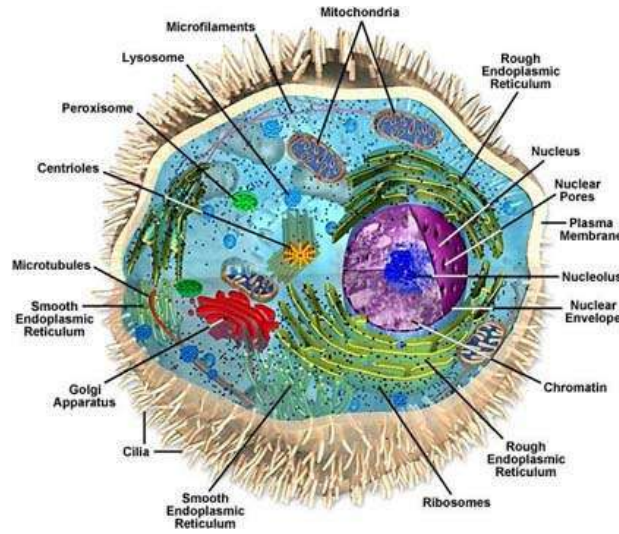
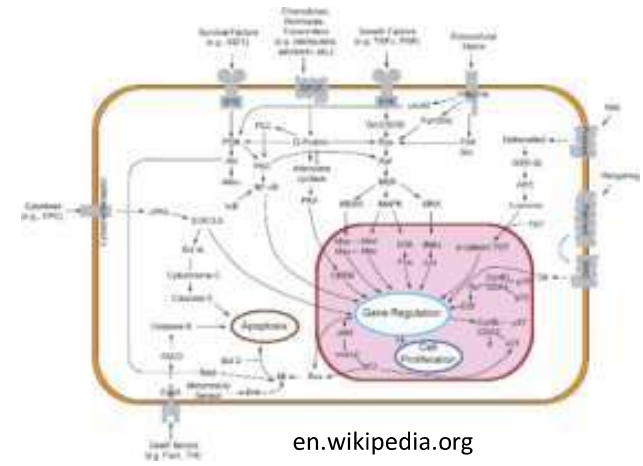


blindflaneur.com

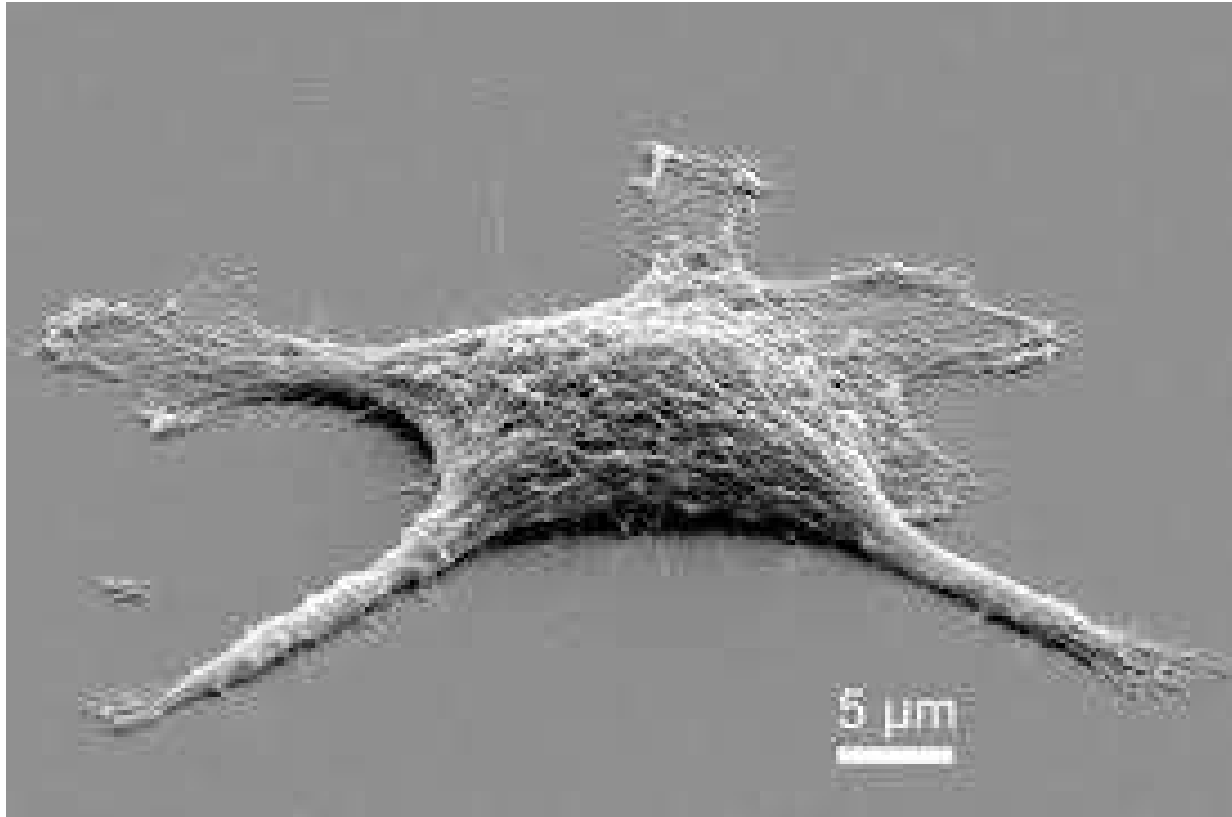


www.mcb.ucdavis.edu



A slice of cell and molecular biology: Cell signaling and cell communication

Scanning electron microscope image of a eukaryotic cell



Phys.org

**What's going on inside this cell?
How does it respond to its environment?**

Lecture Outline

1. Overview of the Cell

2. Membrane function and composition

3. Overview of the Cell Signaling Challenge

- Common themes among many different cell types
- Different types of signals: electrical, chemical, mechanical
- External stimulus → membrane interactions → intracellular cytoplasmic events
→ gene expression changes

4. Gene expression events: Transcription (RNA synthesis) Translation (protein synthesis)

5. Summary

Take Home Summary

- Cells communicate with their environment through interactions at the cellular membrane
- Membrane proteins are essential features that enable cellular communication by interacting with signals (e.g., chemical, electrical, mechanical)
- Signaling at the membrane causes intracellular changes that affect different pathways depending on the type of cell
- Cell signaling can stimulate changes in gene expression at the nuclear level, resulting in the production of new proteins

