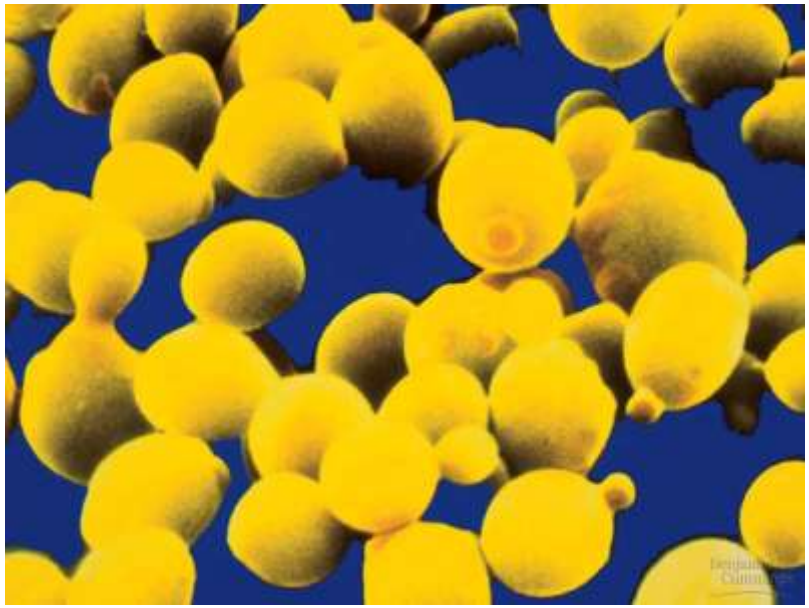
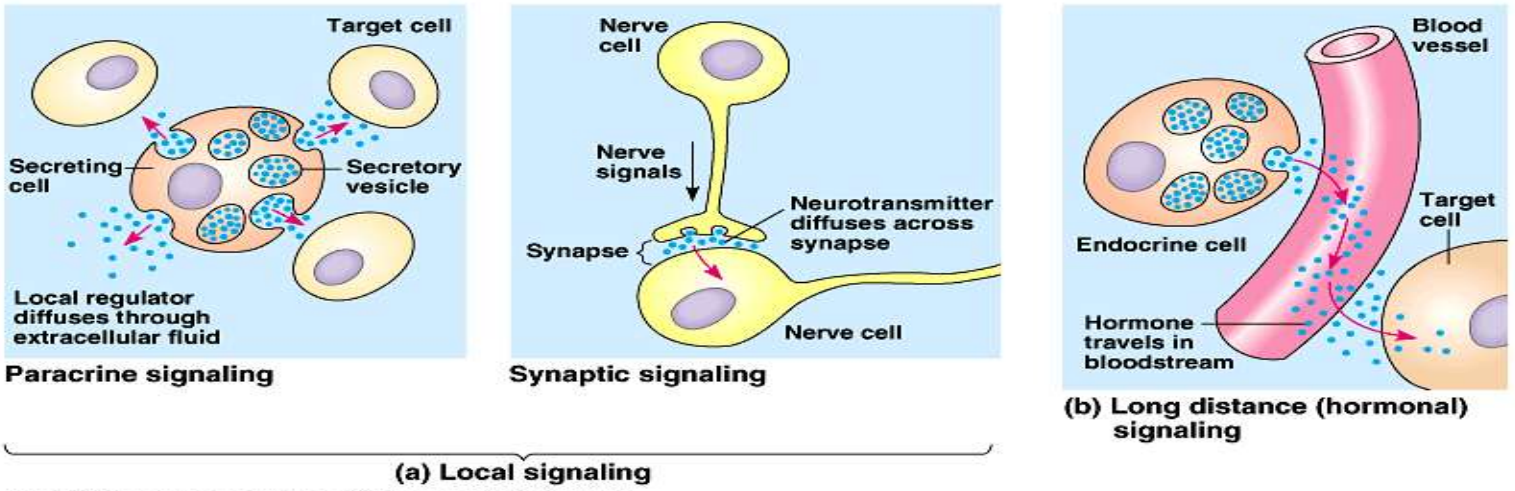
Cell Communication



