Advanced Cell Biology. Lecture 34

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Outline

Questions and answers

Cell communication

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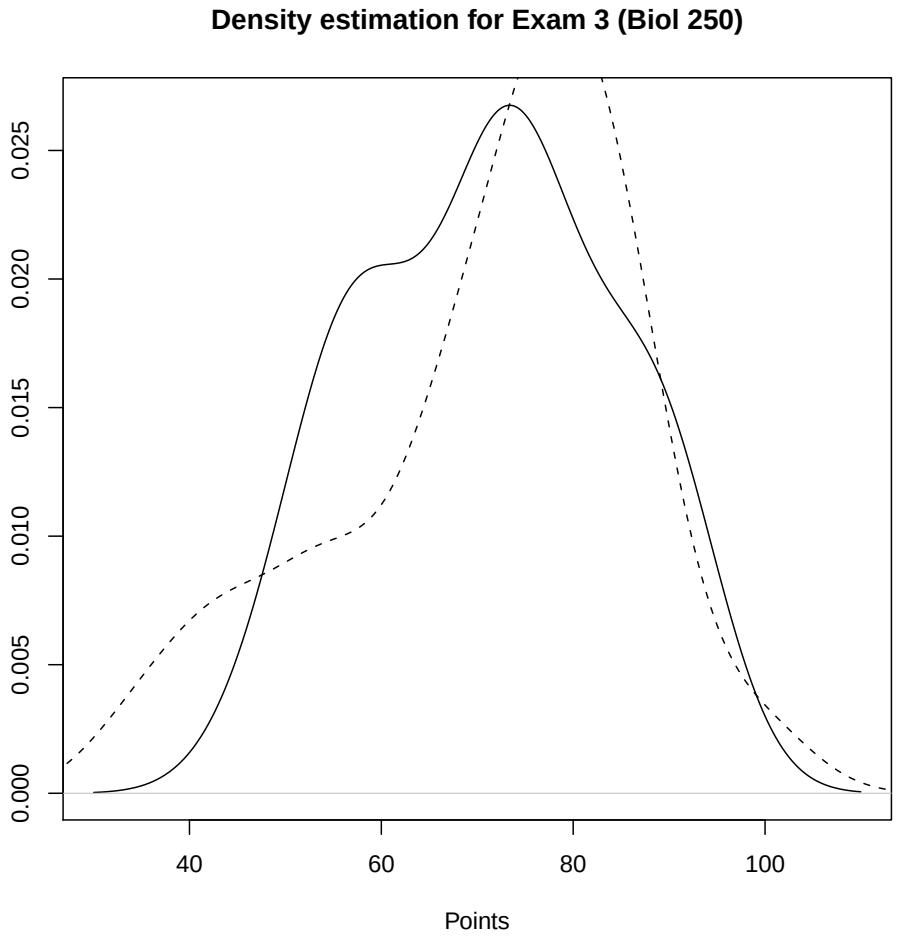
Cell communication

Exam 3 distribution



Exam 3 notes

General principles

- Signal cell $\rightarrow$ Target cell
- Target cell will take signal molecule (*reception*) and then (not necessary) make *transduction* with receptor protein

Types of signals

- Endocrine: hormones
- Paracrine: local mediators
- Neuronal: neurotransmitters
- Contact-dependent: membrane-bound signal molecules (like Delta-Notch system in fly neurons)

