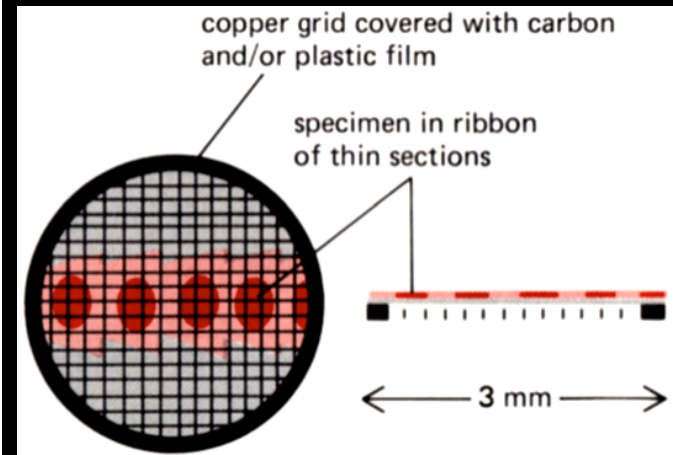
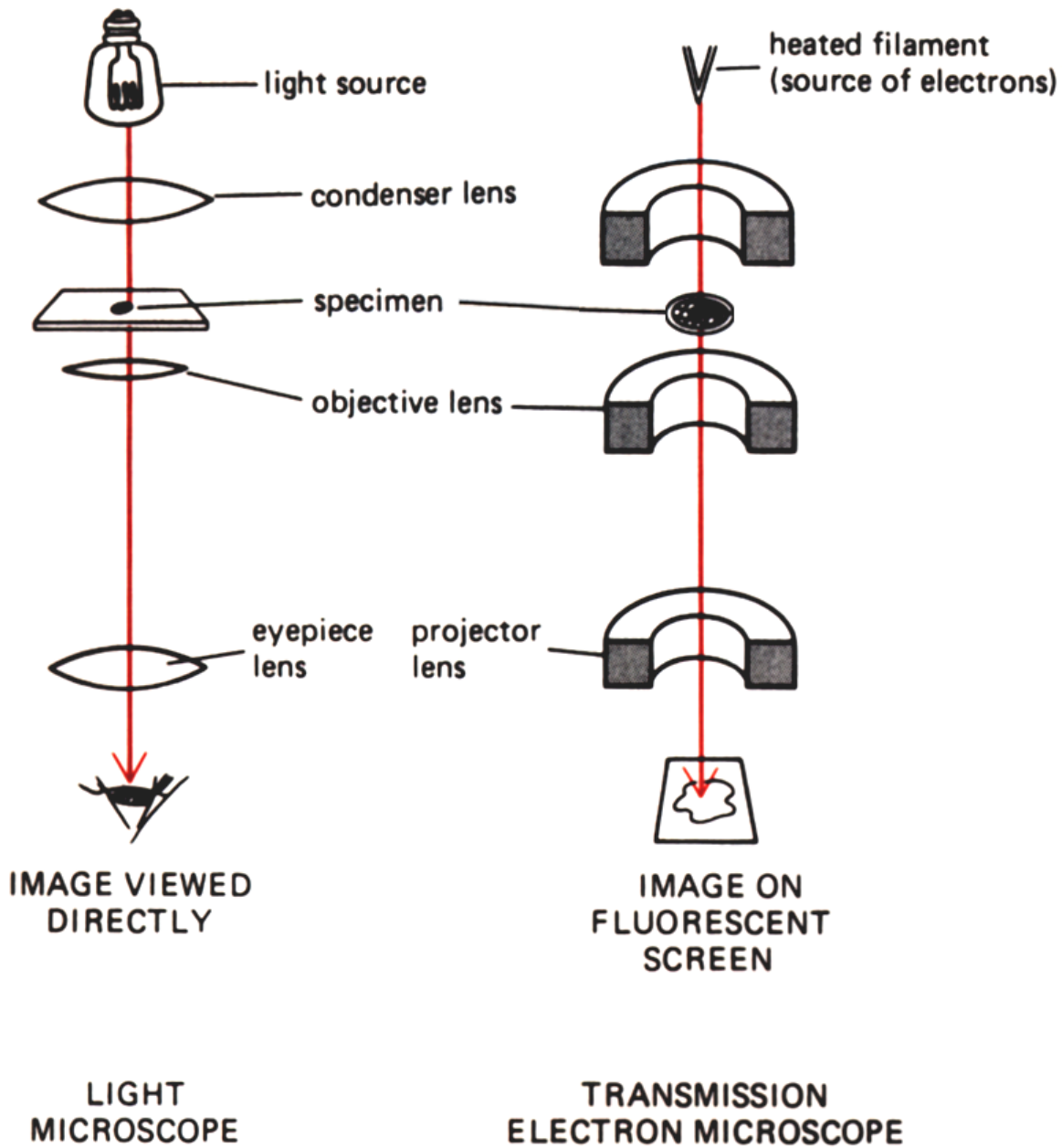
- “Synaptic vesicles”
 - some are “docked”
 - acetylcholine
 - amino acids (glu, gly)
 - GABA
 - ATP
 - amines (NE, DA, 5-HT)
- Large dense-cored vesicles
 - not “docked”
 - peptides