1. Overview of the Cell

2. Membrane function and composition

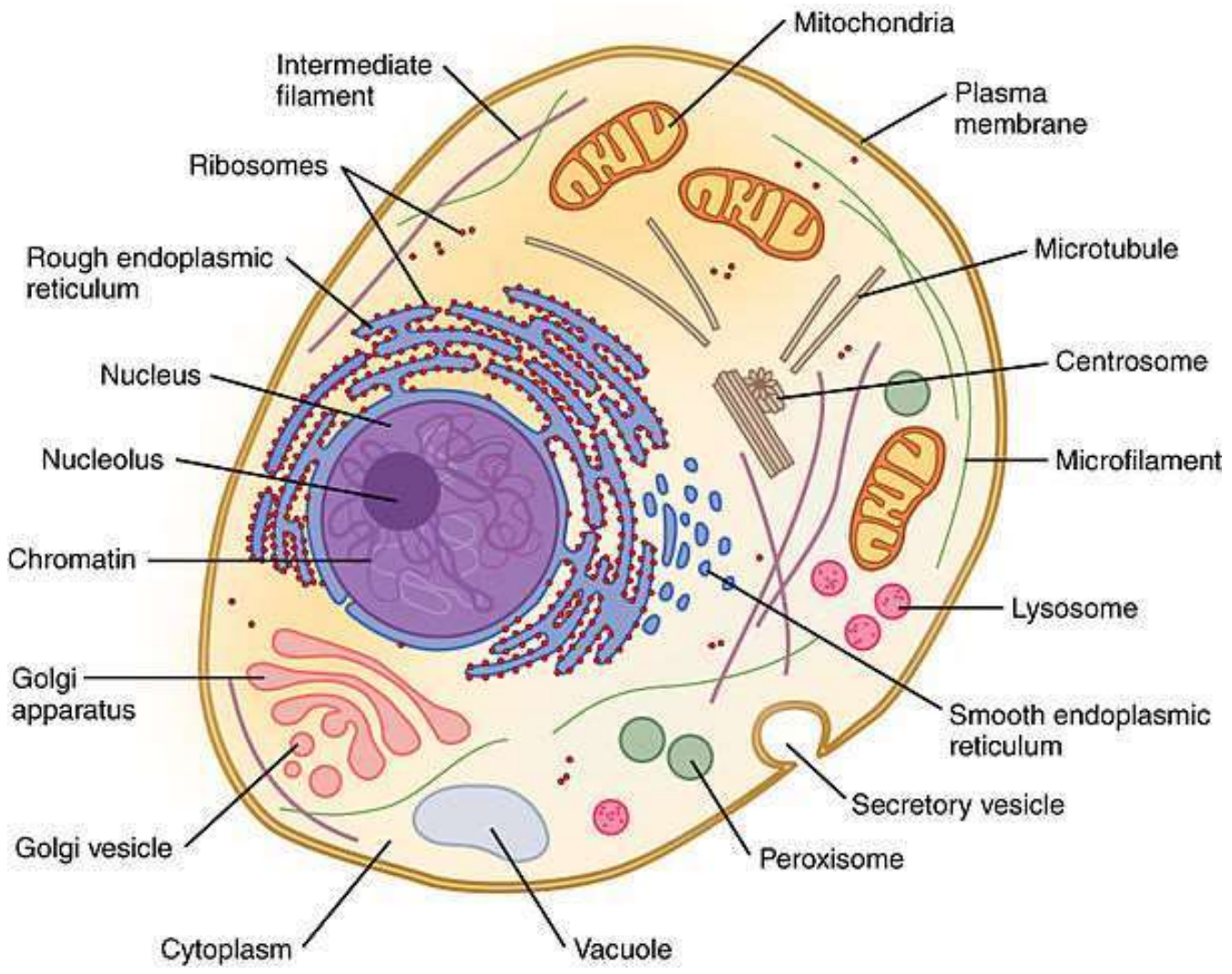
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Schematic cross-section of a eukaryotic cell showing internal organelles



1. Overview of the Cell

2. **Membrane function and composition**

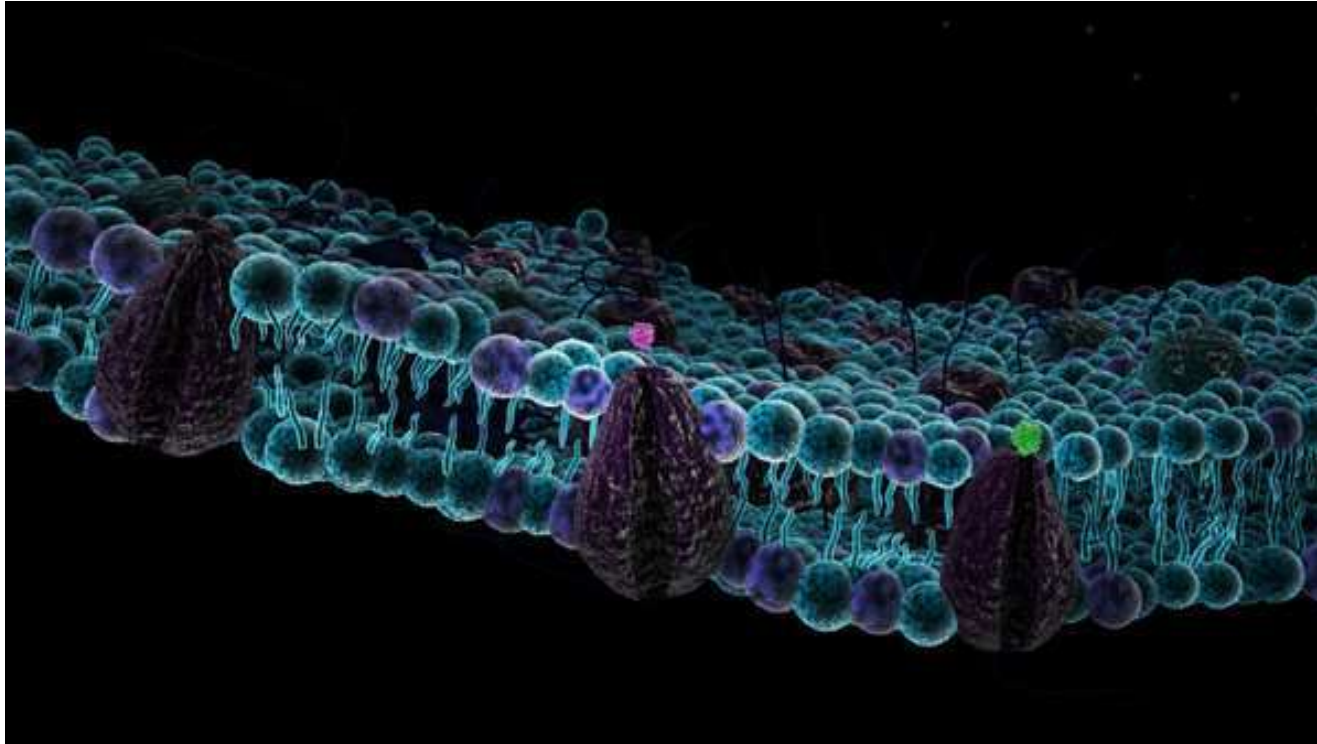
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FUNCTION of CELLULAR MEMBRANES



- Semi-permeable to ions and organic molecules (allows selective influx and efflux)
- Protects cell from surroundings; responds to surroundings
- Comprised of phospholipids and embedded proteins
- Protein composition is most variable part between different types of cells