Animal cell signals

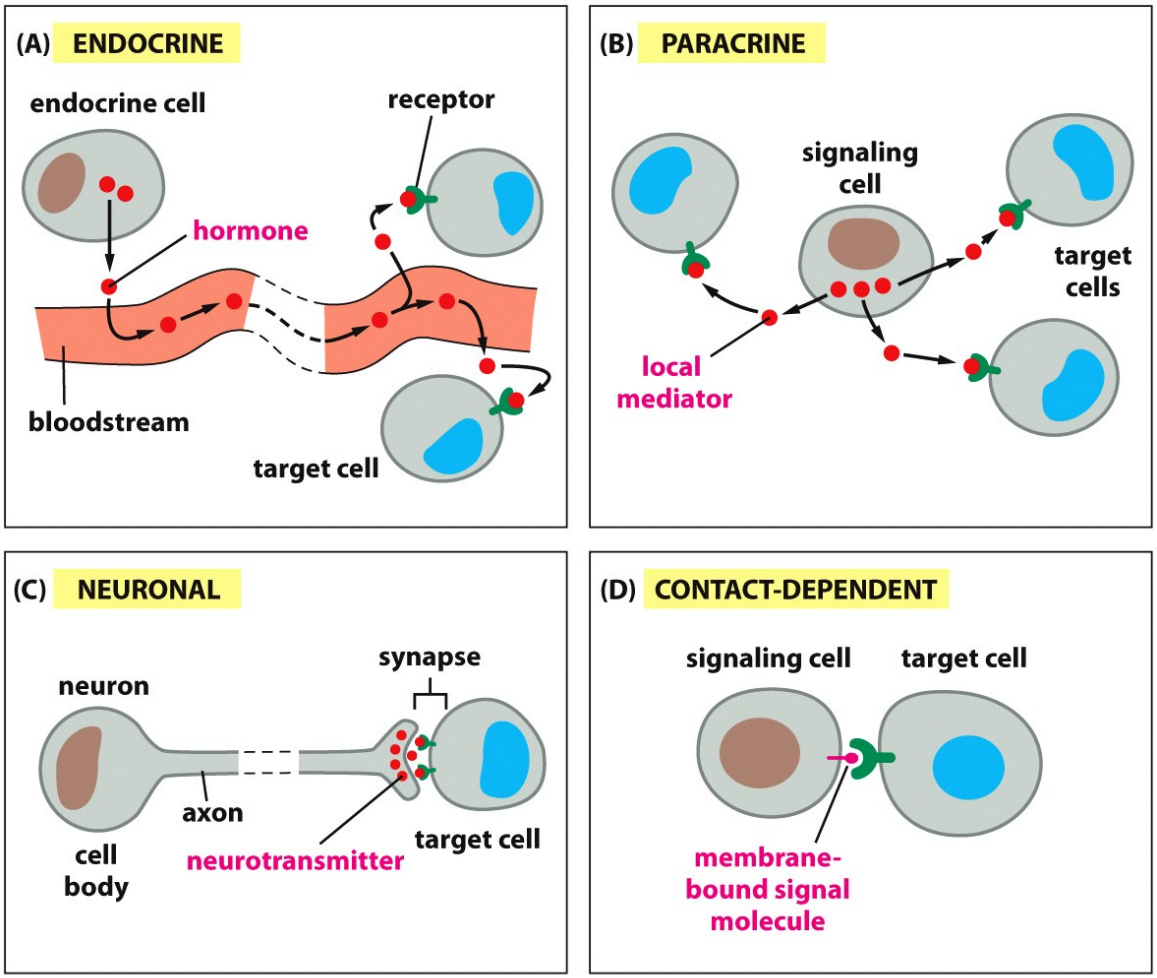


Figure 16-3 Essential Cell Biology 3/e (© Garland Science 2010)

Diversity of responses

- Receptor protein, not a signal molecule, provides a response
- Depending on receptor, response may be completely different (e.g., in case of acetylcholine)
- Generally, there may be: “survive” (“contract”, “excrete”, “stay still”), “grow/divide”, “differentiate”, “die” (apoptosis) responses