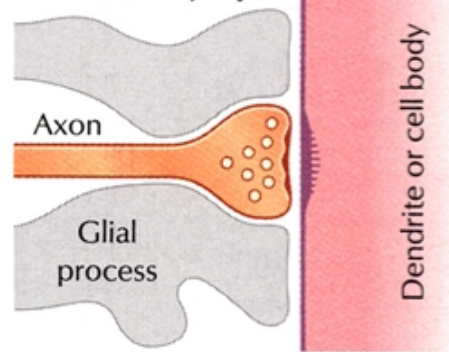


Silver Stained terminal varicosities on a motor neuron - G. L. Rasmussen

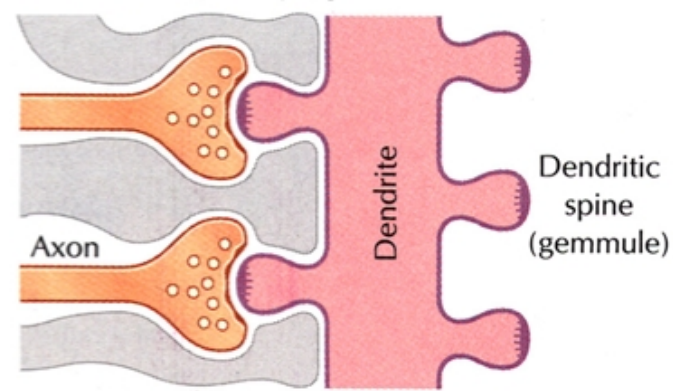




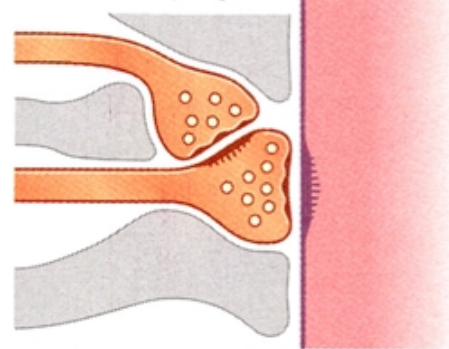
A. Simple axodendritic or axosomatic synapse



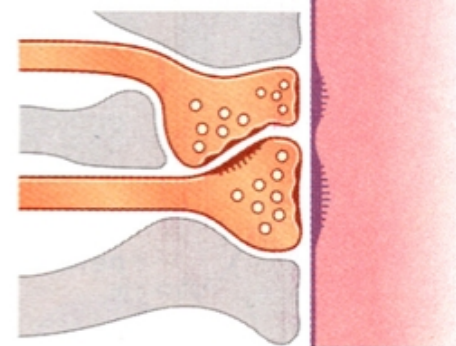
B. Dendritic spine synapse



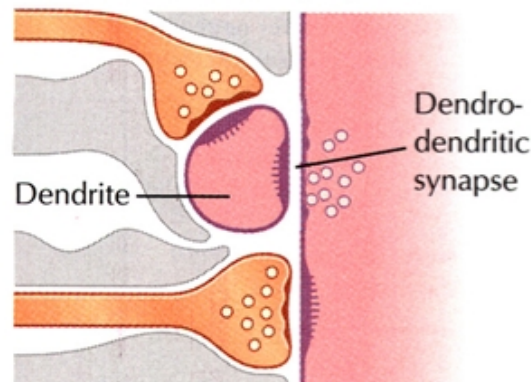
D. Simple synapse plus axoaxonic synapse



