**Objectives**

1. To learn about different types of immune cells
2. To understand basic flow cytometry
3. Learn how flow cytometry can be used to diagnose different diseases

**Background**

Flow cytometry is a technique used largely in research science, but also in hospitals to diagnose different diseases and illnesses. Flow cytometry uses fluorescence to sort cells. It is called flow cytometry because cells “flow” in a stream, and cytometry means to measure a parameter of a cell—in this case the fluorescence. Cells are tagged with fluorescent markers (Green, blue, red, etc.) and then sorted based on their color. In this way, we can stain for three different proteins expressed on a cell. More information is available by following the link below, along with an interactive display: [http://www.unsolvedmysteries.oregonstate.edu/flow_06](http://www.unsolvedmysteries.oregonstate.edu/flow_06)

Immunology is the study of the immune system. There are many types of immune cells, but this activity focuses on white blood cells. Those are comprised of B- and T-cells. Typically, T-cells will respond and fight off an invading bacterium or virus, while B-cells will produce antibodies specific to the invader. However, some diseases are mediated predominantly by B-cells, or by T-cells.

Epstein Barr virus (mononucleosis) is caused by the virus infecting B-cells, which then expand. Symptoms are synonymous with strep throat – fever, swollen lymph nodes, sore throat, and white spots in the throat and on the tongue. However, strep throat is bacterial in origin, and T-cells respond to that bacterium. Thus, a patient with increased B-cells and those symptoms may have the Epstein Barr virus.

By tagging B-cells with one color, and T-cells with another color, we can use flow cytometry to quantify the percent total of these cells.

**Guiding Questions:**

- When we get a cold, and we have the sniffles, is that an immune response?
- Why do we take antibiotics?
- What is the function of an antibiotic? Is it similar to that of a T-cell? Do they work together?
- Why do we have to use fluorescence? Hint: can we see differences between B-cells and T-cells just by using a microscope?

**Fun Facts**

- The average flow cytometer can sort over 4,000 cells per second.
- Some cytometers can ‘see’ up to 14 different colors.
- A high speed cell sorter flow cytometer will not just sort the cells, but will isolate them into a tube so that you can use those cells for other experiments.