Acetylcholine effects

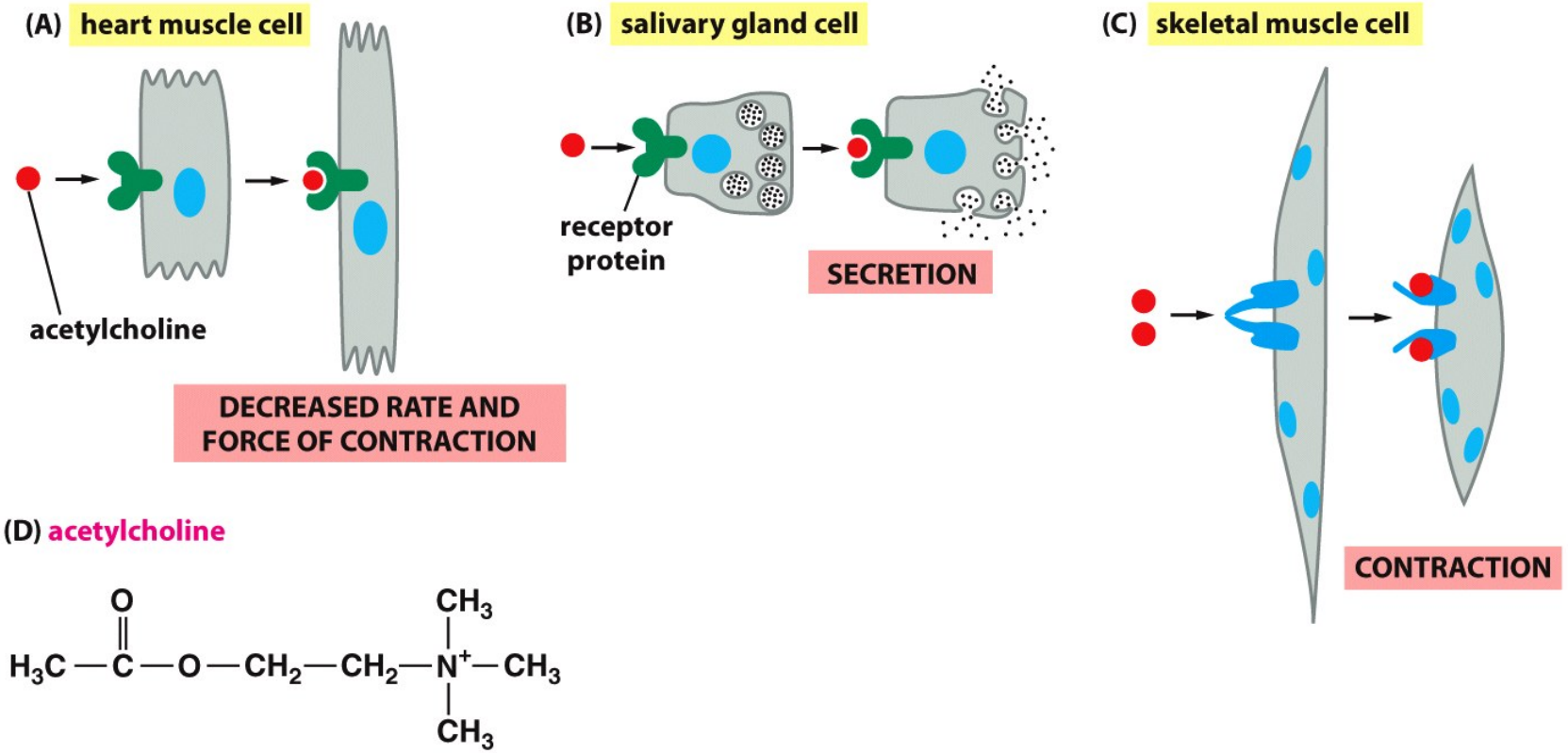


Figure 16-5 Essential Cell Biology 3/e (© Garland Science 2010)

Speed of response

- Fast response: alter protein function
- Slow response: through transcription/translation

Cross-membrane hormone signals

- Steroid hormones are small enough (+ hydrophobic) to go through the membrane
- They bind to receptor proteins which are transcription regulators and may be located in nucleus or in cytoplasm