E. Combined axoaxonic and axodendritic synapse



G. Dendrodendritic synapse



H. Reciprocal synapse

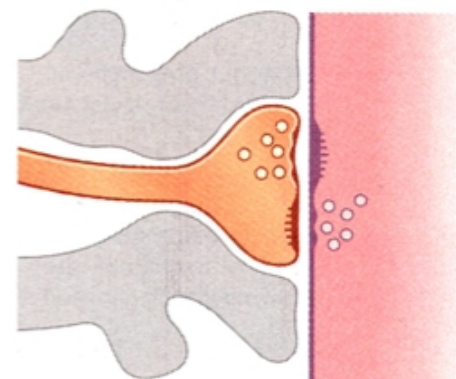
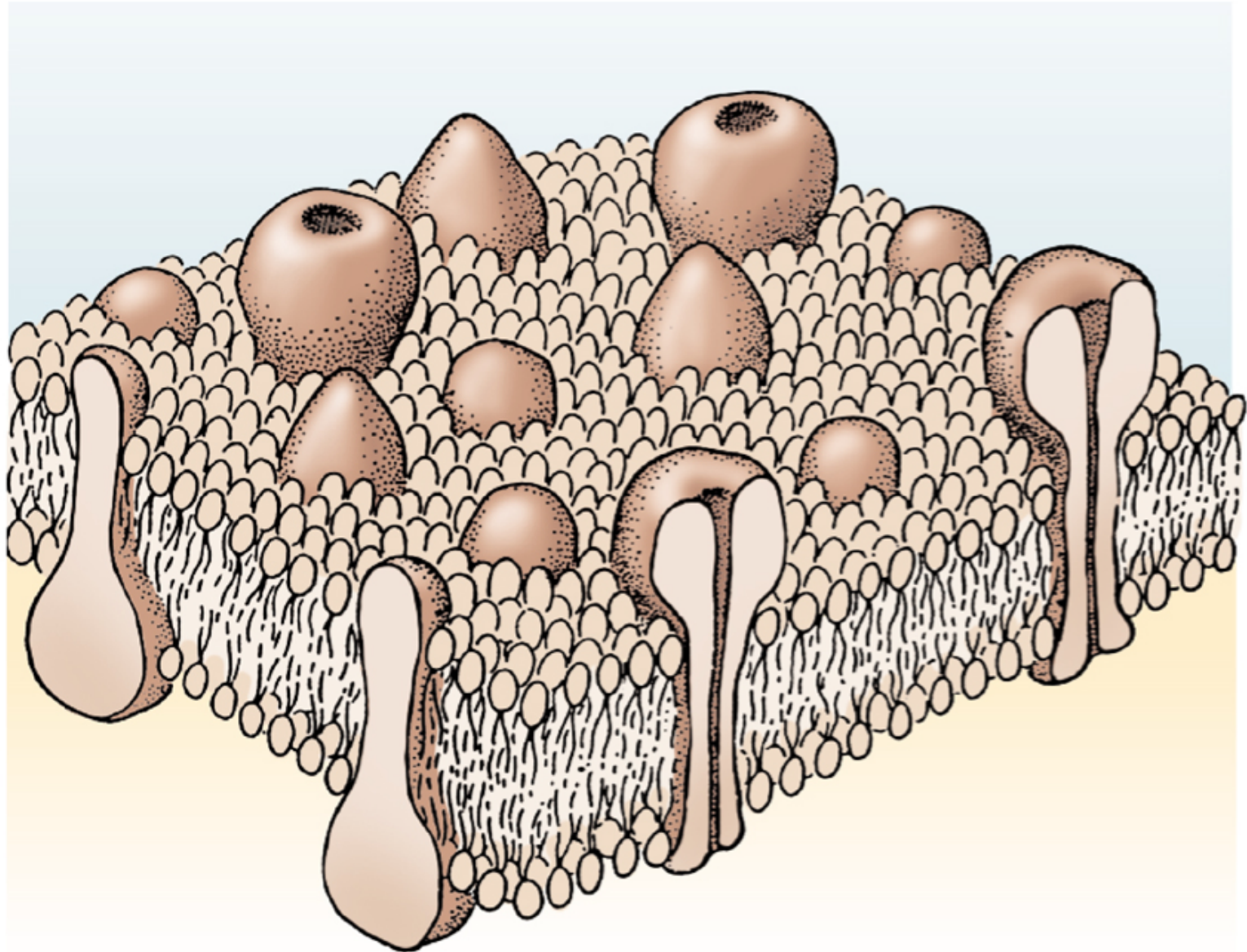


