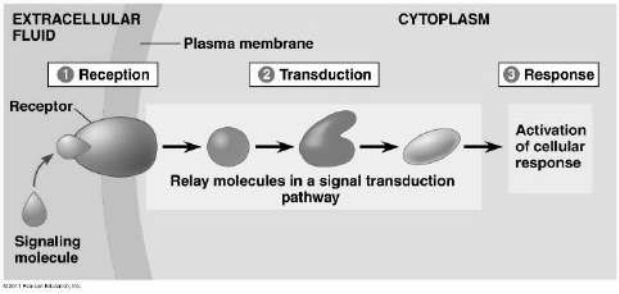
AP BIOLOGY **Name**_____

Chapter 11 Guided Reading Assignment (p. 206-227)

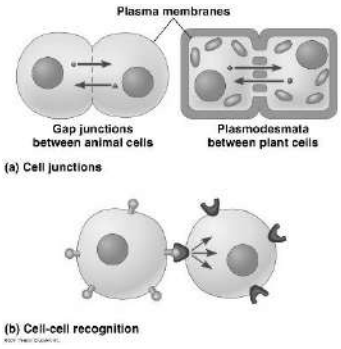
****NOTE:** This chapter is often considered difficult as you have not covered it in your general biology course. **Plan on reading this chapter slowly!!** I would suggest that you read the key concepts in bold first and then for each concept, look at the headings, then the figures and then ***READ for detail…and STUDY the figures and their captions.***

1) What is a **signal transduction pathway**?



2) How do yeast cells communicate while mating?

3) How do intercellular connections function in cell to cell communication?



4) Explain the two types of local signaling:

A) Paracrine signaling

B) Synaptic signaling

5) How are long distance signals sent?

6) Explain Sutherland's investigations with epinephrine and the inferences that were derived from this work.

7) Define the three stages of cell communication:

A) Reception:

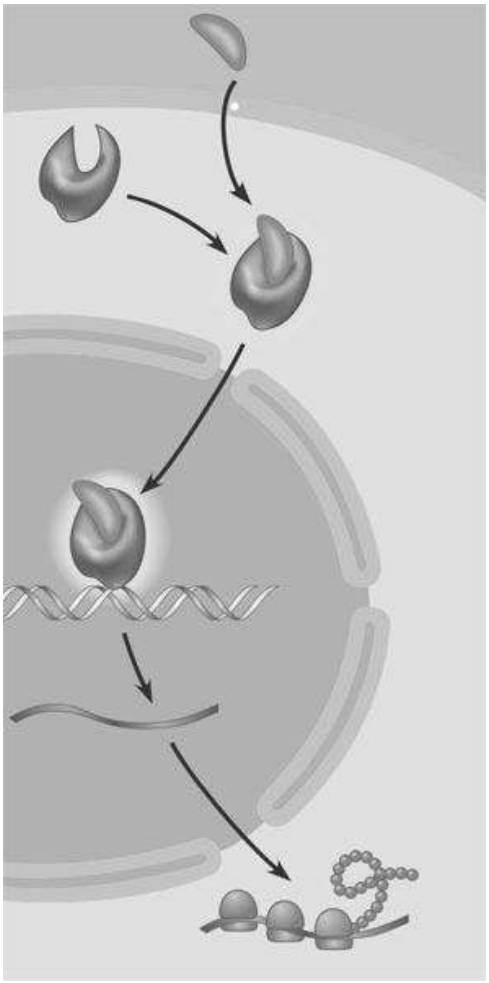
B) Transduction:

C) Response

8) What is a **LIGAND**?_____

9) What is special about **intracellular** receptors – hint think of the structure of the cell membrane and how this relates?

10) Label this diagram of a steroid interacting with an intracellular receptor. (HINT: see fig. 11.9)



11) Where would you expect most water soluble messengers to bind and why?

12) What is a **G-protein-linked receptor**? (see fig. 11.7)

13) **(see fig. 11.7, p. 211 captions):**

(overview): A G-protein-coupled receptor is a _____ receptor that works with the help of a **G protein**, a protein that binds the energy-rich molecule_____.

(1) When GDP is bound to the G protein, the G protein is_____. The receptor and G protein work together with another protein, usually an_____.

(2) When the appropriate signaling molecule binds to the extracellular side of the receptor, the receptor is activated and _____. Its cytoplasmic side then binds an inactaive G protein, causing a _____ _____ to replace _____. This _____ the G protein.

(3) The activated G protein leaves (dissociates from) the receptor, diffuses along the membrane, and then binds to an _____, altering the enzyme's_____&_____. Once activated, the enzyme can trigger the next step, leading to a _____.

