Emily Spradling

Biological Engineering
Year in School: Senior
Hometown: St. Louis, Mo.
Faculty Mentor: Dr. John A. Viator, Biological Engineering

Funding Source: College of Engineering Undergraduate Research Option

Photoacoustic detection of circulating melanoma cells in the plasma layer of the blood

Emily Spradling & John A. Viator

When a melanoma patient is diagnosed, aggressive treatment is advised in an effort to contain the disease. Although the initial malignant cells are destroyed, it is impossible to determine whether or not the cancer has metastasized until a secondary tumor forms. This can take months to discover, by which time the cancer could be advanced. Our research focuses on using photoacoustic signals to detect melanoma cells circulating in the blood, allowing for much earlier discovery and treatment of this type of cancer. Photoacoustic signals are produced when a laser illuminates a medium – blood, in this case – and the resultant pressure created by the light causes the medium to emit a sound wave. These waves are specific to the medium being illuminated, and melanoma cells can therefore be differentiated from surrounding blood cells based on the waveform it produces. Our current technique involves the in vitro separation of blood through centrifugation to isolate and test only the white blood cell layer since the contrast between these cells and melanoma cells is clear. Using this method, we have detected a single cancerous cell in the blood stream. However, the process could be made simpler if the plasma layer were used for detection instead of the white blood cell layer. This layer is easier to obtain after blood has been centrifuged, the optical difference between plasma cells and melanoma cells is more pronounced in this layer than in the white blood cell layer, and the possibility that any stray red blood cells could distort the results is eliminated. The primary focus has therefore been to determine whether or not melanoma cells are commonly found in the plasma layer of the blood. If such is the case, this research will be one step closer to revolutionizing the treatment of melanoma patients around the world.