Signal-transduction pathway

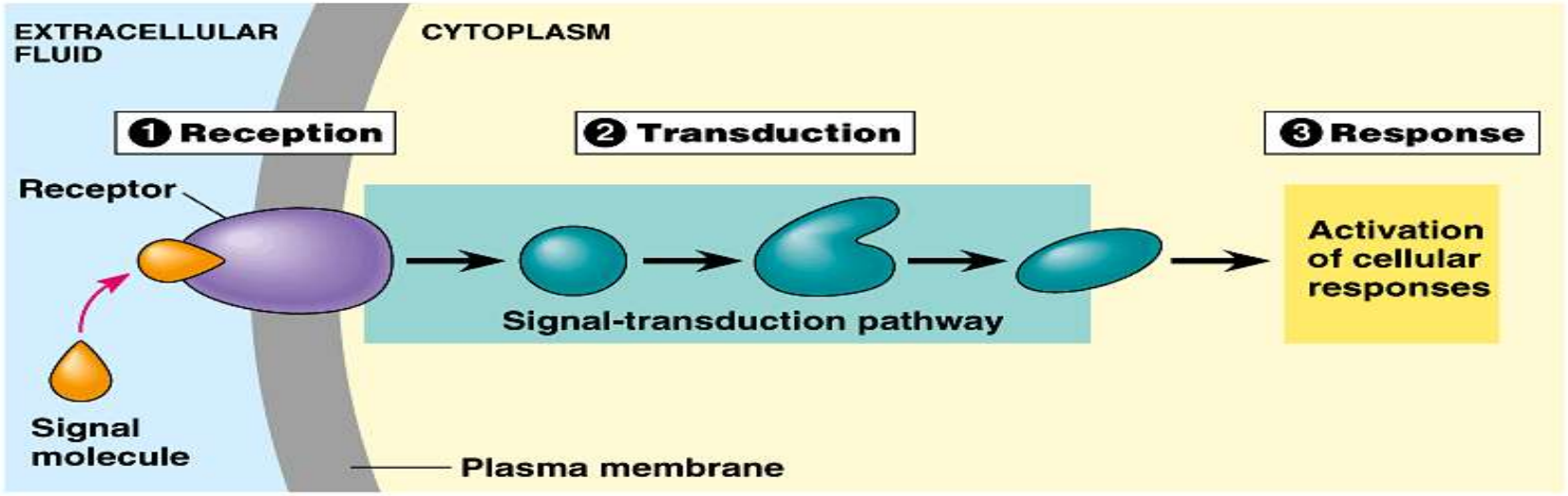
- Signal on a cell's surface is converted into a specific cellular response
  - Local signaling (short distance):

    Paracrine (growth factors) Synaptic (neurotransmitters)
  - Long distance: hormones



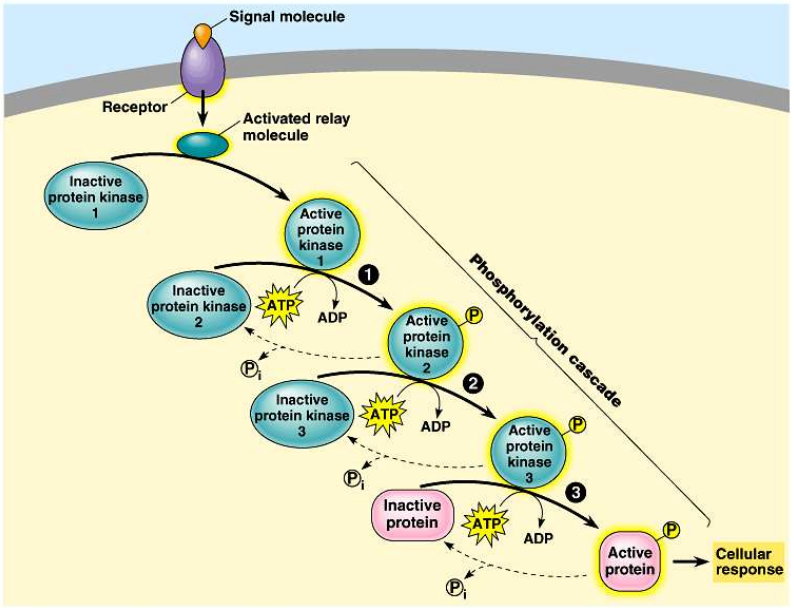
Stages of cell signaling

- 3 steps:
  - Reception: target cell detection
  - Transduction: single-step or series of changes
  - Response: triggering of a specific cellular response