(4) The changes in the enzyme and G protein are only temporary because the G pr otein also functions as a _____ _____ enzyme – in other words, it then hydrolyzes its bound GTP to GDP. Now inactive again, the G protein _____ the enzyme, which returns to its original state. The GTPase function of the G protein allows the pathway to _____ rapidly when the _____ _____ is no longer present.

14) What is a **KINASE (i.e. a protein kinase)**? (see p.212; 215)

15) **(see fig. 11.7, p. 212 captions):**

(overview): Receptor tyrosine kinases belong to a major class of plasma membrane receptors characterized by having _____ activity. The part of the receptor protein extending into the cytoplasm functions as a tyrosine kinase, an enzyme that catalyzes the transfer of _____ from ATP to the amino acid _____ on a substrate protein. One receptor tyrosine kinase comlex may activate _____ _____ different transduction pathways and cellular responses. The ability of a single ligand-binding event to trigger so many pathways is a key difference between _____ and _____ _____.

(1) Before the signaling molecule binds, the receptors exist as_____ referred to as monomers. Each monomer has an extracellular_____site, an α helix spanning the membrane, and an intracellular tail containing_____.

(2) The_____(such as growth factor) causes 2 receptor monomers to _____, forming a complex known as a dimer (dimerization).

(3) Dimerization activates the _____region of each monomer; each tyrosine kinase_____from an ATP molecule to a tyrosine on the tail of the other monomer.

(4) Now that the receptor is _____, it is recognized by specific relay proteins inside the cell. Each such protein binds to a specific phosphorylated tyrosine, undergoing a resulting structural change that activates the bound protein. Each activated protein triggers a_____,leading to a _____.

16) **(see fig. 11.7, p. 213 captions):**

(overview): What triggers a ligand-gated ion channel to open/close?

What then passes through the channel once it is open?_____

_____

***study and read the captions for parts 1-3 of this diagram!*

(conclusion): How do nerve cells make use of ligand-gated ion channels?_____

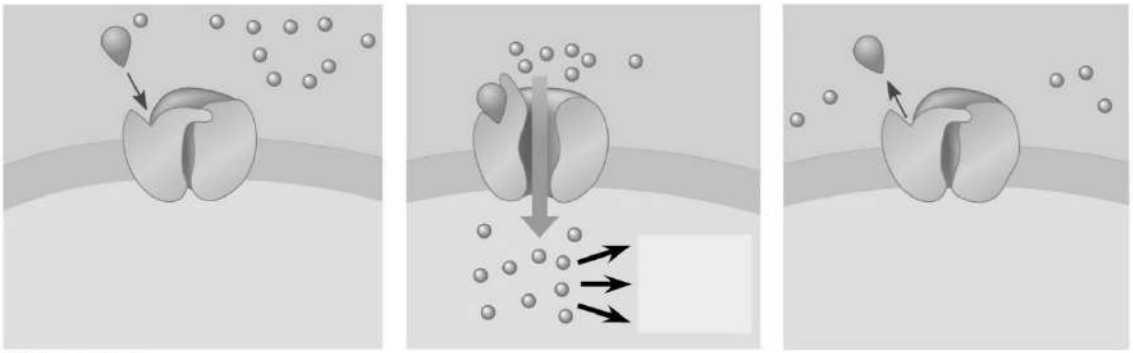
_____

How is a voltage-gated ion channel different?_____

_____

(label the diagram on the next page…see fig. 11.7,page 213)

DIAGRAM: Ligand-gated ion channel



17) **(see fig. 11.10, p. 215 captions):**

(overview): Summarize what occurs in a phosphorylation cascade:_____

_____

(1) A relay molecule _____.

(2) Active protein kinase 1 transfers _____to an inactive molecule of protein kinase 2, thus_____this 2nd kianse.

(3) Active protein kinase 2 then catalyzes the phosphorylation (&_____) of protein kinase 3.

(4) Finally, active protein kinase 3 phosphorylates a protein that brings about the cell's response to the signal.

(5) Enzymes called protein phosphatases catalyze the _____ from the proteins, making them _____ & _____ for reuse.