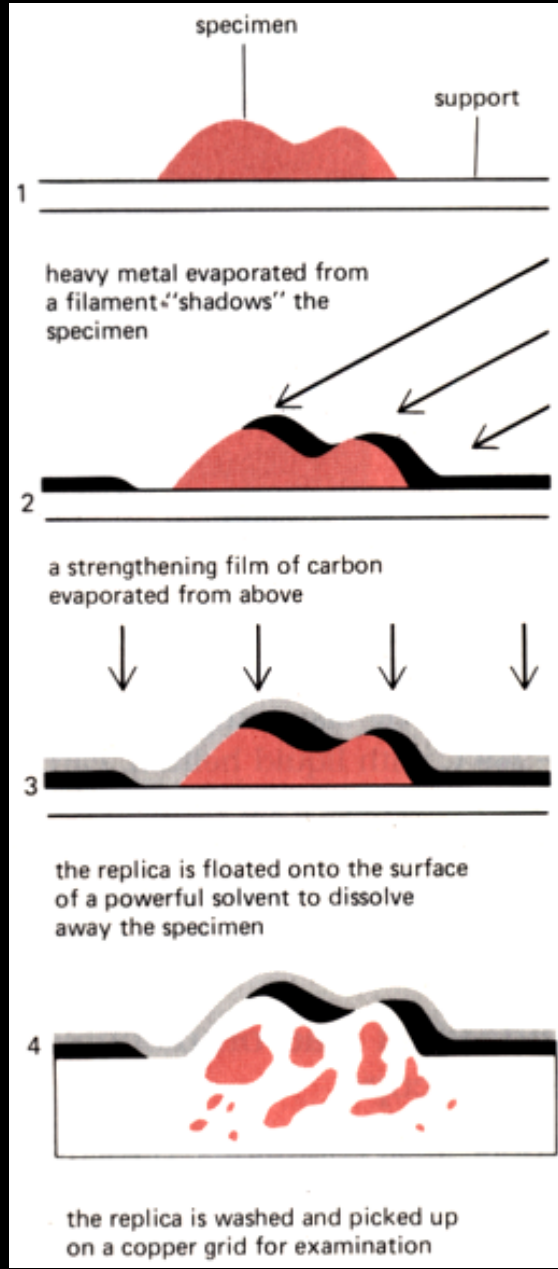
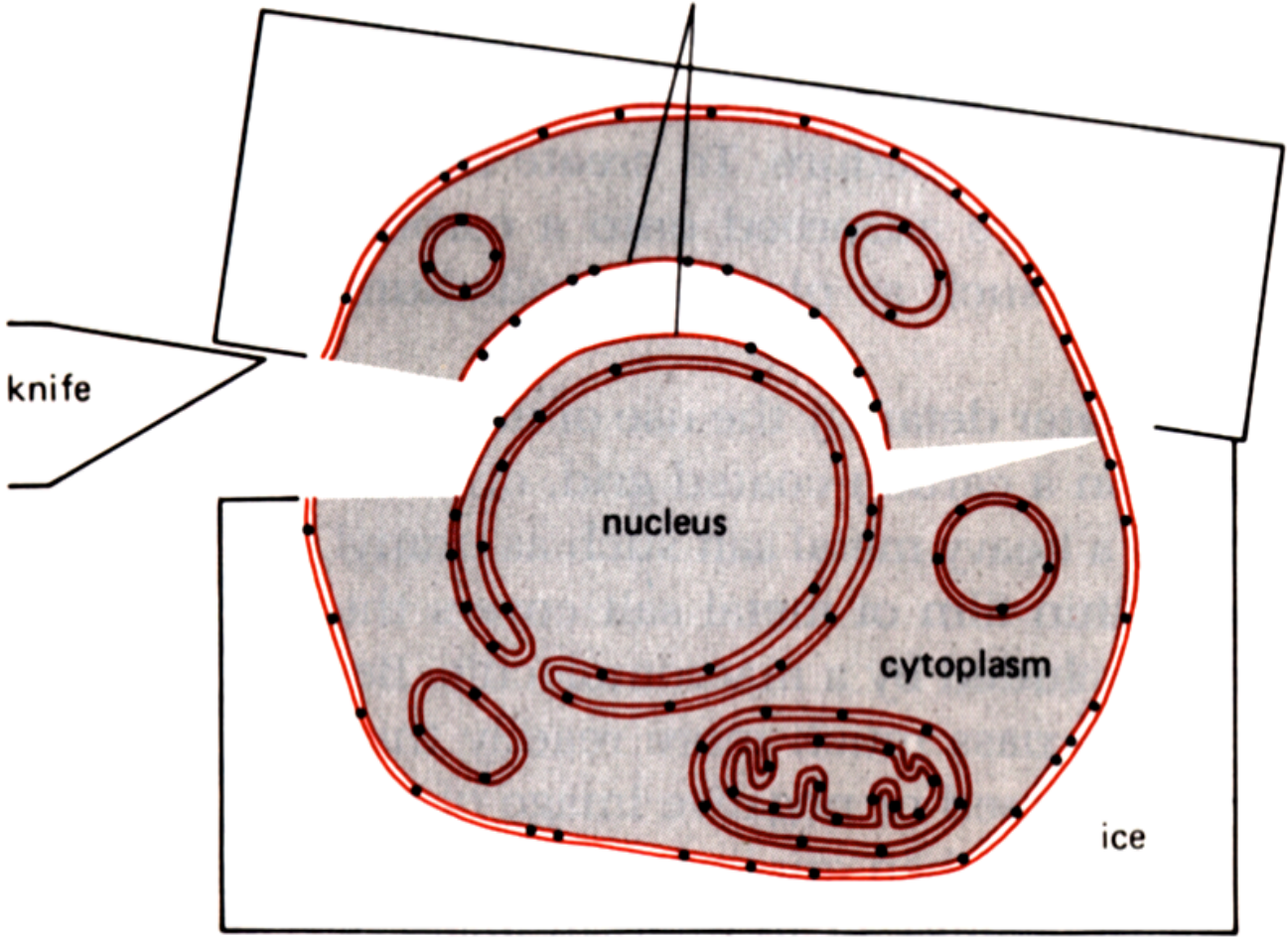
FIGURE I.2: TYPES OF SYNAPSES