Membrane Composition: Phospholipids

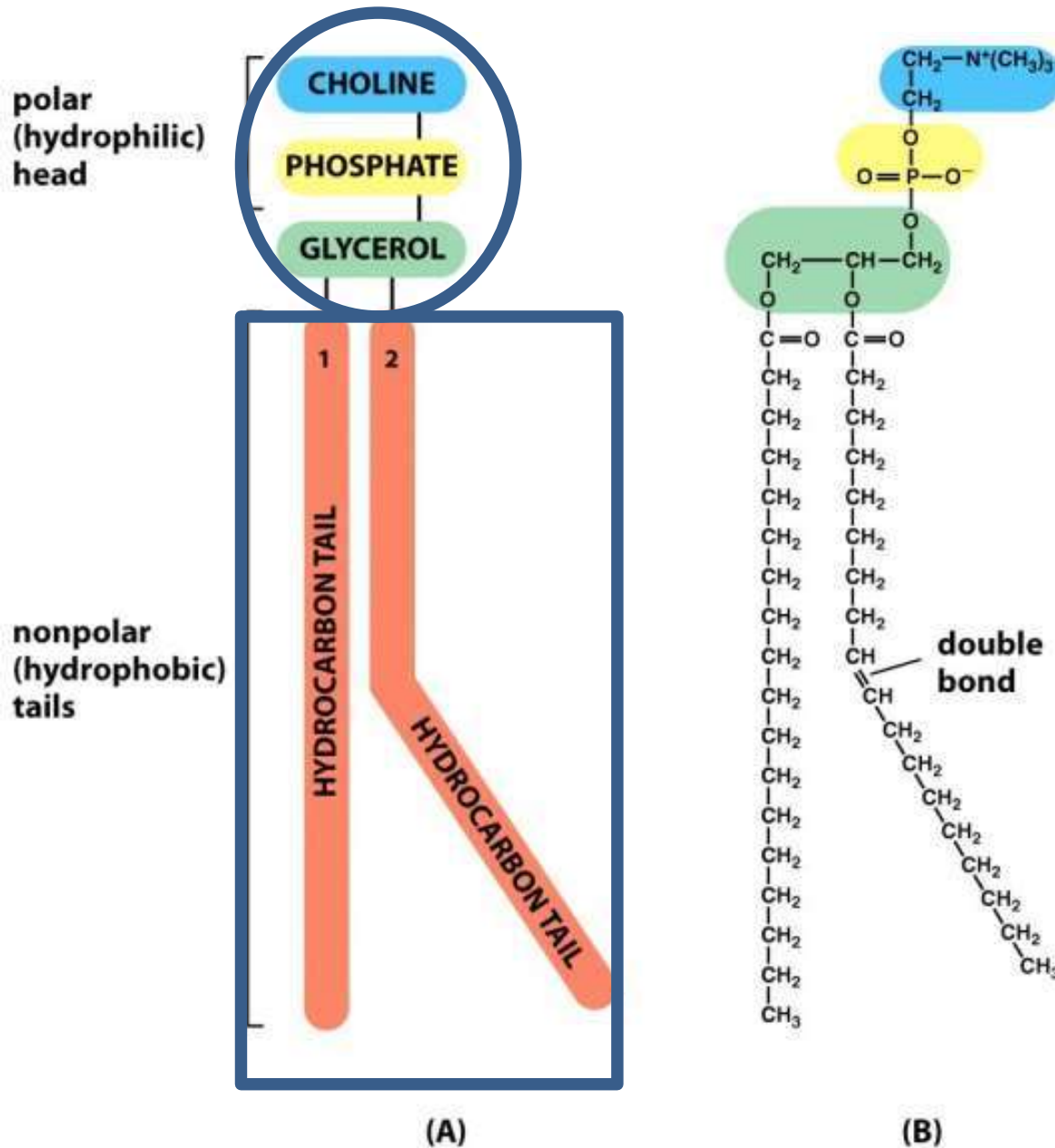


Figure 11-6 *Essential Cell Biology* (© Garland Science 2010)

Membrane schematic shows orientation of phospholipids in bilayer

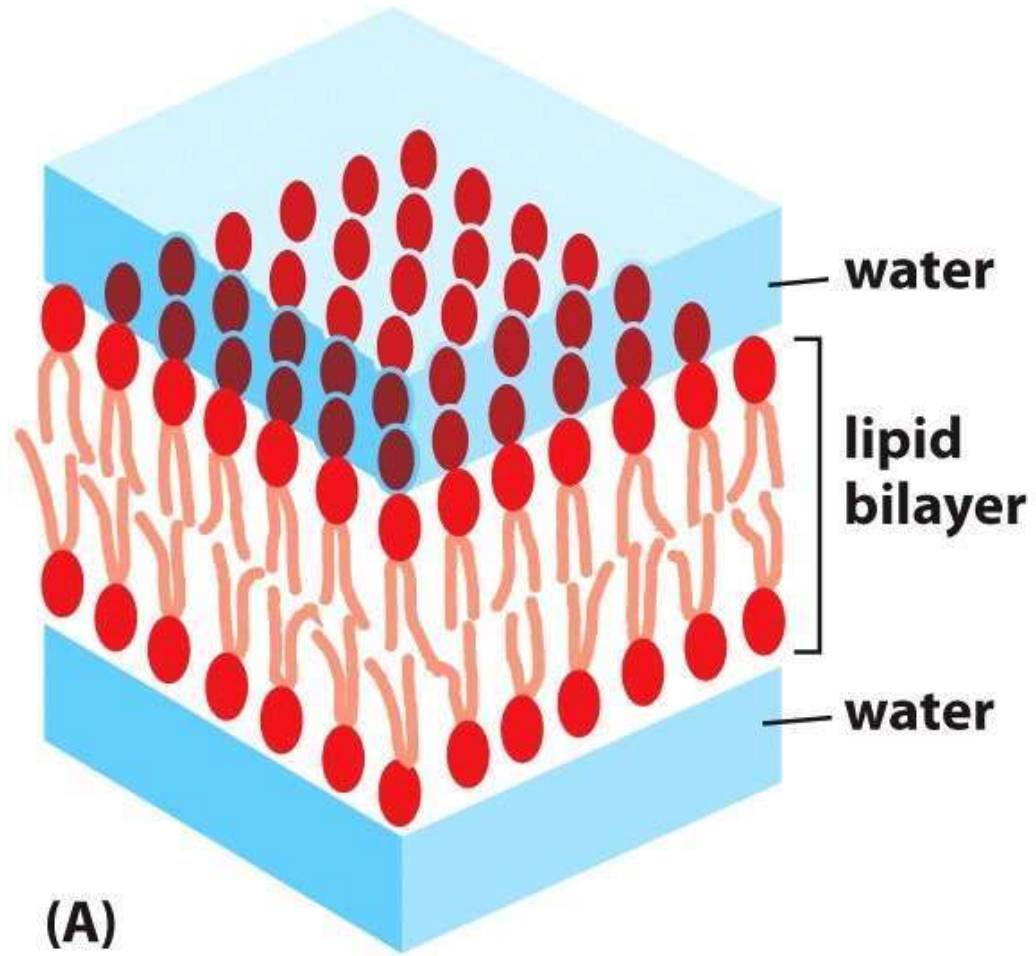
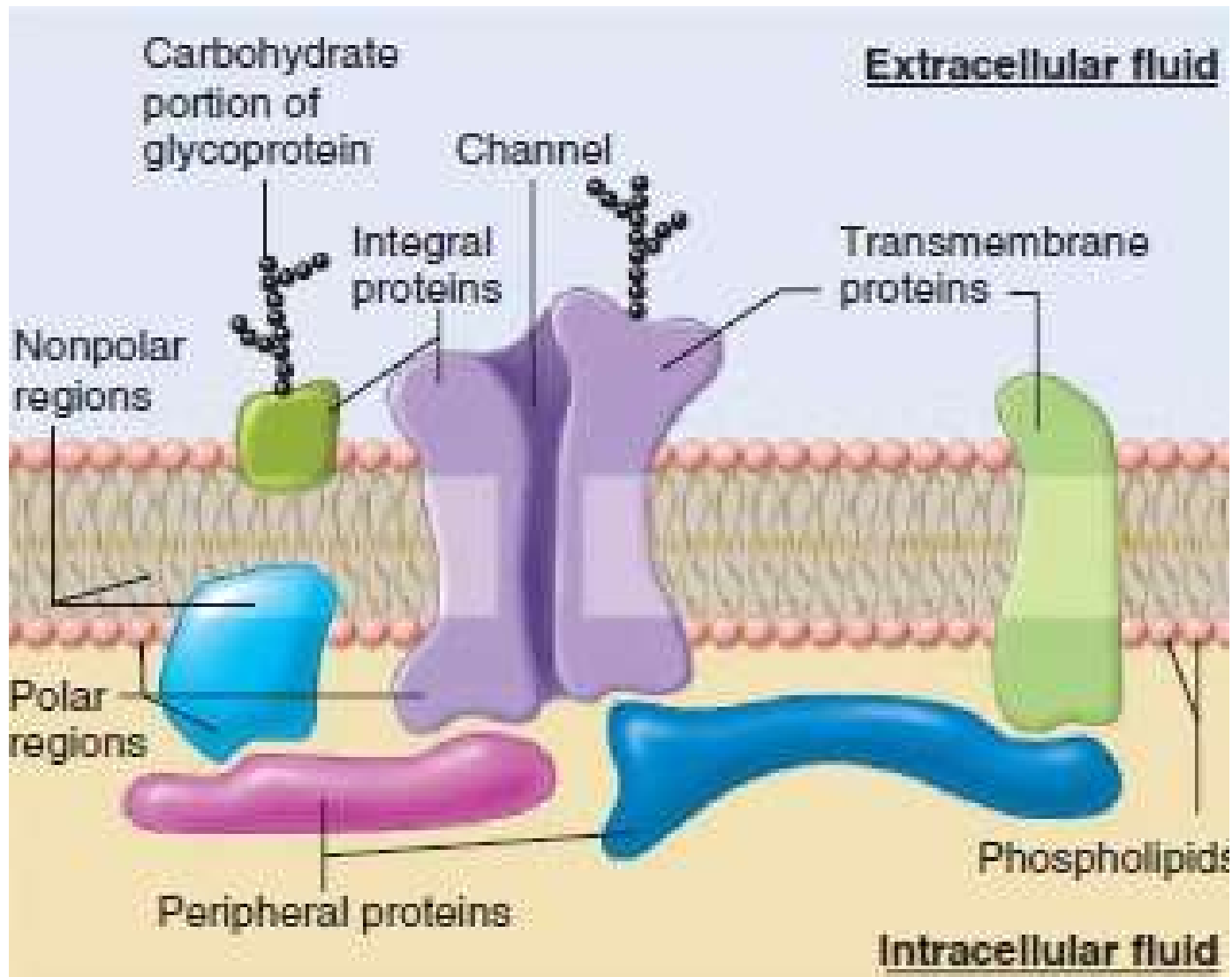