Cortisol signaling pathway

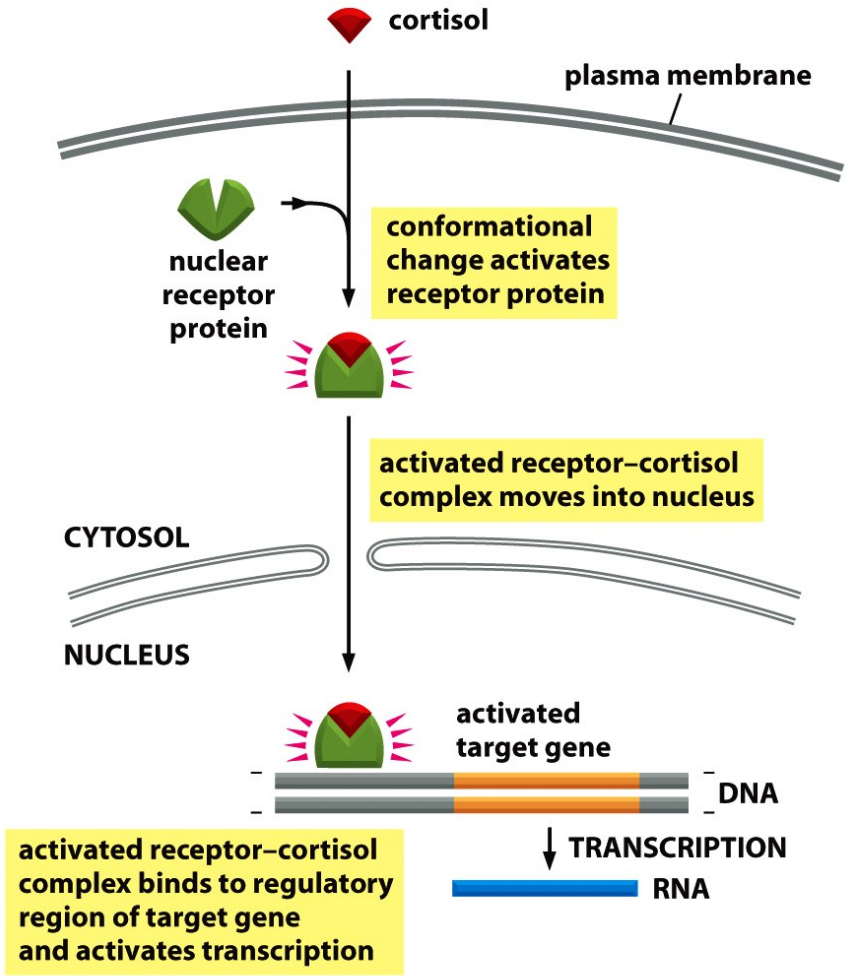


Figure 16-10 Essential Cell Biology 3/e (© Garland Science 2010)

Cross-membrane gas signals

- Nitroglycerin (component if dynamite!) releases nitric oxide, N=O which goes across membrane and activate *guanylyl* enzyme responsible for making *cyclic GMP*
- Smooth and heart muscle cells will relax, blood vessels will dilate
- Viagra drug activates cyclic GMP synthesis and dilation of vessels responsible for erection