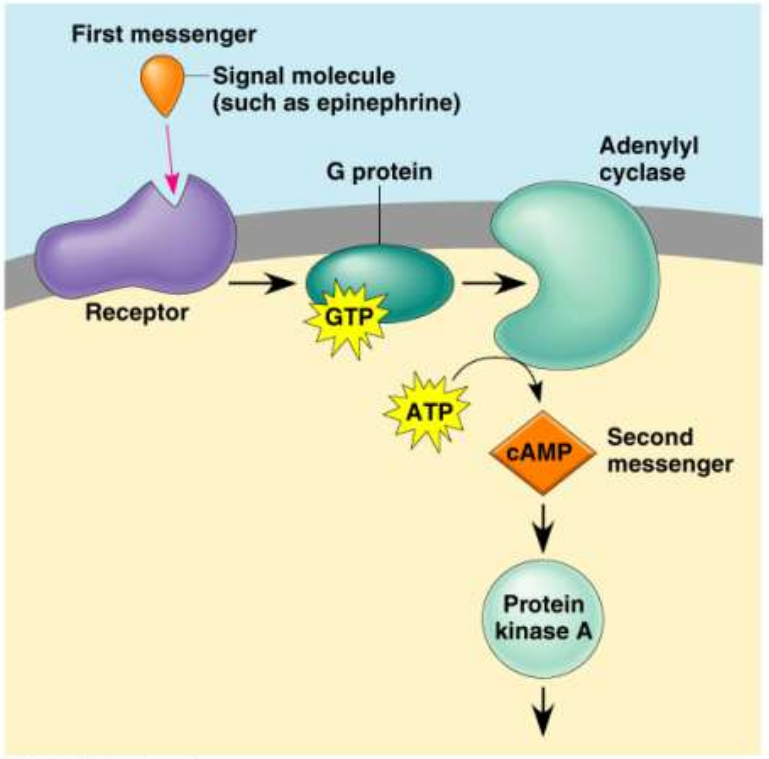
Protein phosphorylation

- Protein activity regulation
- Adding phosphate from ATP to a protein (activates proteins)
- Enzyme: protein kinases (1% of all our genes)
- Example: cell reproduction
- Reversal enzyme: protein phosphatases



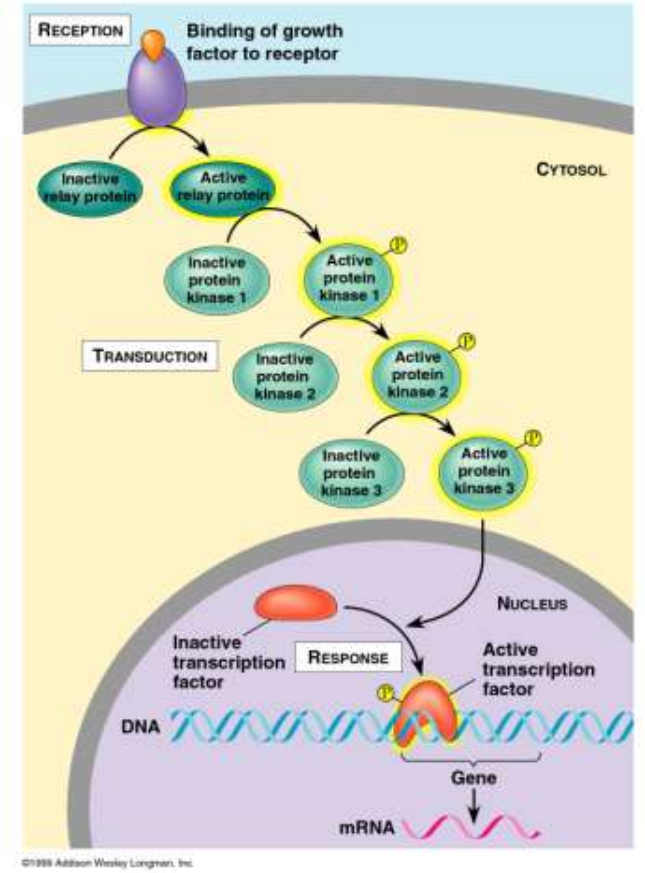
Second messengers

- Non-protein signaling pathway (
- Example: cyclic AMP (cAMP)
- (cyclic adenosine monophosphate)
- Ex: Glycogen breakdown with epinephrine
- Enzyme: adenylyl cyclase
- G-protein-linked receptor in membrane (guanosine di- or tri- phosphate)