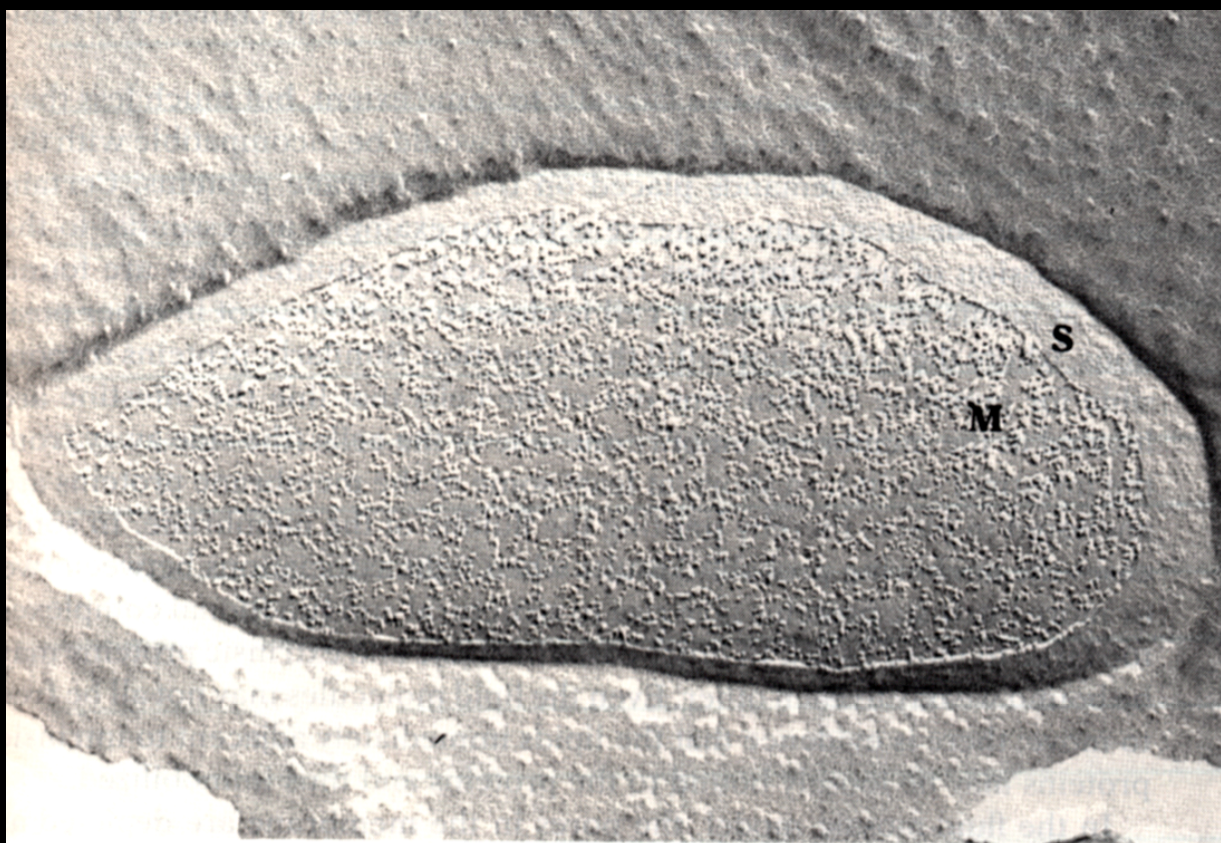
(A)



