Chapter 4

How Cells Work

4.2 Cell Communication

The cells of multicellular organisms communicate with one another in order to coordinate their activities. The "messages" they send take the form of molecules. For example, nerve cells send special molecules to muscle cells, telling the muscle cells to contract. The pituitary gland sends a different molecule, called growth hormone, to many different cells in the body, telling them to grow and divide.

In animals and plants, special structures allow local messages to pass directly from one cell to an adjacent cell. In animal cells, these structures are *gap junctions*, which are tiny channels between cells (Figure 4.9a). Gap junctions are found between many cells in the body. For example, how is it that heart muscle is able to contract simultaneously to produce each powerful heart beat? Answer: The unified contraction is orchestrated by messenger molecules moving through the gap junctions between adjacent heart muscle cells. In plant cells, these "in between cell structures" are called plasmodesmata (Figure 4.9b). Plasmodesmata are slender threads of cytoplasm that link adjacent plant cells. It is through the plasmodesmata that one plant cell is able to send a chemical signal to an adjacent plant cell.

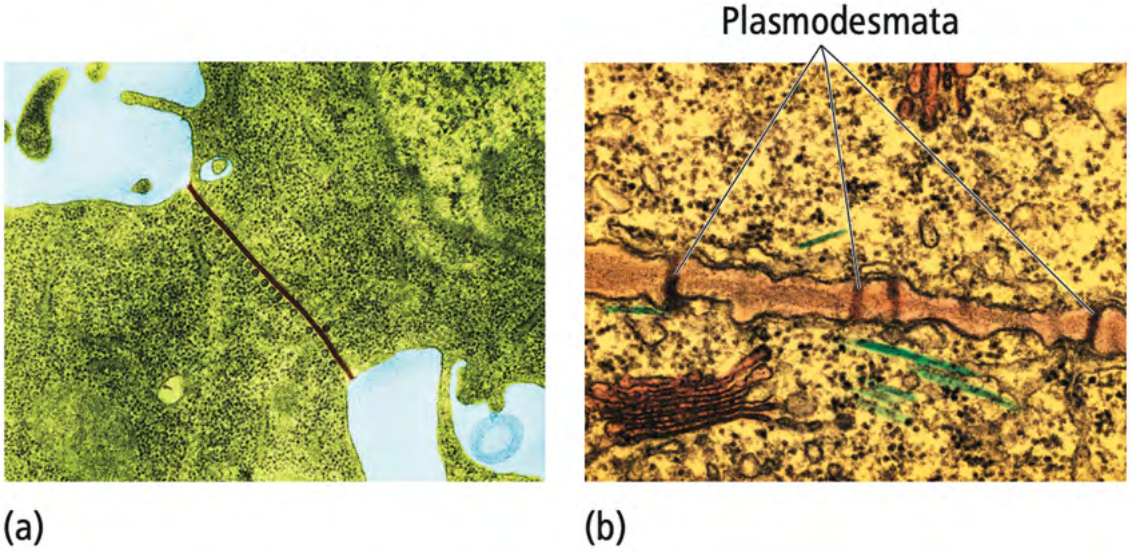


FIGURE 4.9

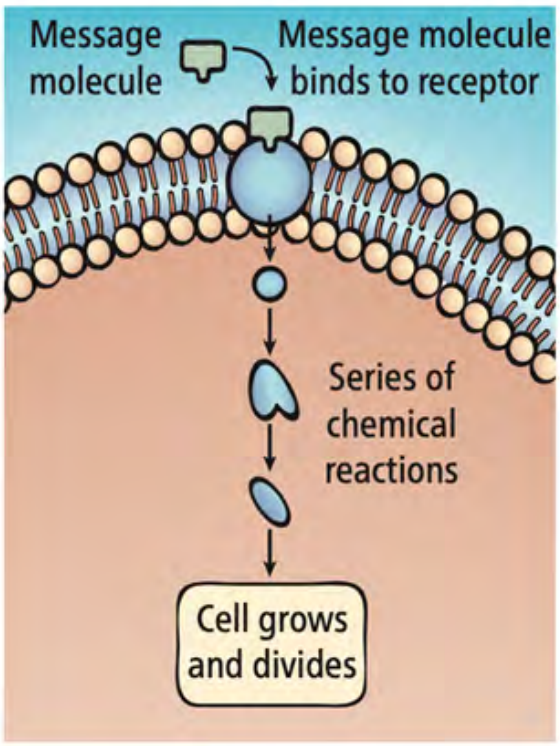
(a) Gap junctions are tiny channels between adjacent animal cells. These channels allow small molecules to pass. This photo shows a gap junction between two rat cells. (b) This photo shows plasmodesmata, narrow passages that link the cytoplasm of adjacent plant cells.

Message molecules may also travel through the bloodstream to faraway target cells. As mentioned earlier, an example of this is growth hormone, which is sent from the pituitary gland in the brain to cells all over the body. When a message molecule reaches a target cell, it binds to a protein called a *receptor*. Some receptors are membrane proteins, whereas others are inside the cell. Receptors are extremely specific about the molecules they bind to. This is because a message molecule and its receptor fit together like a key in a lock—only the right combination will work. This lock-and-key fit also means that only cells with the appropriate receptors will "receive" and respond to specific message molecules. The binding of a message molecule to its receptor sets off a series of chemical reactions that results ultimately in the target cell's response to the message. As just one example, a cell may receive a message that tells it to grow and divide (Figure 4.10).

Problems with cell communication can be dangerous. In some cancer cells, a problem in the communication process causes cells to receive the "grow and divide" message continuously and divide out of control.

FIGURE 4.10

A cell receives a message when a message molecule binds to a receptor in its cell membrane. This begins a chain of events that ends with the cell's response to the message. In this case, the cell responds by growing and dividing.



READING CHECK

Explain how a cell uses a chemical message molecule to communicate with another cell elsewhere in the body.

CHECK YOUR ANSWER

A cell releases a message molecule, which travels through the bloodstream to a target cell. There, the message molecule binds to a protein called a *receptor*, which might be a membrane protein or a protein inside the cell. The binding of a message molecule to its receptor sets off a series of chemical reactions that results ultimately in the target cell responding to the message in some manner. An example of a target cell response could include a muscle cell contracting in response to a message molecule from a neuron.

You can read a lot more about cell communication here:

https://projects.ncsu.edu/project/bio183de/Black/communication/communication.html