Name _____ Course/Section_____

Date _____ Professor/TA _____

Activity 11.1 How are chemical signals translated into cellular responses?

Chapter 11 in *Biology,* 7th edition, describes at least four kinds of signal receptors. Three of these—G-protein-linked receptors, tyrosine-kinase receptors, and ion-channel receptors—are plasma membrane proteins. Protein receptors found in the cytoplasm, or nucleus, of the cell are the fourth type. Some signals (for example, a protein hormone) interact with signal receptors in the cell membrane to initiate the process of signal transduction. This often involves changes in a series of different relay molecules in a signal-transduction pathway. Ultimately, the transduced signal initiates an intracellular response. Other types of signals (for example, steroid hormones) can diffuse through the cell membrane and interact with intracellular receptors. For example, testosterone interacts with its receptor in the cell's cytoplasm, enters the nucleus, and causes the transcription of specific genes.

To help you understand how signal transduction occurs in cells, develop dynamic (claymation-type) models of both a G-protein receptor system and a tyrosine-kinase receptor system. Use playdough or cutout pieces of paper to represent all the structural components and molecules listed here under each system.

G-protein receptor system

signal protein
G-protein-linked receptor
plasma membrane
inactive and active G protein
GTP and GDP
inactive and active enzyme
signal-transduction pathway

Tyrosine-kinase receptor system

signal protein
tyrosine-kinase receptor
plasma membrane
inactive and active relay proteins
ATP and ADP
signal-transduction pathway

Use your models to show how signal reception by each of the systems can lead to the release of Ca^+ from the endoplasmic reticulum. Demonstrate and explain your models to another student group or to your instructor.

Then use your models to answer the questions on the next page.

1. How are these two systems similar? Consider both structural similarities and similarities in how the systems function.

2. How are the two systems different? Consider both structural differences and differences in how the systems function.

3. Both systems can generate elaborate multistep signal-transduction pathways. These pathways can greatly amplify the cell's response to a signal; the more steps in the pathway, the greater the amplification of the signal. Explain how this amplification can occur. (Review Figure 11.13, page 213, in *Biology,* 7th edition.)