Cell Signaling Module Worksheet

Answer the below questions for each animation in the space provided:

1. What seems to be happening in each step of each animation? Can you list the events?

2. What do you think the molecules moving from cell to cell are?

3. What appears to be the tiny molecules' function (what effect do they have on their parent cell or other cells)?
4. What process seems to be happening inside the cells once they receive a signal?

5. Can you think of real biological examples (perhaps in animals or other organisms) where cells might need to signal other cells in order to communicate or carry out a function?

6. What other important observations can you make about these animations?
Answer the below questions for the above animation in the space provided:

1. Compare and contrast the signaling in this animation to the signaling observed in previous animations. What aspects are the same? What aspects are different?

2. What possible consequences could this type of signaling result in for an organism?

3. Organisms are made of trillions of cells so normally a single mutation in a cell would not be that big of a deal. Do you think this mutation would have a drastic effect or not that big of an effect? Why or why not?
The Scientific Approach

What two control experiments should you run in addition to your co-culture experiment? (Hint: you will be able to test the media to see which signal molecules are present).

Control 1:

Control 2:

What are other possible questions/hypothesizes that you may potentially want to know the answer to? (That pertain to this experiment)
Animation Explanations and Answers

Animation 1 Explanation:

As you can see, the three cells in this animation are of the same type. Each time they release a green signal molecule, the molecule binds to the green receptor on one of the other cells. This binding of the signal molecule to the receptor causes the receptor to release another, internal signal molecule (this is called a second messenger) and it is represented by the yellow star. Once the yellow star is released from the receptor, it binds to a protein inside the cell causing it to become active and release another green signal molecule. Then the whole process repeats itself. Cells use signal feedback loops like this constantly to ensure that they are in the correct location. Since cells can no physically see where they are, they use cellular signaling to detect if they are surrounded by the correct cell types.

Animation 2 Explanation:

In this animation, there are cells of two different types. When the green signal molecule binds to the green receptor on the bottom cell, this causes the receptor to release a blue star (second messenger). The star then causes a protein in the cell to make and secrete an orange signal molecule. This orange signal molecule then binds to the orange receptor on the top cell causing the release of a red star (second messenger). The red star then causes changes in a protein which then causes the cell to divide. Signaling loops like this are commonly used in wound responses. For example if an organism like a human sustains a cut, cells are signaled to divide in order to help replenish the lost cells. One important aspect of this animation is that a cell of a different type is required to signal the other cell to divide. This is not always the case but when this kind of signaling loop is used it is to help tightly regulate cell division.

Animation 3 Explanation:

In this animation there are cells of two different types. When the blue signal molecule binds to the blue receptor on the top cell, this causes the receptor to release a green star signal molecule (second messenger). The green star then signals a protein in the cell to create and secrete 4 yellow signal molecules. These molecules then bind to the yellow receptors on the four cells at the bottom of the screen. This then causes the four cells to lose adhesion for each other and migrate to a different location. This type of signal is also commonly used in wound responses. When a wound is created, before the cells have time to divide enough to fill the wound, some cells are signaled to migrate over to the site of the wound in order to expedite the healing process.
Animation 4 Explanation:

In this animation, the green receptor is active even without the presence of its green signal molecule. This causes the receptor to constantly release the yellow star (second messenger) into the cell and trigger the cell to divide via the red protein. This then happens over and over since the green receptor is constantly active. Mutations like this are present in many cancer signaling pathways.

Control 1 Explanation:

One of the control experiments would be to culture cells of cell type A by themselves. Then you will be able to test the media and see which signal molecules are present before type B cells are introduced.

Control 2 Explanation:

The other control would be to culture type B cells by themselves. Then you could test the media in order to see which signal molecules type B cells secrete without the presence of type A cells.

Possible Experiment Answers:

1. Find out which cell type is secreting signal molecule alpha (it could be either type A or B).
2. Find out what roles beta, epsilon, and gamma play in cellular signaling.
3. Try to reproduce an experiment that shows that alpha causes type A cells to migrate.