Figure 11-11 *Essential Cell Biology* (© Garland Science 2010)

Membranes contain embedded proteins



1. Overview of the Cell

2. Membrane function and composition

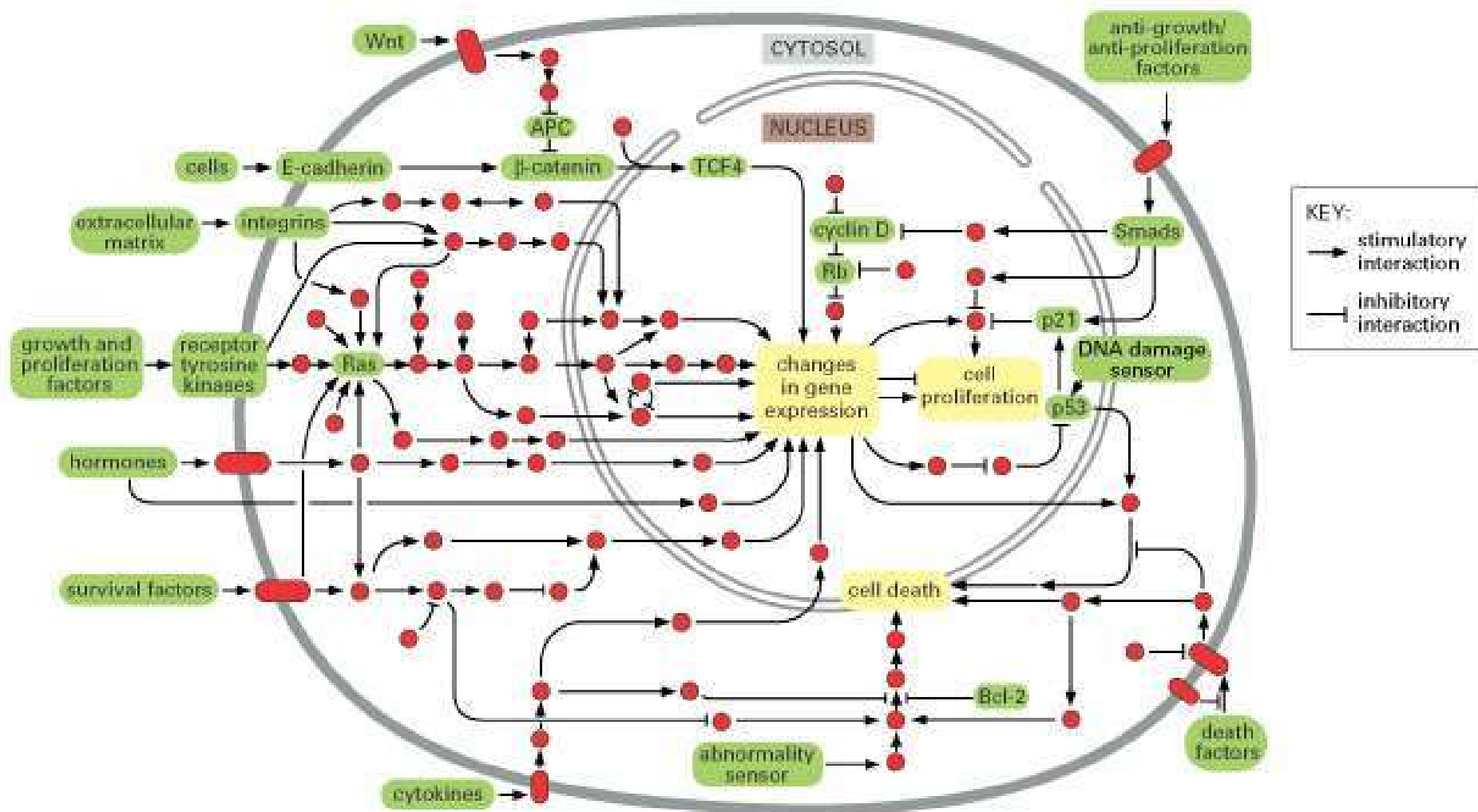
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Cells Respond in Diverse Ways to External Stimuli



