CHAPTER 16
CELL COMMUNICATION

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General Principles of Cell Signaling

16-1 Cell lines A and B both survive in tissue culture containing serum but do not proliferate. Factor F is known to stimulate proliferation in cell line A. Cell line A produces a receptor protein (R) that cell line B does not produce. To test the role of receptor R, you introduce this receptor protein into cell line B, using recombinant DNA techniques. You then test all of your various cell lines in the presence of serum for their response to factor F, with the results summarized in Table Q16–1.

Cell line	Factor F	Response
A	– Factor F	Cells do not proliferate
A	+ Factor F	Cells proliferate
B	– Factor F	Cells do not proliferate
B	+ Factor F	Cells do not proliferate
B + receptor R	– Factor F	Cells proliferate
B + receptor R	+ Factor F	Cells proliferate

Table Q16-1

Which of the following cannot be concluded from your results above?

(a) Binding of Factor F to its receptor is required for proliferation of cell line A.

(b) Receptor R binds to Factor F to induce cell proliferation in cell line A.

(c) Cell line A expresses a receptor for Factor F.

(d) Factor F is not required for proliferation in cell line B.

16-2 For each of the following sentences, fill in the blanks with the best word or phrase selected from the list below. Not all words or phrases will be used; each word or phrase should be used only once.

> Cells can signal to each other in various ways. A signal that must be relayed to the entire body is most efficiently sent by _____ cells, which produce hormones that are carried throughout the body through the bloodstream. On the other

hand, _____ methods of cell signaling do not require the release of a secreted molecule and are used for very localized signaling events. During _____ signaling, the signal remains in the neighborhood of the secreting cell and thus acts as a local mediator on nearby cells. Finally, _____ signaling converts electrical impulses into a chemical signal. Cells receive signals through a _____, which can be an integral membrane protein or can reside inside the cell.

amplification	G-protein	phosphorylation
contact-dependent	K^+ channel	receptor
endocrine	neuronal	target
epithelial	paracrine	

16-3 Rank the following types of cell signaling from 1 to 4, with 1 representing the type of signaling in which the signal molecule travels the least distance and 4 the type of signaling in which the signal molecule travels the largest distance.

_____ paracrine signaling
_____ contact-dependent signaling
_____ neuronal signaling
_____ endocrine signaling

16-4 Explain why the signal molecules used in neuronal signaling work at a longer range than those used in contact-dependent signaling.

16-5 Circle the phrase in each pair that is likely to occur more rapidly in response to an extracellular signal.

A. changes in cell secretion / increased cell division
B. changes in protein phosphorylation / changes in proteins being synthesized
C. changes in mRNA levels / changes in membrane potential

16-6 Receipt of extracellular signals can change cell behavior quickly (e.g., in seconds or less) or much more slowly (e.g., in hours).

A. What kind of molecular changes could cause quick changes in cell behaviour?
B. What kind of molecular changes could cause slow changes in cell behaviour?
C. Explain why the response you named in A results in a quick change, whereas the response you named in B results in a slow change.

16-7 Which of the following statements is *false*?

(a) Nucleotides and amino acids can act as extracellular signal molecules.

(b) Some signal molecules can bind directly to intracellular proteins that bind DNA and regulate gene transcription.

(c) Some signal molecules are transmembrane proteins.

(d) Dissolved gases such as nitric oxide (NO) can act as signal molecules, but because they cannot interact with proteins they must act by affecting membrane lipids.

16-8 All members of the steroid hormone receptor family _____.

(a) are cell-surface receptors

(b) do not undergo conformational changes

(c) are found only in the cytoplasm

(d) interact with signal molecules that diffuse through the plasma membrane

16-9

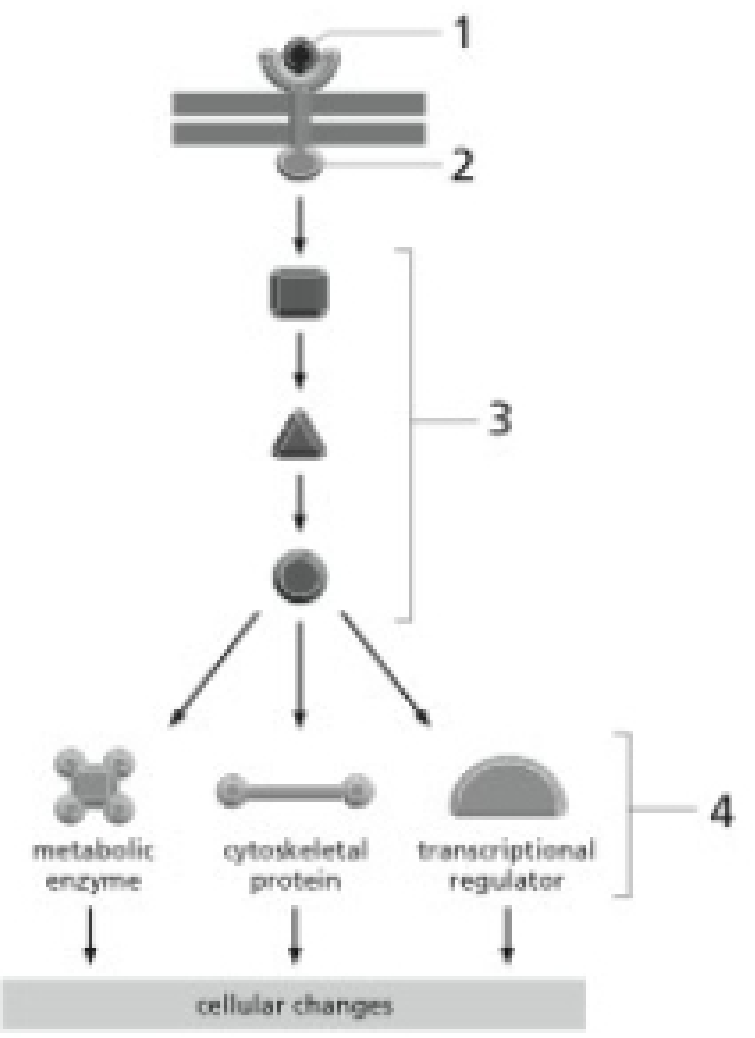

Figure Q16-9

Given the generic signaling pathway in Figure Q16-9, write the number corresponding to the item on the line next to the descriptor below.