In March, I met with Dr. Tyrrell Conway, Professor and Microbiology Department Head at Oklahoma State University. Lately, concussions have been a hot topic in the news. Football players, rodeo athletes, soccer players, and many other athletes have come forward, or have been examined after their death to reveal that concussions are a major concern in contact sports. There are not very many treatments currently available that will cause shortening of the recovery of a concussion. Most of these treatments do not even treat the concussion, they only treat the symptoms. This is because concussion diagnosis and treatment is heavily dependent on subjective analysis. This means the medical professionals can not directly see most of the issues a person who has sustained a concussion is experiencing. Unlike a broken bone, a headache, nausea, dizziness, lack of focus, and other like symptoms cannot be observed through medical imaging or otherwise. However, ongoing research suggests that certain biomarkers can help in diagnosing, and down the road possibly treating concussions. These biomarkers are parts of cells that exist in the bloodstream that should be there in low concentrations or be absent, but are present/ in high concentrations post concussion. Some of these biomarkers can be present months after a concussion is sustained, i.e. pieces of nerve cells, increased inflammation, proteins found in the brain, etc. I wondered if the treatment of concussions currently (using pain medication and radiological imaging) and the presence of these biomarkers would affect the microbiome, or the bacteria that live in our intestines symbiotically, enter Dr. Conway.

Dr. Conway specializes in research of *E. Coli*, which is commonly found in the gut (intestines) of animals and humans. There are harmful and helpful strains of *E. Coli*. Since this organism is commonly found in the human gut, I decided to investigate how treatment and diagnosis of concussions can affect these organisms. The drugs that affect these organisms the most, “…is antibiotics. Most antibiotics are given orally, no question, there is a major impact. The best evidence in animals is that it takes 6-9 months to recover from that change in the makeup of that microbial community” according to Dr. Conway. But, antibiotics aren’t really used in concussions so I wondered what radiation might do to the microbiome. “Bacteria would be more resistant to radiation damage than [human] cells. They have DNA repair mechanisms that work like crazy. There is an organism called radiocaucus radiodurans that was isolated from the walls of a nuclear reactor. It is somewhere near 1000x more resistant to radiation. All it does is amp up expression of its DNA repair systems. Every microorganism has the ability to grow up in any possible niche. But, they only grow where the find the niche that suits them. I’m not sure if radiation would affect the human microbiome, there may be some drugs we take that would affect it, but in general microorganisms are fairly resilient. If there was an effect it would be very minor, and would be repaired quickly.”

As mentioned above, bacteria are going to occupy the most optimal environment for them. For example, what strain of *E. Coli* you have is most likely different from the strain your neighbor has. This is partly because of the restaurant hypothesis. Dr. Conway directed my research to a paper he and Dr. Paul S. Cohen of the University of Rhode Island authored. The restaurant hypothesis attempts to explain how different organisms (in this case *E. Coli* specifically) occupy different niches in the human gut and how the harmful strains might take over. This is possible because of the different “restaurants” an organism would open/occupy to feed itself. In other words, certain organisms feed better one sugar over another that a different organism may feed well on, and so on. In other words, the organism opens a restaurant in the area that its most abundant supply of sugar is present in. With the help of anaerobic bacteria (bacteria that lives without oxygen) and biofilms, a mucousy film that is secreted by an organism where nutrients are present, *E. Coli* can flourish in certain areas over others because of the location of a certain sugar. This explains why some *E. Coli* can appear to not grow well in mucous in the lab, but flourish in the body because of the right sugar being present and the environment being just right. This also explains how harmful strains can live too. Some of the “good” sugar can leak through the good strains where the harmful strains have access to it. This can cause the two strains to compete equally for this one sugar source, which could lead to the harmful strain taking over.

**References**

Conway, Tyrrell and Cohen, Paul S. (2015) *Applying the Restaurant Hypothesis to Intestinal Microbiota*. American Society for Microbiology, 10(8), 324-328.