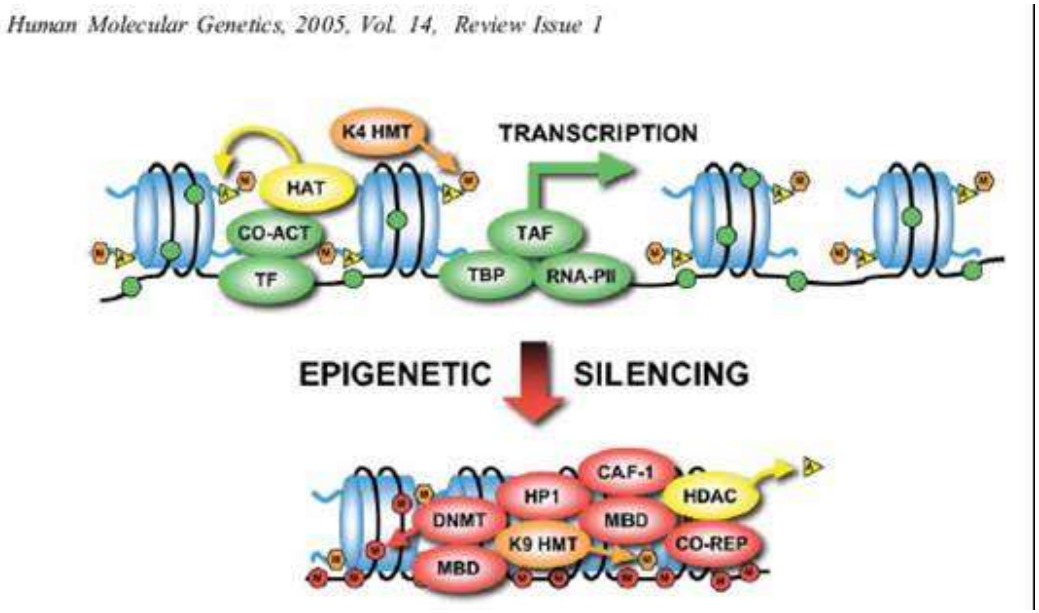
Cellular responses to signals

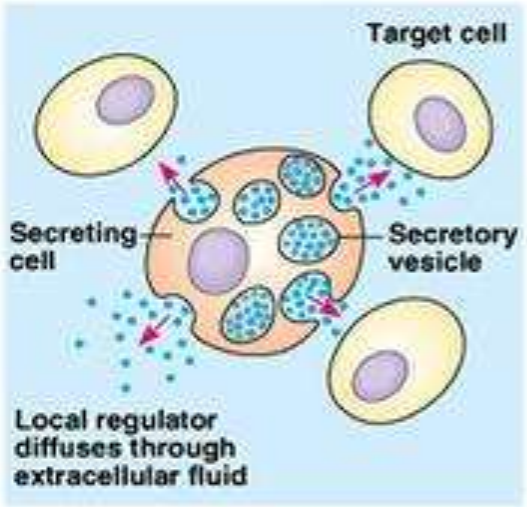
- Cytoplasmic activity regulation
- Cell metabolism regulation
- Nuclear transcription regulation



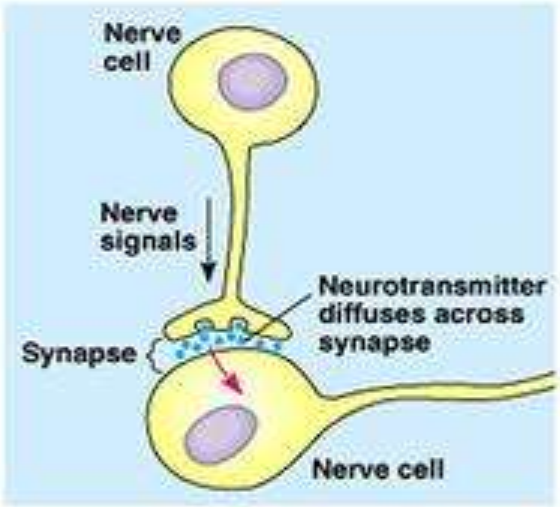
Methylation

- Just as phosphates are used to activate proteins, methylation can be used to deactivate them. You will learn more about this when we get to DNA





