Name: _____ Date: _____ Period: ___

Regulating the Cell Cycle Week # ___

Directions: Read and annotate each section below. Then answer each question.

One striking fact about cells is how they know when to divide and when to stop. Cell division is a carefully regulated or controlled process, and as we have already learned, not all cells move through the cell cycle at the same rate.

When scientists grow cells in the laboratory, cells will divide until they come into contact with each other. Once they do, they stop dividing and growing. What happens if those neighboring cells are suddenly removed? The remaining cells will begin dividing again until they once again make contact with other cells.

Figure 1: Normal section of skin (on left) and skin cells that have been damaged (on right)

1. On Figure 1, draw an arrow to indicate where you would expect to find rapidly dividing cells.
2. Why did you draw your arrow in this place? _____

_____

The cell cycle is controlled by regulatory proteins that tell the cell when it is time to divide or not divide. Much like stoplights regulate traffic, regulatory proteins regulate the cell cycle. There are external regulatory proteins that cause the cell to speed up or slow down the cell cycle based on some event that occurred outside the cell. An example that would require external regulatory proteins is wound healing. Internal regulatory proteins respond to events that occur in the cell itself. For example, a regulatory protein checks to make sure the cell is large enough to begin duplicating DNA, another regulatory protein checks that the DNA has been duplicated correctly before the cell prepares for division, and a third regulatory protein checks to make sure a cell has completed mitosis correctly. If a cell does not pass any of these checkpoints, an event called apoptosis occurs in which the cell dies.

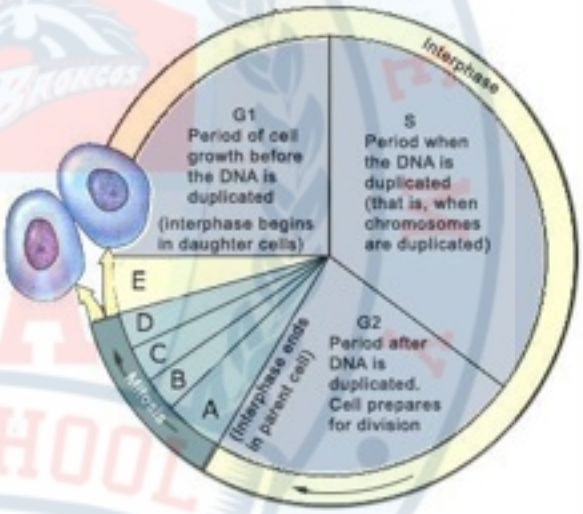

Figure 2: The cell cycle

3. Name the phases in Figure 2.
   A. _____ C. _____ E. _____
   B. _____ D. _____
4. On Figure 2, draw a stoplight where you would find the three internal regulatory proteins.
5. Is the cell division in Figure 1 an example of an external regulatory protein or an internal regulatory protein? Explain your answer. _____

_____

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What happens if cell growth is not regulated to carefully? Imagine if someone decides to not obey the stoplight. Obviously the results could be disastrous. When a cell does not obey a regulatory protein, it can start to divide uncontrollably. The disorder in which cells lose the ability to control growth, is cancer. Cancer starts with one cell with a mutation in the gene that regulates cell growth such that the cell no longer responds to regulatory proteins. This cell divides and grows rapidly, and begins to form a tumor, or a mass of cancer cells. The cancer cells continue to divide rapidly, acquiring more mutations along the way, and begin to look more and more abnormal. The mass of abnormal cancer cells becomes more obvious as it displaces (takes the place of) other cells. At this point, the tumor is benign because it has not spread to other parts of the body. However, if the tumor keeps on growing, cancer cells can break off from the tumor and travel through the bloodstream to another part of the body. This causes the cancer to spread to healthy parts of the body. This type of tumor is malignant. As tumor cells spread, they absorb the nutrients needed by other cells and prevent cells, tissues, and organs from functioning properly, which is what makes cancer so deadly.

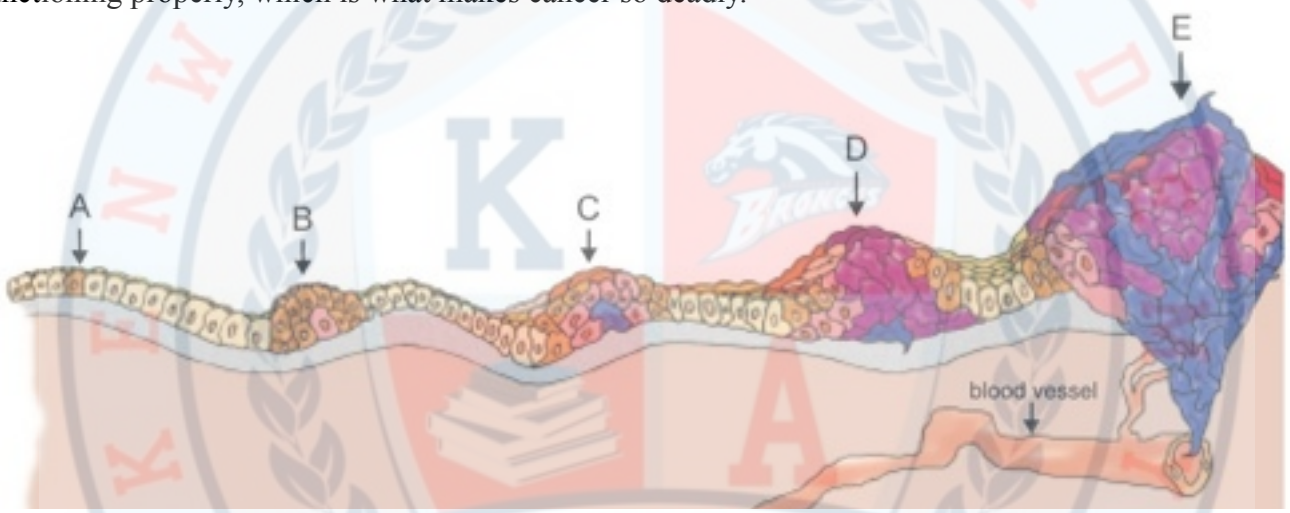

Figure 3: Skin cancer development

6. Based on the paragraph, identify what is happening at each letter in Figure 3.

A. _____

_____

_____

B. _____

_____

_____

C. _____

_____

_____

D. _____

_____

_____

E. _____

_____

_____