

Ethan Alan Stone: STEAM Project

Objective: Cancer Cells and Cell Division (Describe the stages of Mitosis)

For my STEAM project I chose the course objective “Describe the Stages of Mitosis”. My STEAM project is focused on growth and division of cancer cells and how that compares to the growth and division of healthy cells. Healthy cell growth and division is a controlled cycle, when cells become old or damaged cells enter a process called apoptosis (programmed cell death). The main purpose of apoptosis is to destroy cells that are no longer needed in the body. If apoptosis is not entered, these old or damaged cells are given an opportunity to form into cancerous cells. Because these cells are old and damaged there is a greater likelihood they will experience mutations (when compared to young healthy cells). A mutation can be defined by a permanent change in the DNA of a cell, if this mutation affects the cells ability to proliferate (reproduce rapidly) properly it can result in an abnormal division. These mutations can then turn these cells into precancerous cells that will form into a cancerous disease over an undefined period of time (cancer does not occur in a single event, it is developed over time; case to case basis). The mutated/damaged cells lose the ability to form regular tissues, and this is when tumors are formed. A tumor is a mass of abnormal/mutated/damaged cells that forms within the tissue. Just because a tumor is formed, it does not mean cancer has been developed. In fact, many tumors end up being benign (not harmful in effect, does not cause a disease). Cancer cannot be defined as a single disease, instead it is many different diseases all drawn under the same umbrella. The factor that pulls all of these cancerous diseases together is the uncontrolled proliferation of cells, these cells will not respond to the body's signals to stop growth/division. The cells that escape the body's regulatory signals are referred to as malignant cells. The malignant cells can display uncontrolled growth, invasion into adjacent tissues, and colonization of other organs if not treated/caught at an early stage. When the tumor cells become malignant, that is when the tumor is no longer defined as benign (at this point it is now malignant or cancerous). The name of the cancer generally stems from the tissue the cancer originated in. The treatment approach of the cancer depends on the type of cancer and the stage it is found at. Treatment methods include: surgery, radiation, chemotherapy, and hormone therapy. The goal of all these treatments is to remove and/or destroy these proliferating malignant cells, but they all have their limitations. Tumor locations can prevent surgical removal, radiation/chemotherapy are harsh and cannot target cancer cells specifically (high stress on patients body, destroys healthy tissue as well). Researchers are currently focused on creating treatment methods that can target proteins associated with cancer molecular pathways (to reduce destruction of healthy tissues). In my project I created 4 stages of cancer development out of cupcakes in this order: The first cupcake (blue genetic material is a normal cell, the second cupcake is a mutated cell that is not yet cancerous, the third step of cupcakes (2 cupcakes) are malignant or cancerous cells that have undergone division, and the final stage is a large group of malignant cancerous cells that compose the tumor.

Work Cited:

Papaccio, F., Paino, F., Regad, T., Papaccio, G., Desiderio, V., & Tirino, V. (2017). Concise review: cancer cells, cancer stem cells, and mesenchymal stem cells: influence in cancer development. *Stem cells translational medicine*, 6(12), 2115-2125.

Mills, C. C., Kolb, E. A., & Sampson, V. B. (2018). Development of chemotherapy with cell-cycle inhibitors for adult and pediatric cancer therapy. *Cancer research*, 78(2), 320-325.

Casero, R. A., Stewart, T. M., & Pegg, A. E. (2018). Polyamine metabolism and cancer: treatments, challenges and opportunities. *Nature Reviews Cancer*, 18(11), 681-695.

Pfeffer, C. M., & Singh, A. T. (2018). Apoptosis: a target for anticancer therapy. *International journal of molecular sciences*, 19(2), 448.