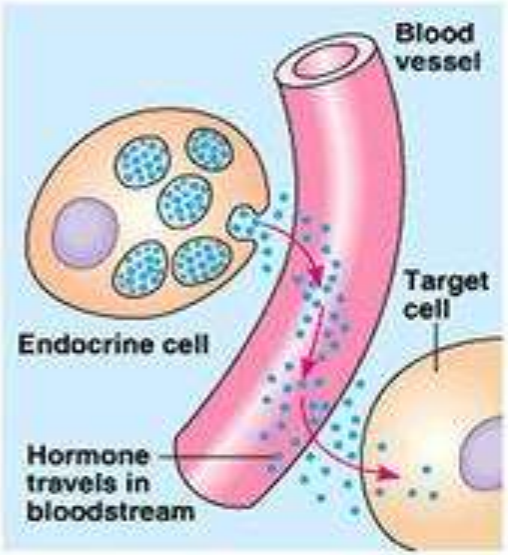
Paracrine signaling



Synaptic signaling

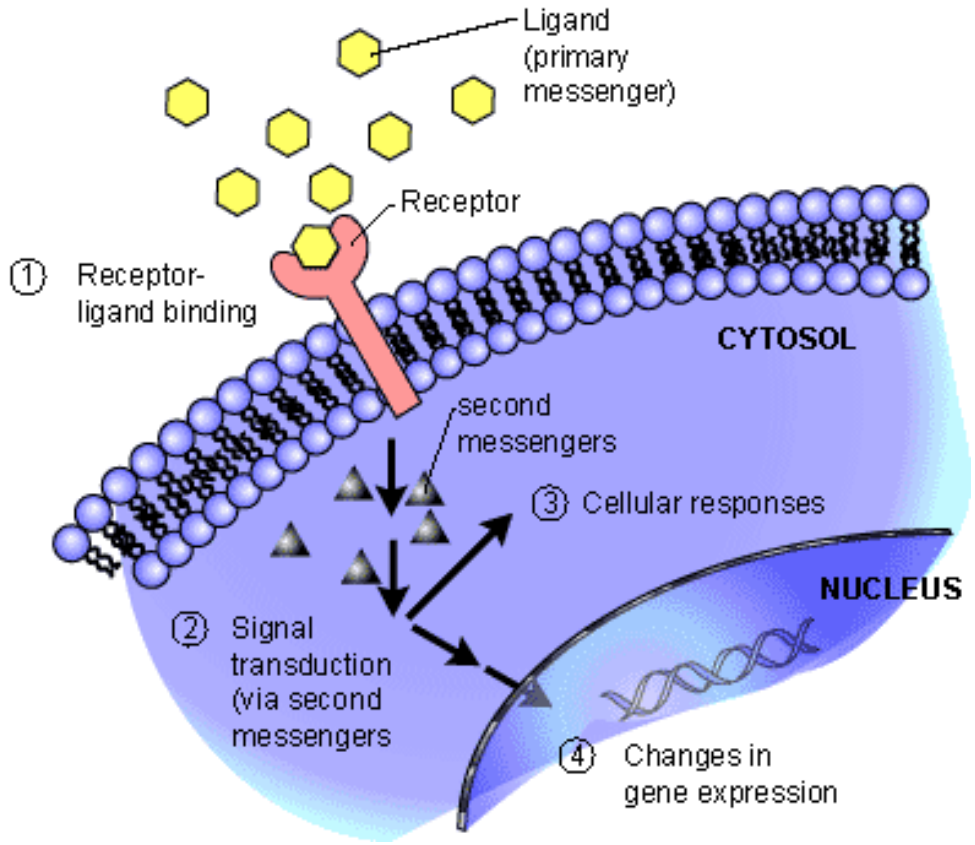
paracrine signaling

(a) Local signaling



(b) Long distance (hormonal) signaling

endocrine signaling


Ligand
(primary
messenger)
Receptor
① Receptor-
ligand binding
CYTOSOL
second
messengers
③ Cellular responses
NUCLEUS
② Signal
transduction
(via second
messengers
④ Changes in
gene expression