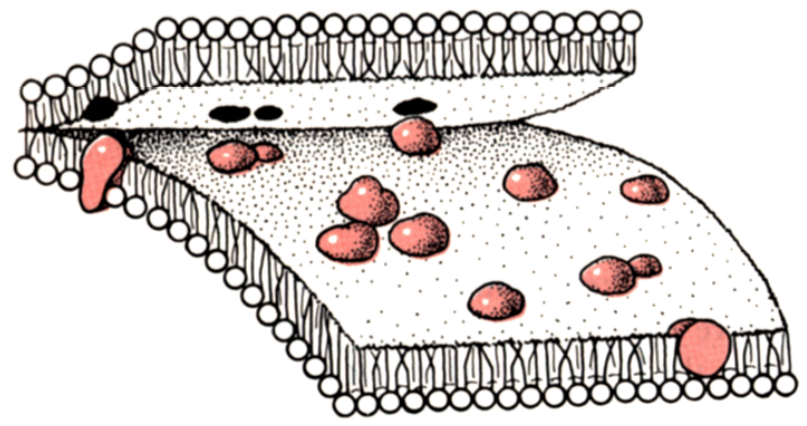
(A) FRACTURE

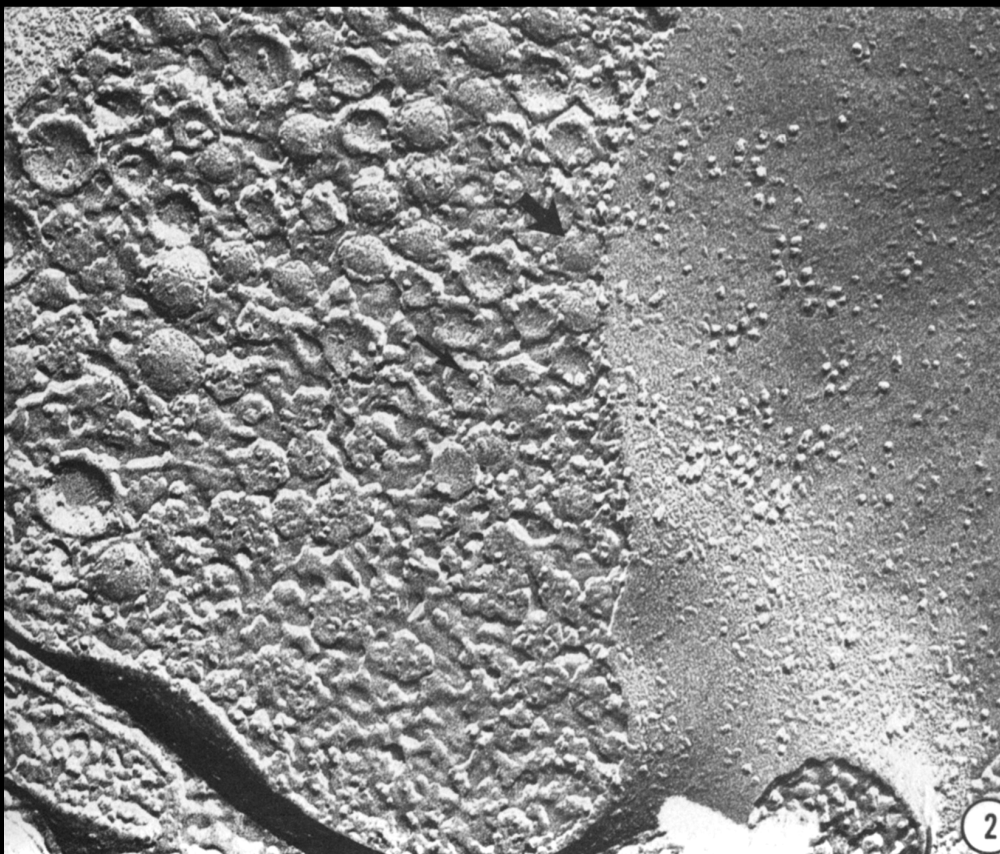
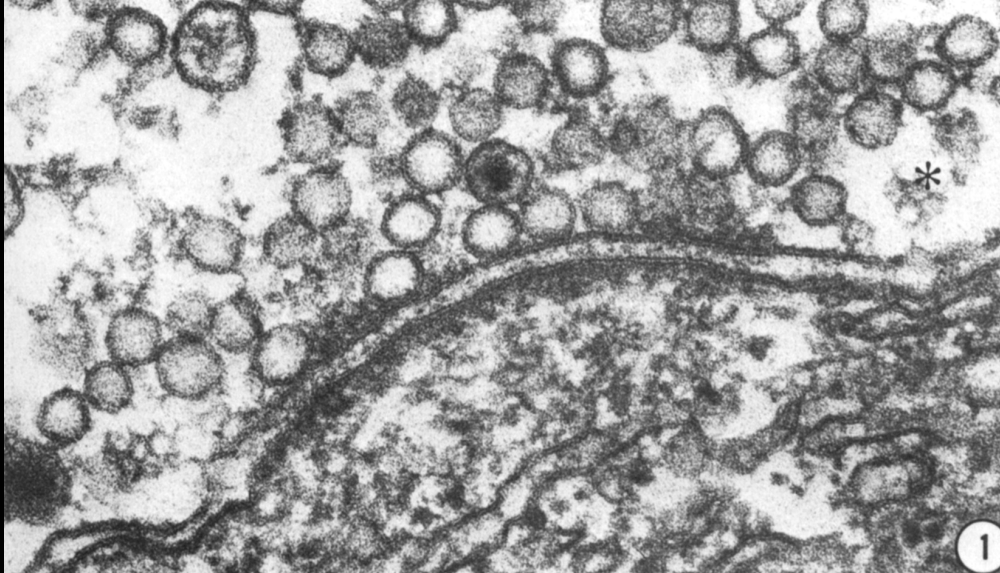
the 2 fracture faces of the outer membrane of the nuclear envelope