Cells Respond in Diverse Ways to External Stimuli

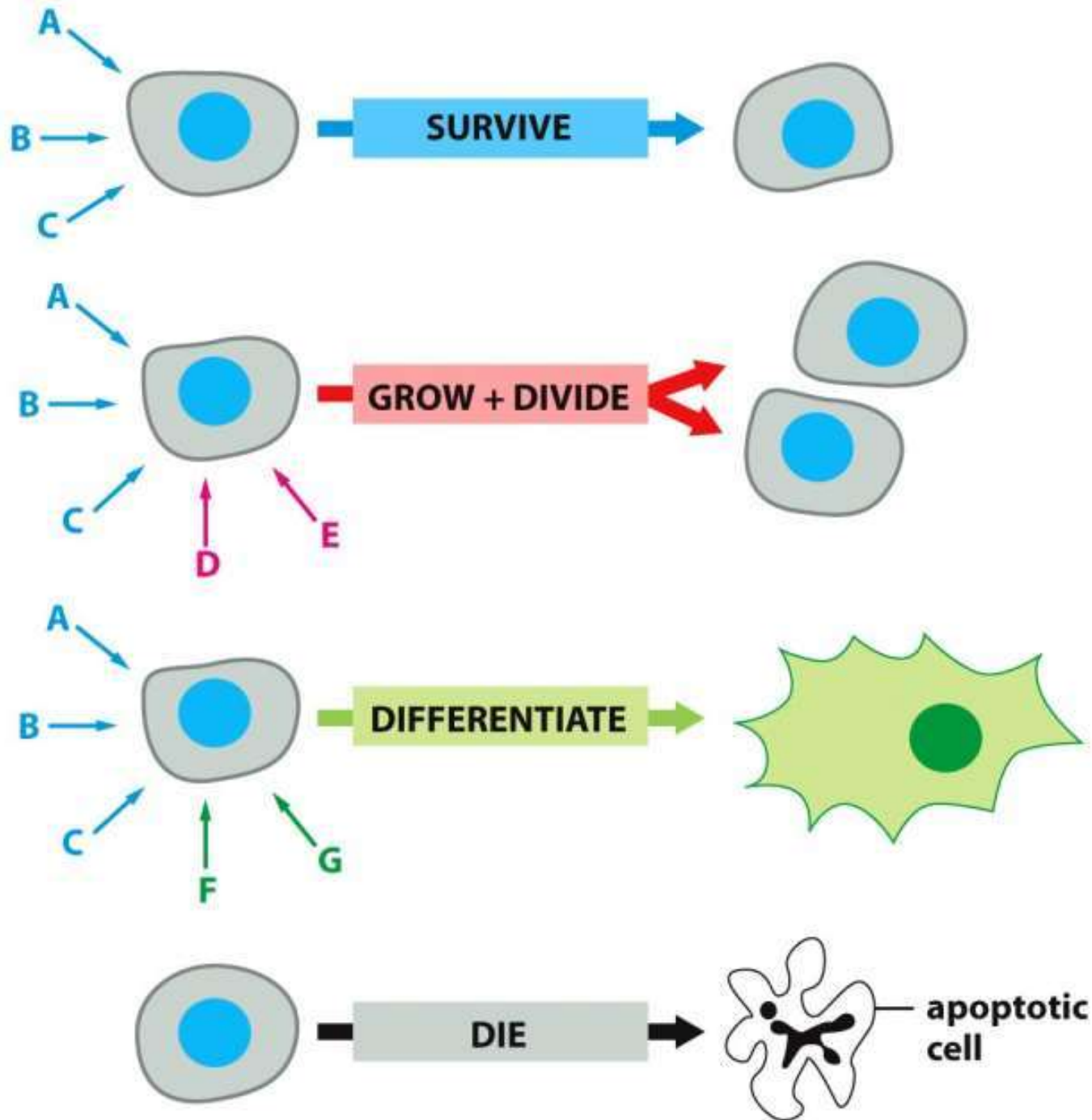
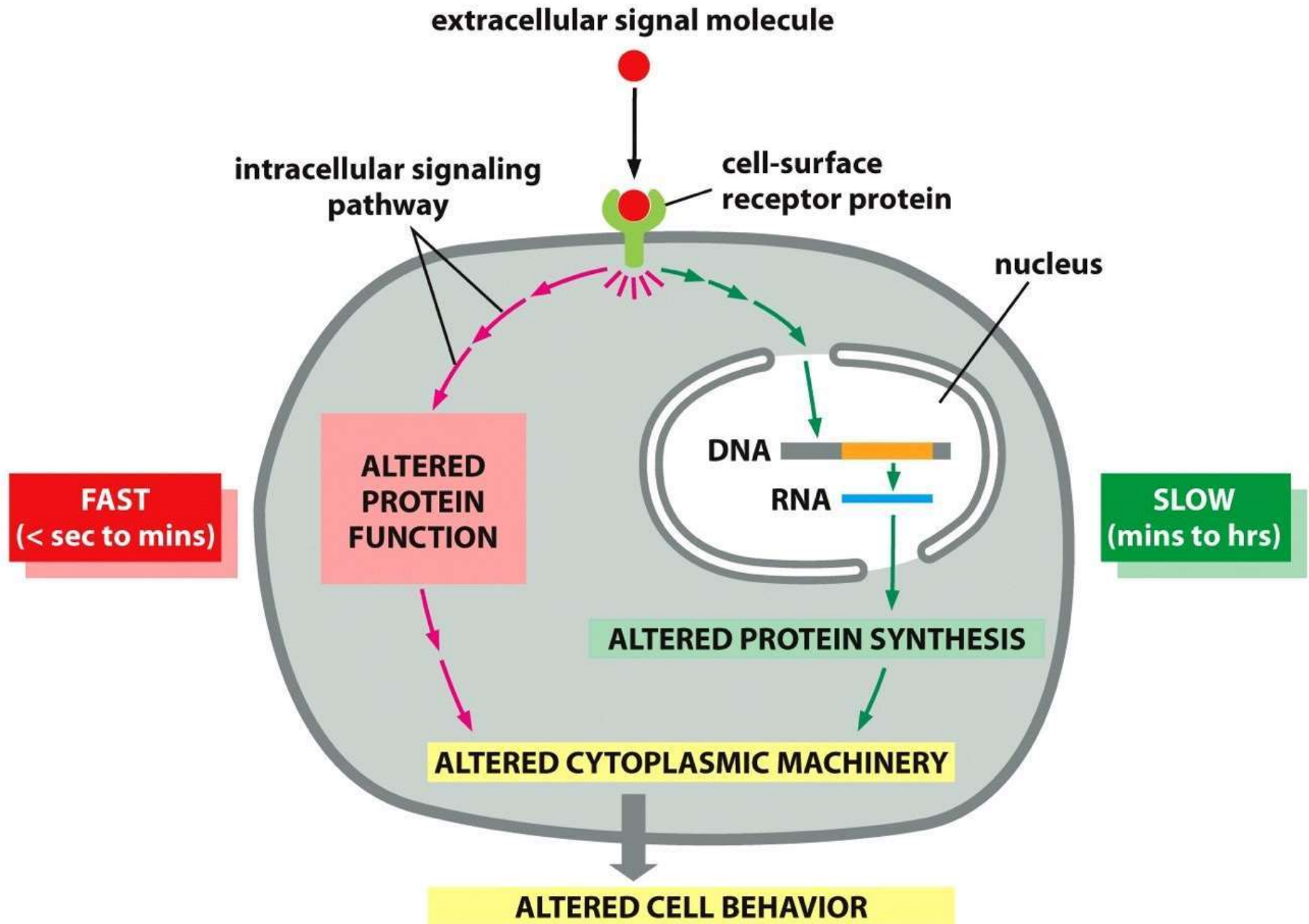
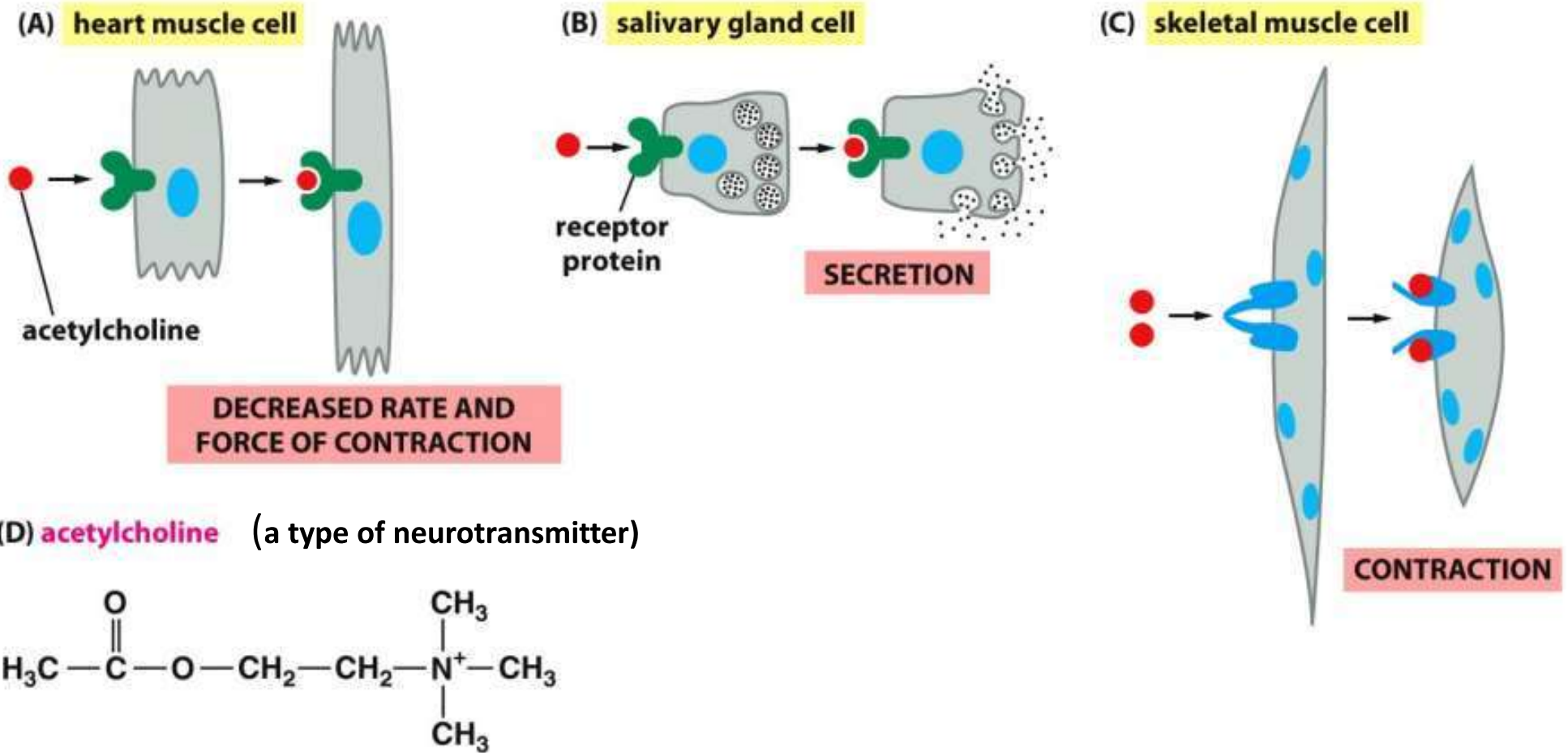