Nitric oxide signaling pathway

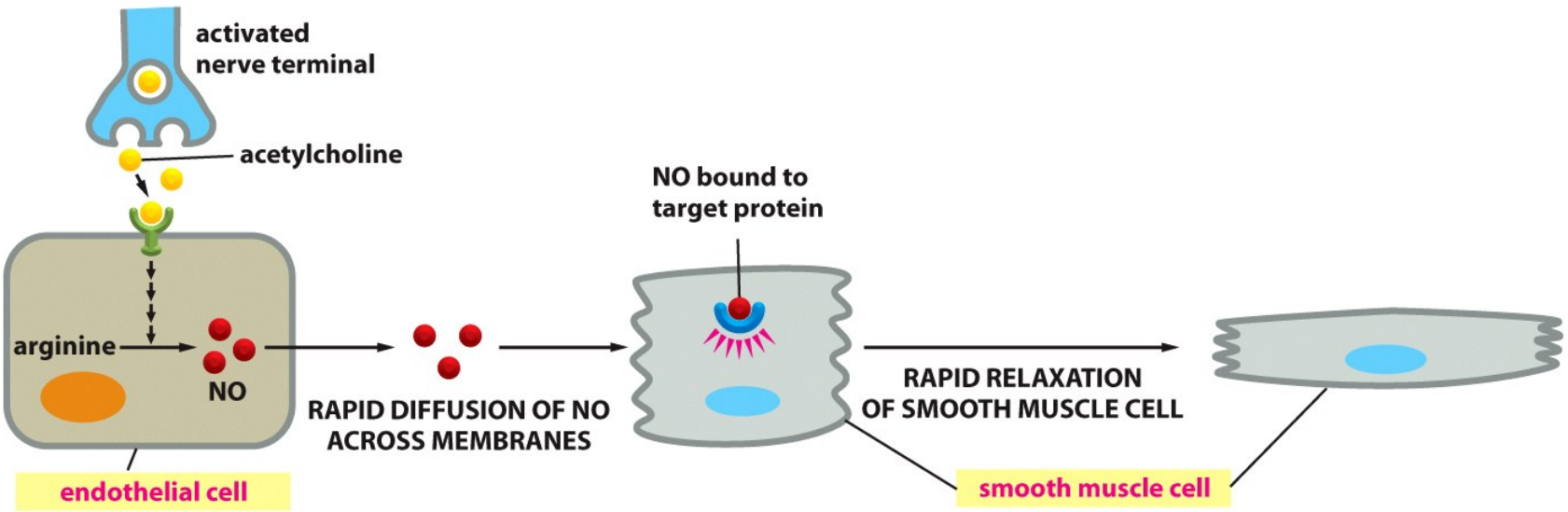
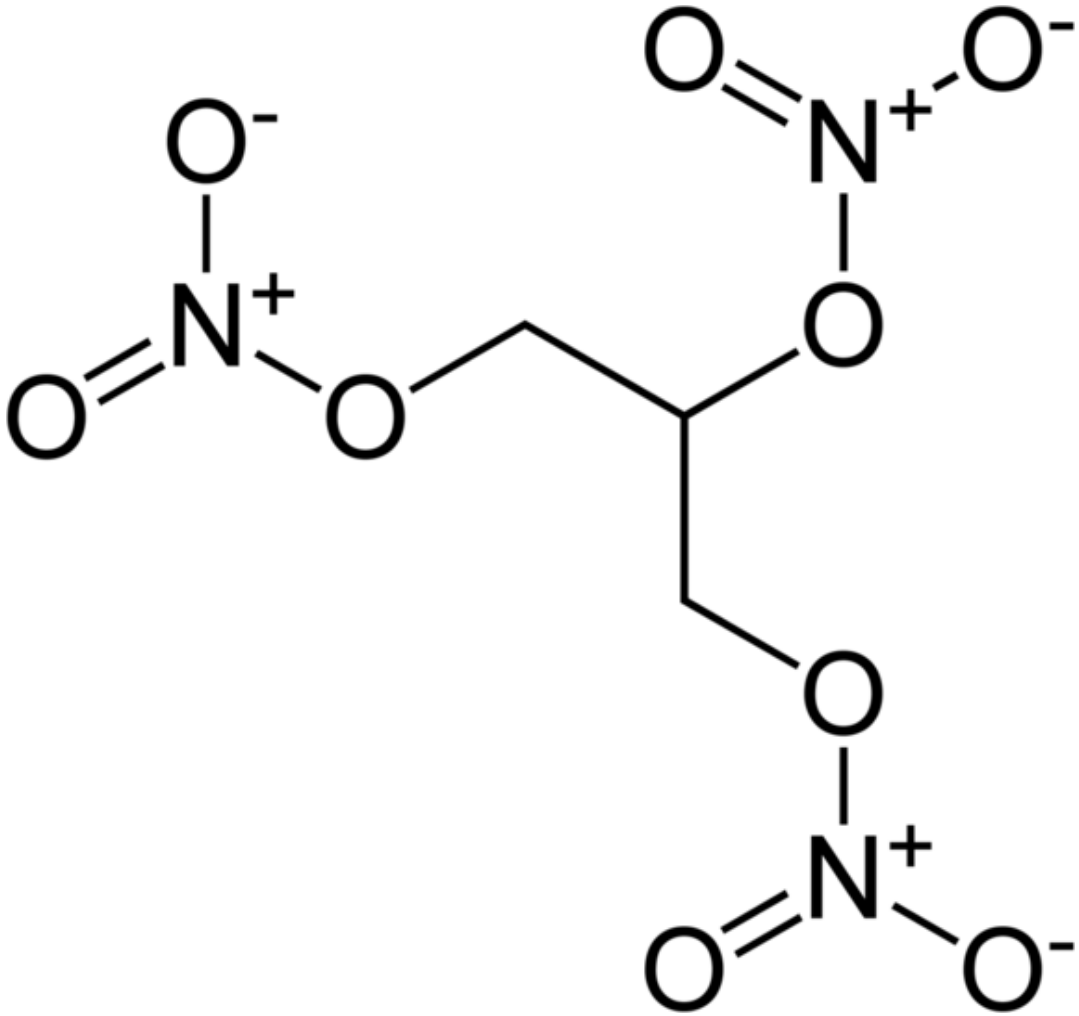


Figure 16-11b Essential Cell Biology 3/e (© Garland Science 2010)

Nitroglycerin



Receptor-bind signals

- Most of signals are proteins which are larger or not hydrophobic and cannot go through the membrane
- They bind to membrane receptors activating intracellular signaling molecules
- ISM will cause effector proteins to alter metabolism, change cell shape or movement or alter gene expression