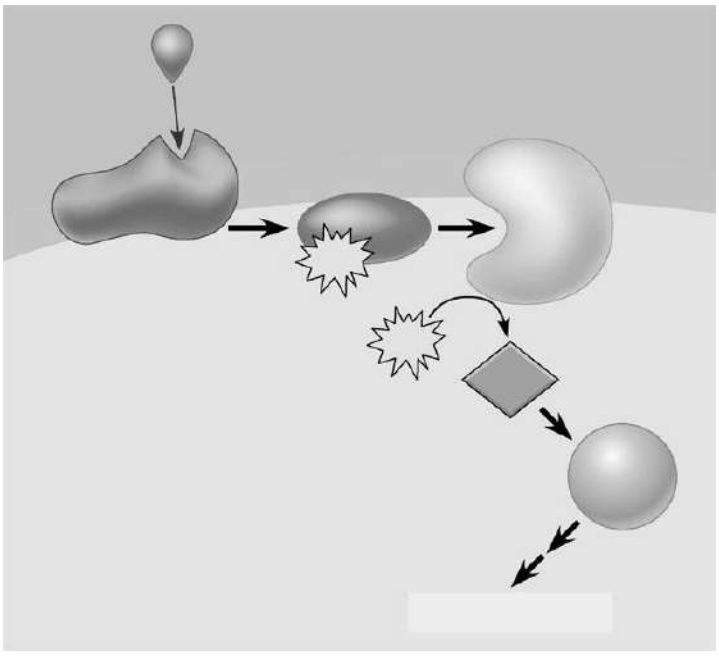
18) What are **protein phosphatases** and why are they so important?

19) What are **second messengers** and what are two characteristics of a second messenger (& why are these characteristics significant)?

20) What did Sutherland find in his experiments with regard to cyclic AMP and why is this important?

21) What is **adenylyl cyclase**?

22) Complete the diagram here of cAMP as second messenger: (see fig. 11.12)

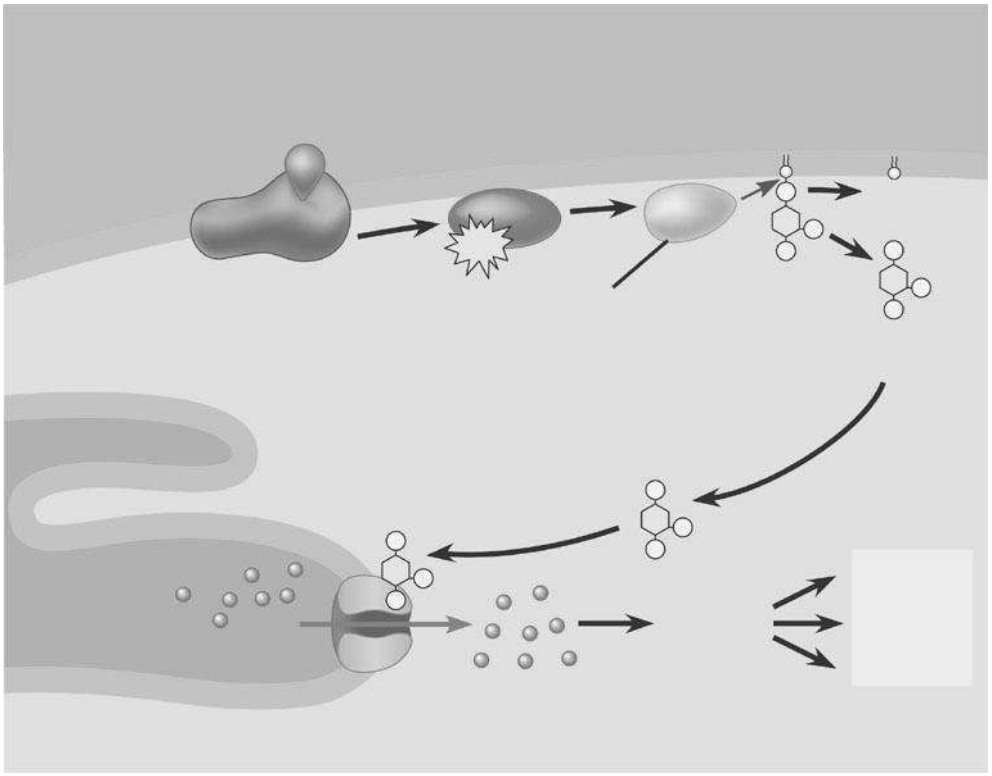


23) How does the cholera bacterium (& how this microbe causes disease) connect with the concepts of cell to cell communication?