Figure 16-6 *Essential Cell Biology* (© Garland Science 2010)

An external signal can cause a fast and/or a slow response that alters cell behavior

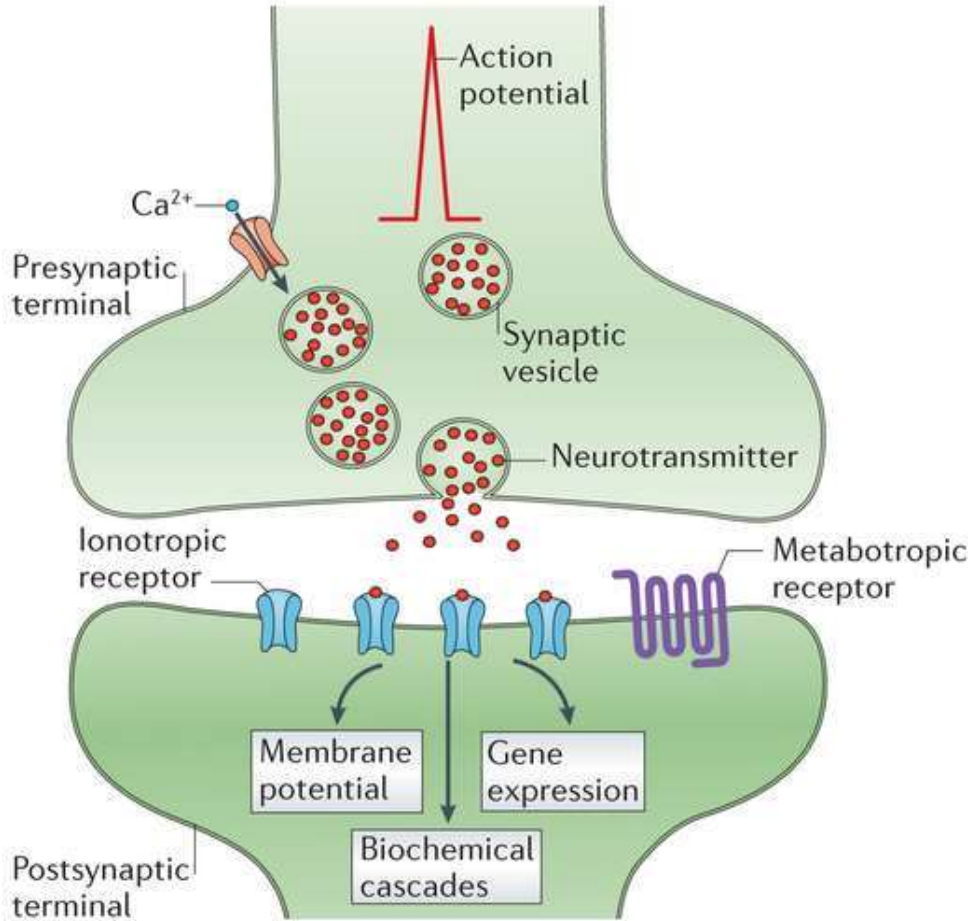


Binding of a single ligand type to a receptor can cause different cellular responses depending on the cell type