Intracellular signaling pathways

- Relay signal forward
- Amplify
- Integrate multiple signals
- Distribute signals to more than one effector

Intracellular signaling pathways

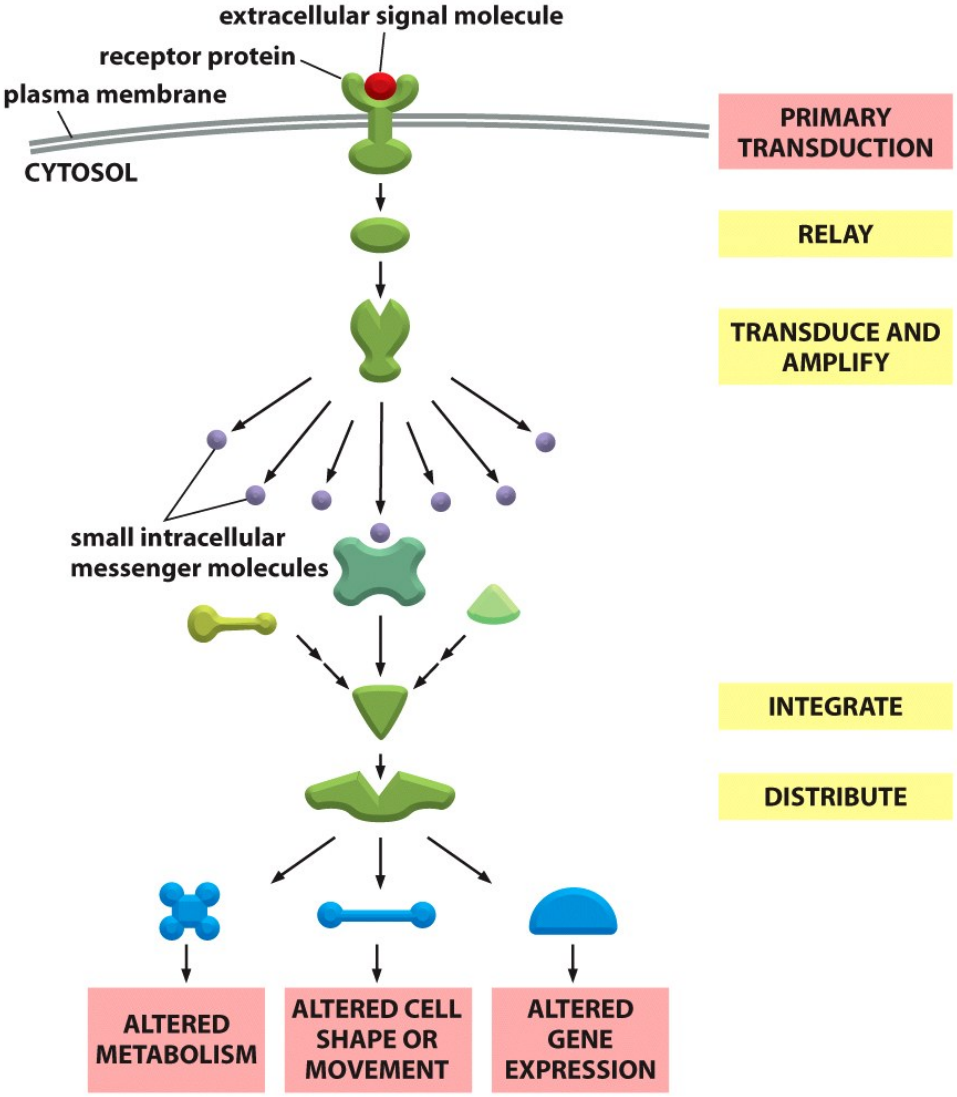


Figure 16-13 Essential Cell Biology 3/e (© Garland Science 2010)

Final question (2 points)

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How dynamite relates to Viagra?

Summary

- Small hydrophobic signals can go directly through the membrane

For Further Reading

A. Shipunov.
Advanced Cell Biology [Electronic resource].
2011—onwards.
Mode of access: http://ashipunov.info/shipunov/school/biol_250.

B. Alberts et al.
Essential Cell Biology. 3rd edition.
Garland Science, 2009.
Chapter 16: 531–544.