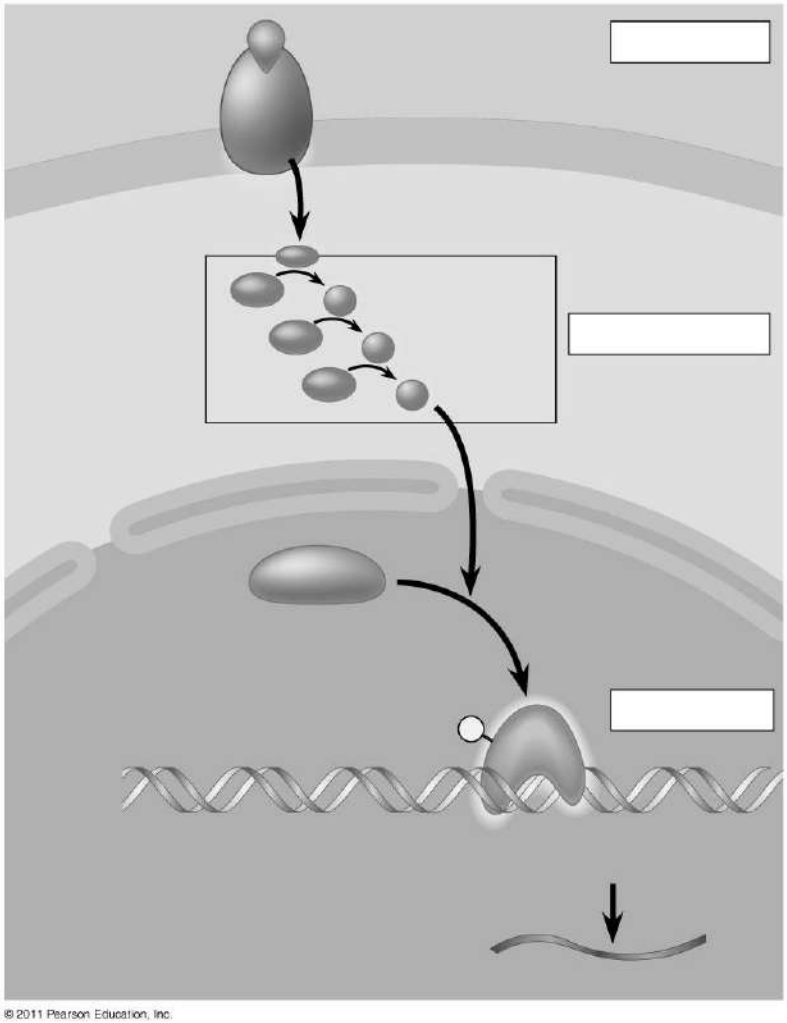
24) How does the drug known as Viagra work? Why was it originally prescribed for chest pain?

25) How and why are the calcium concentrations kept different and separate comparing the endoplasmic reticulum, mitochondria and cytoplasm?

26) Label the diagram below showing calcium and IP_3 in a cell. (see fig. 11.14)



27) Label the diagram below showing nuclear responses to a signal. (see fig. 11.15)



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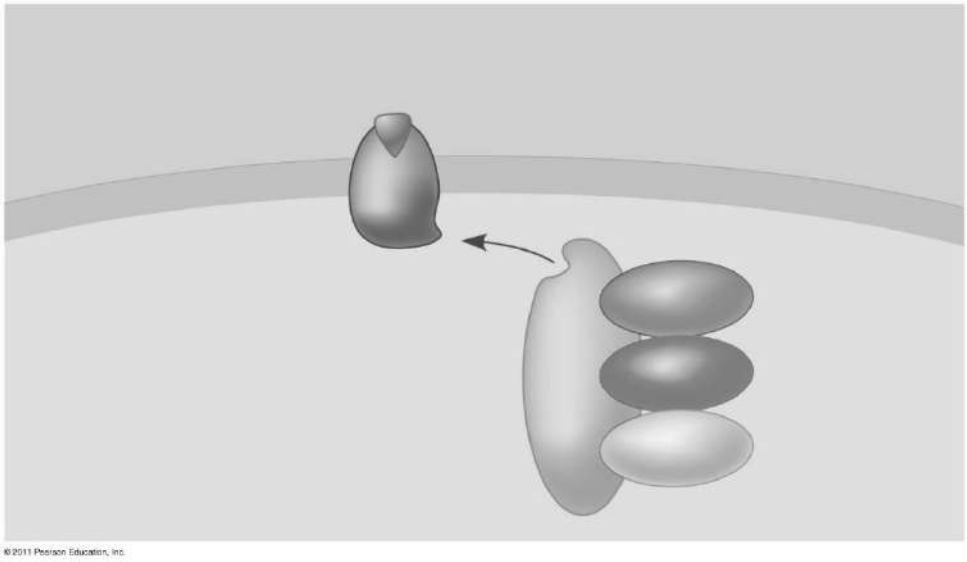
28) How is **signal amplification** accomplished in the cell?

29) How is **specificity** accomplished in cell signaling?

30) What is a **scaffolding protein** and why is it important?

31) Label the diagram of a scaffolding protein shown here. (see fig. 11.19)



32) How is the termination of a signal accomplished and why is it so important that termination be accomplished?