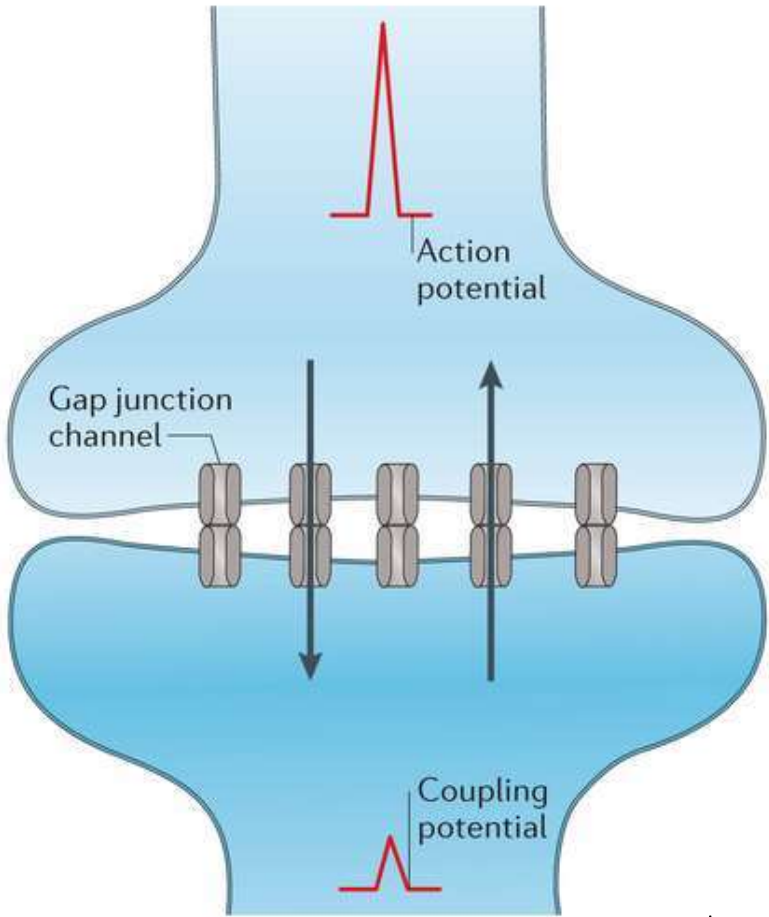


Neuronal Communication and Signaling at Synapses

a Chemical synapse



b Electrical synapse



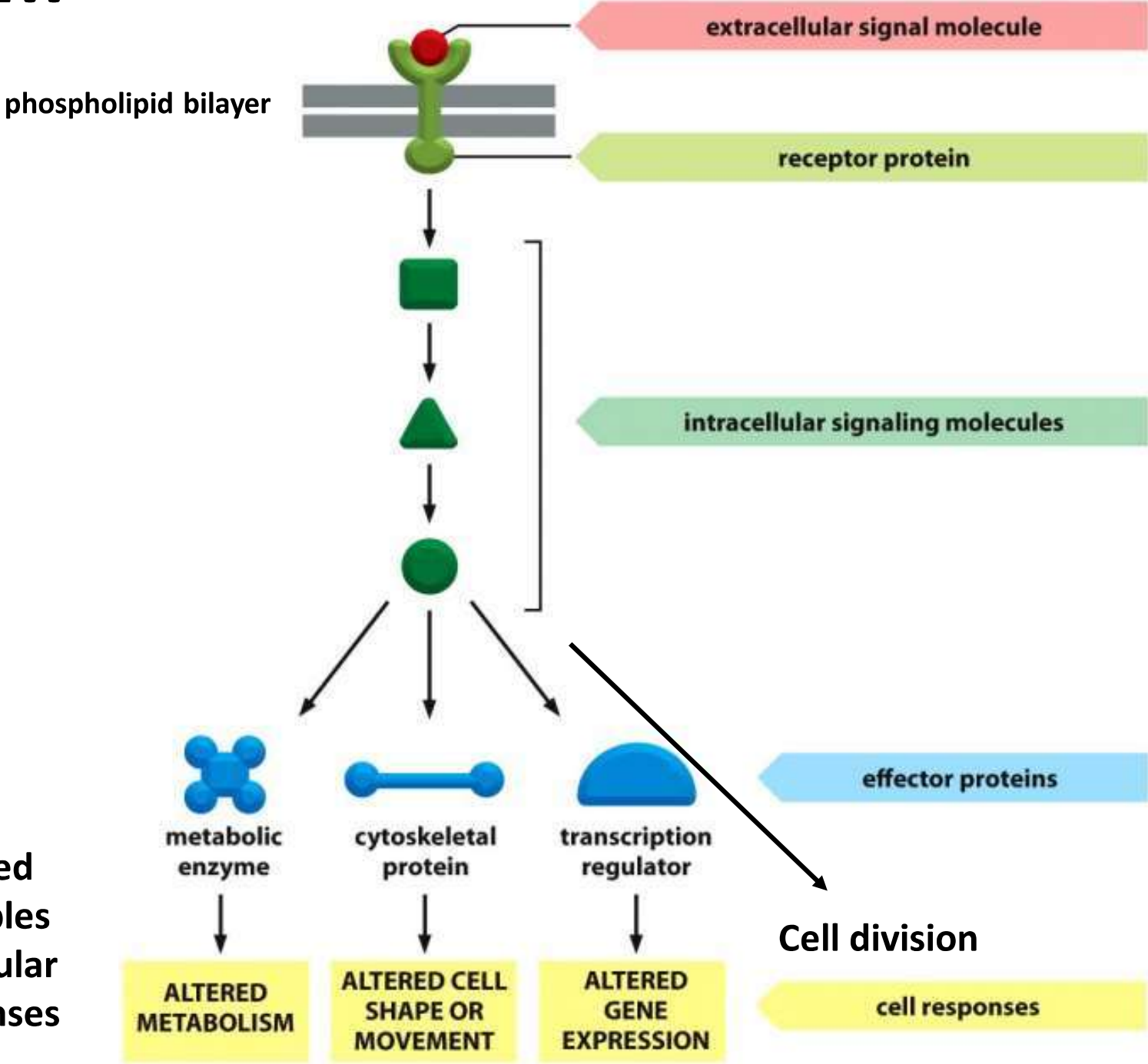
www.nature.com

Nature Reviews | Neuroscience



Lectures by several neuroscientist in the course will focus on this type of signaling in the nervous system