1 μ m

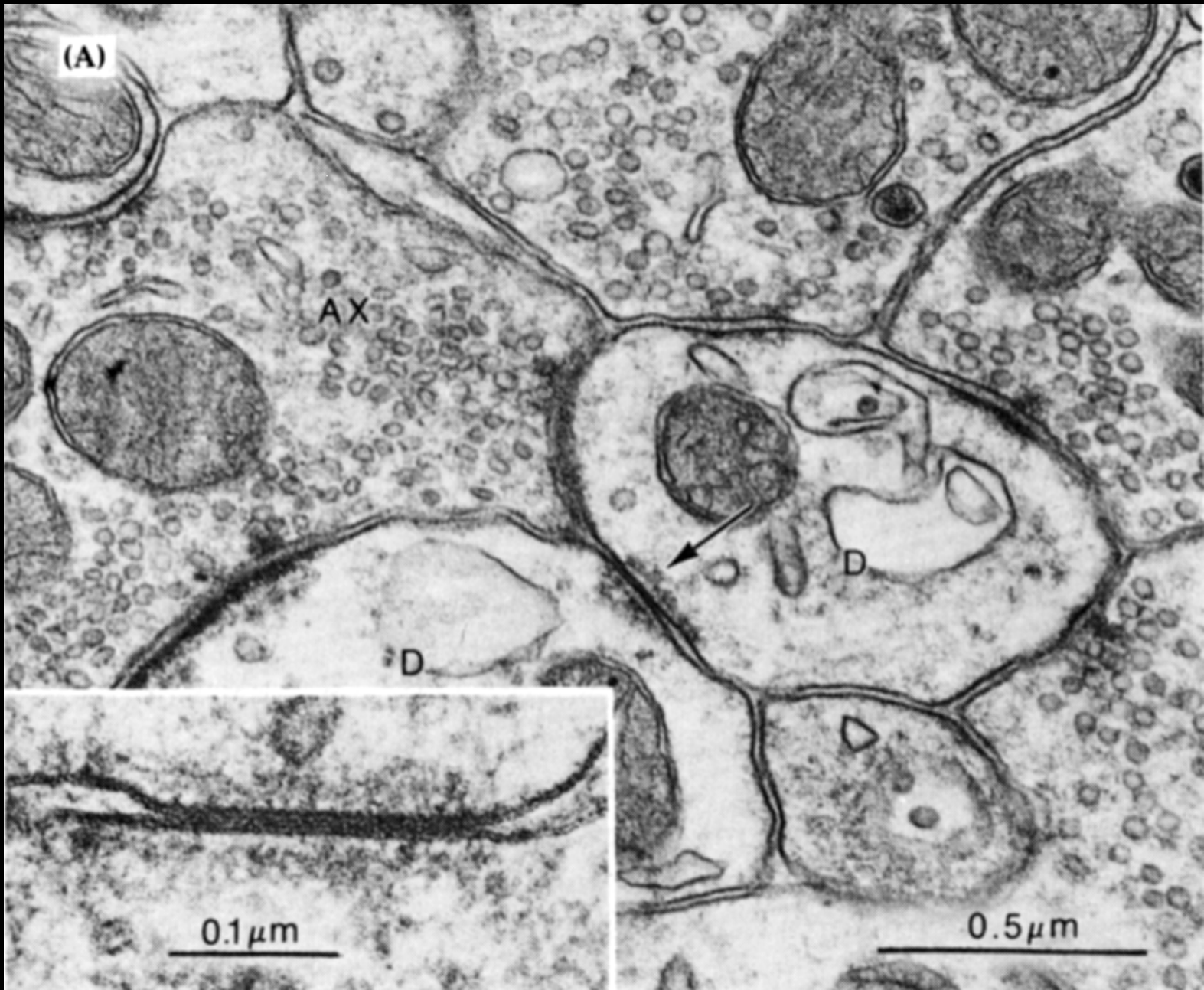


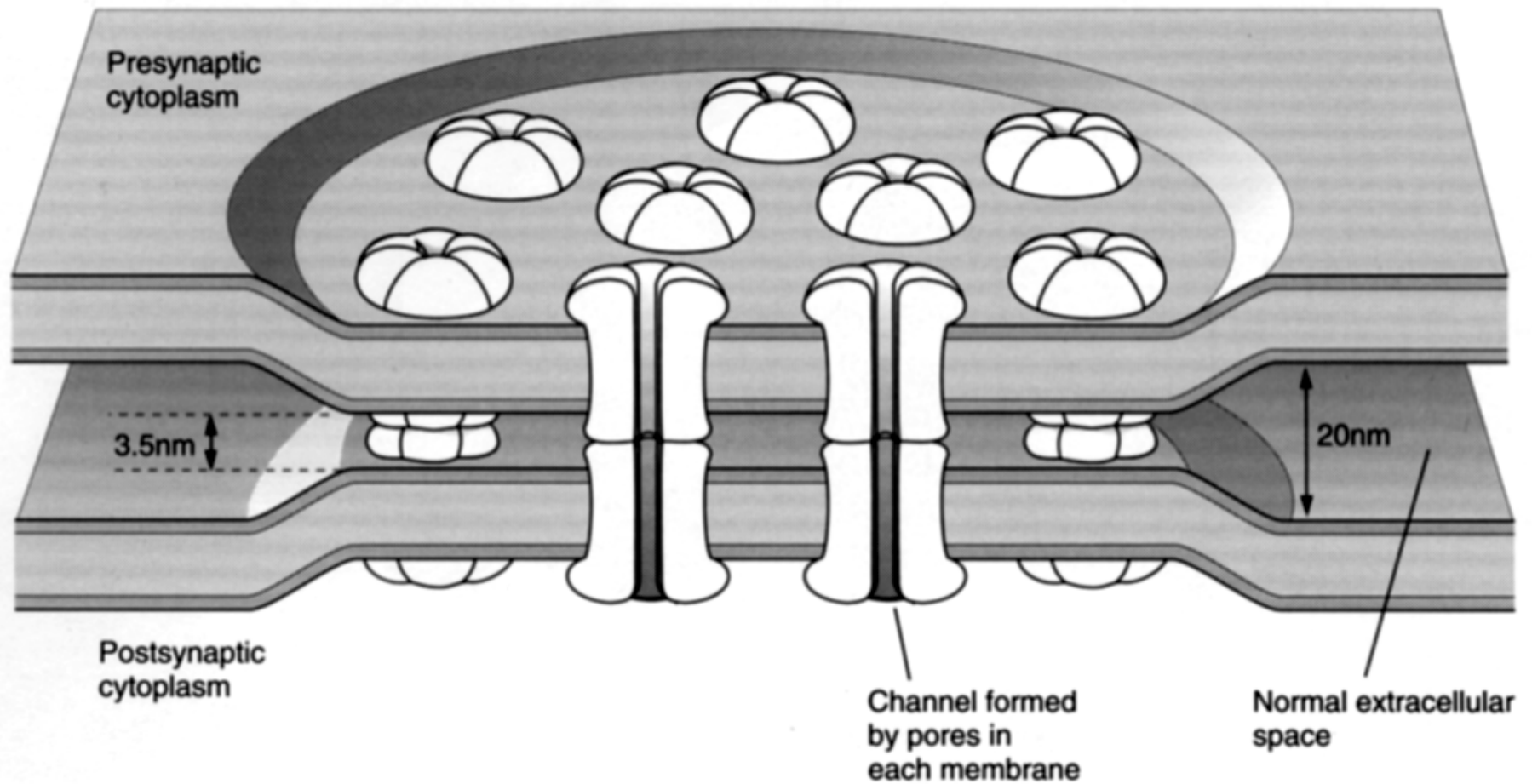


Dickinson-Nelson A. & Reese
TS.
J. Neurosci., 3:42-52 (1983).



Landis & Reese, 1974, J. Comp. Neurol. 155: 93-125.





From: Kandel, Schwartz & Jessell, Principles of Neuroscience "3rd edition", Elsevier, New York, 1991.

