**Research in the Cabeen Lab**

Here at Oklahoma State University research is highly valued. Research is conducted in departments all over campus over a vast range of subjects. The Microbiology Department is an example of one of these departments whose research is making a change in the world as we know it. Dr. Cabeen, a professor who is responsible for research concerning bacterial stress responses, is helping the microbiology department strive forward in the field of science.

In *Use of a microfluidic platform to uncover basic features of energy and environmental stress responses in individual cells of Bacillus subtilis*, it is discussed how the bacteria *Bacillus subtilis* responds to both environmental and energy stressors. The bacteria respond by using stress-sensing pathways that converge on sigma factor B which then causes the bacteria to respond to the stress. The stress-exposed cells showed quick responses to the stressors, however wild type cells and mutant cells showed striking differences in how they responded. This paper also discussed how microfluidics to find sigma factor B activation.

While there are many questions surrounding the topic of bacterial stress responses, there are three big ones that Dr. Cabeen’s lab is striving to answer. One of the questions is what does the sensor sense? There is question as to whether it is on the membrane, or perhaps there have been mutations on proteins that help in the identification of specific amino acids which would help identify a potential threat. Another question is where this sensing is localized. While it is known that it takes place it in the cytoplasm, it isn’t clear exactly where in the cytoplasm sensing takes place. One approach to potentially answer this question is to tag a stressosome and learn the dynamics of its localization. The last question is how does the stressosome produce a signal. It is currently known that there are one to four sensors, however each sensor responds differently. These responses are chaotic, meaning they all occur at the same time.

The goal of conducting this research is to understand all of the steps in the stress response system from the initial sensing, the length of time before a cell resets so it can perform another stress response, and all the steps in between. Dr. Cabeen’s lab wants to understand from a single protein level to how stress response patterns affect a cell’s fitness, and how integrated stressosomes on the cell level affect the population of cells and their survival.

While conducting research, it is to be expected that there will challenges that these researchers must overcome. One of the challenges Dr. Cabeen’s lab has encountered is using microfluidics. Using microfluidics can be tricky and requires quite a bit of practice to be proficient at using it. While analyzing data can also be labor intensive, the researchers experience similar challenges as other experimental sciences such as figuring out what to tackle first and finding time to be in the lab.

When asked why this research is important, Dr. Cabeen responded, “This research is fundamental to understand how all organisms deal with stress. For cells, when they’re exposed to stress, they either live or die, unlike larger organisms.” A cell’s ability to survive is fundamental in understanding possible insights into the world of stress in organisms in general. Through this research, learning about stress responses in bacteria can help the world understand how larger organisms respond to stress as well.

**References**

Use of a microfluidic platform to uncover basic features of energy and environmental stress responses in individual cells of Bacillus subtilis

Cabeen MT, Russell JR, Paulsson J, Losick R (2017) Use of a microfluidic platform to uncover basic features of energy and environmental stress responses in individual cells of Bacillus subtilis. PLOS Genetics 13(7): e1006901. https://doi.org/10.1371/journal.pgen.1006901