REVIEW



Selected examples of cellular responses

Figure 16-12 *Essential Cell Biology* (© Garland Science 2010) - edited

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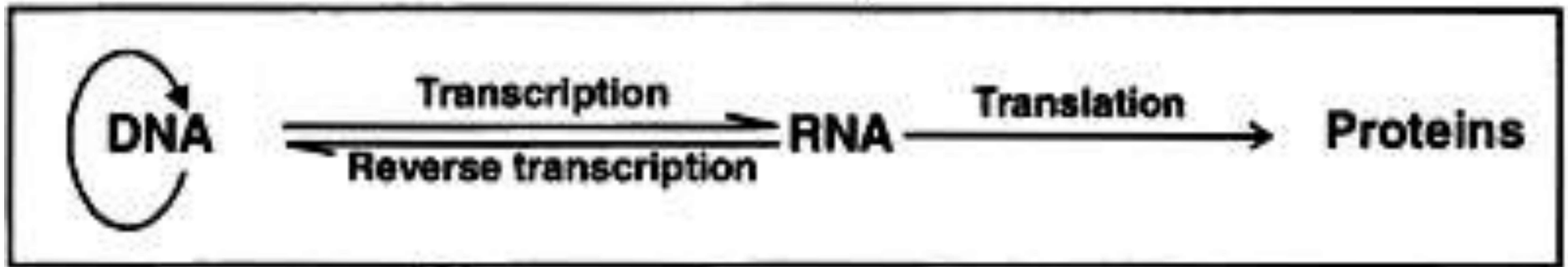
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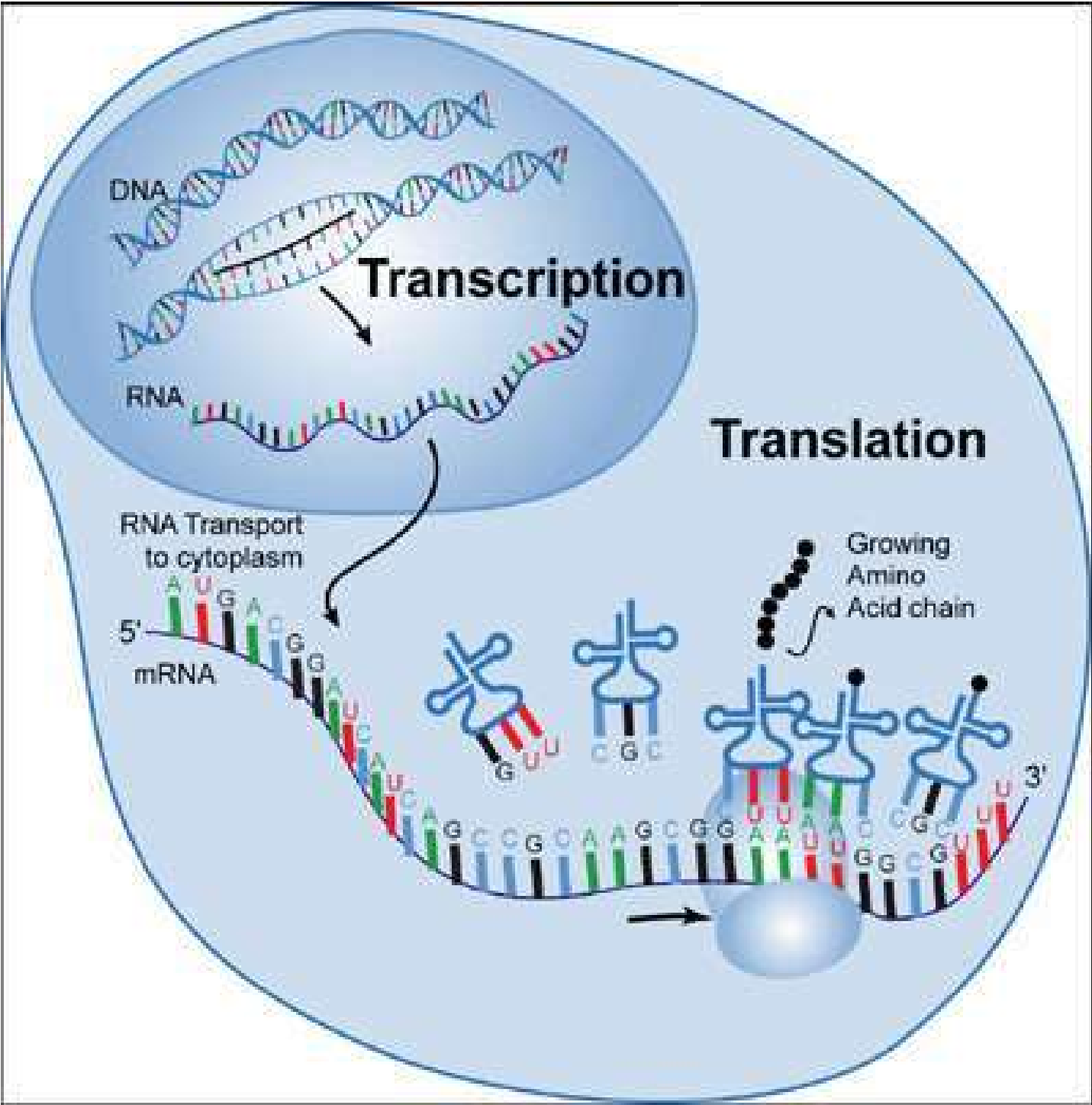
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Central Dogma of Molecular Biology





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2. Membrane function and composition

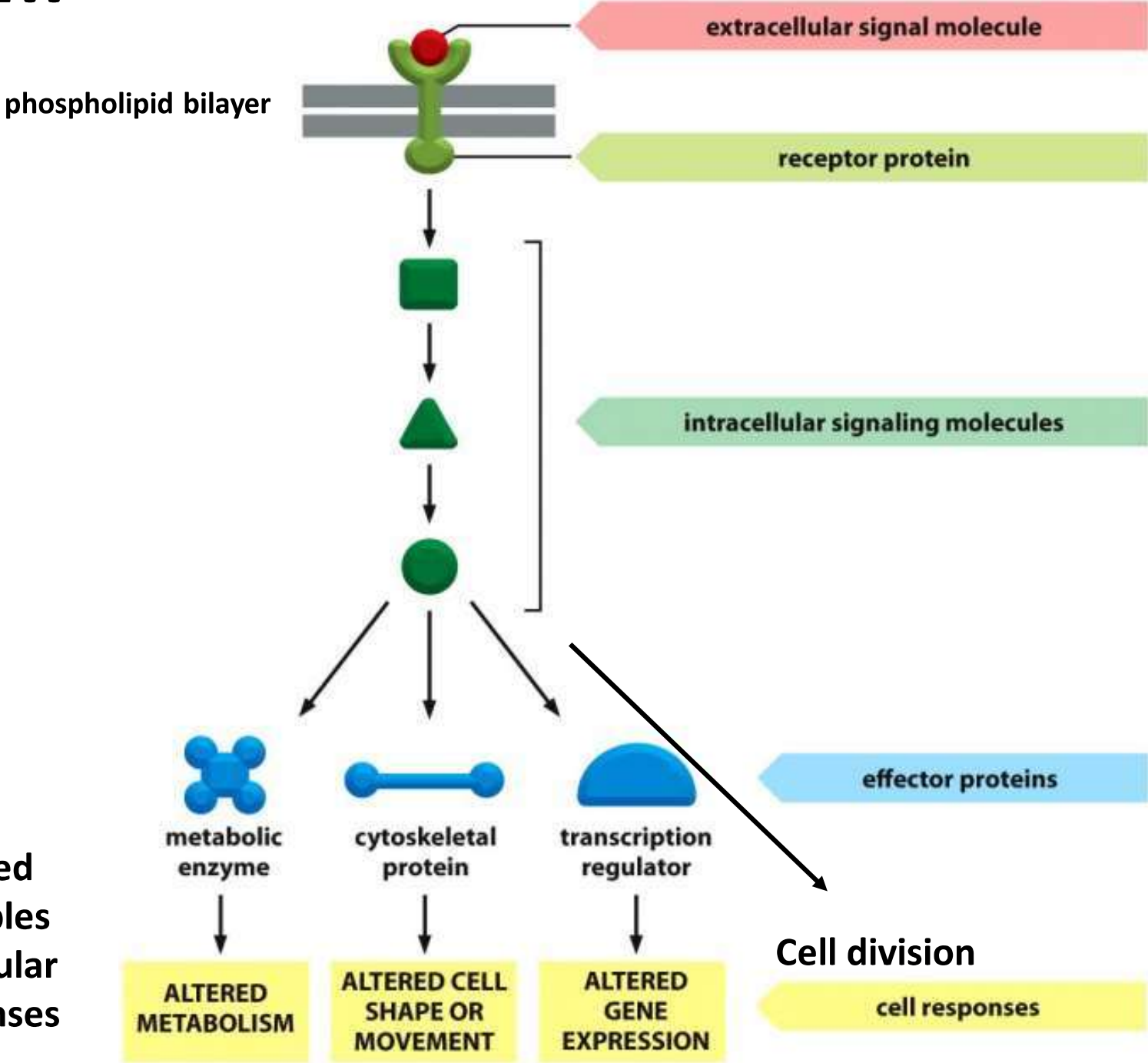
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Additional resource for cell signaling

<http://www.dnalc.org/resources/3d/cellsignals.html>

Optional video to reinforce signaling themes