College of Agricultural Sciences Undergraduate Research Fellowship

Project Application

STEP 1) Faculty, lab staff and other qualified leaders are encouraged to outline a one-semester project below. Please include the following to allow students a broad understanding of how this project may align with their interests and skill development:

a) Fellowship Mentor name and Project title

Mentor Name: Terry Engle

Project Title: Effects of Supplemental Copper on Ruminal Biohydrogenation of Unsaturated Fatty Acids

b) Justification or broad impact of project on the field of science it resides within.
A large proportion of lipids in diets fed to cattle consists of unsaturated fatty acids. When ingested, dietary unsaturated fatty acids are extensively biohydrogenated (removal of the double bonds in unsaturated fatty acids) in the rumen to yield saturated fatty acids as well as intermediates of the biohydrogenation process (e.g. C18:1 trans isomer. This biohydrogenation process allows for only small amounts of dietary unsaturated fatty acids to by-pass the rumen and become absorbed by the animal. Therefore, the lipid content of ruminant tissue contains a high proportion of saturated fatty acids and intermediates from the biohydrogenation process relative to nonruminant species.

Our laboratory has recently reported that adding 20 or 40 mg of Cu/kg dry matter (DM) to growing and finishing diets increased polyunsaturated fatty acids (C18:2 and C18:3) and decreased the C18:1 trans isomer in longissimus muscle. This suggests that Cu supplementation may have decreased microbial biohydrogenation of unsaturated acids in the rumen, thus allowing for a greater amount of unsaturated fatty acids to by-pass the rumen and be absorbed from the lower gut. Therefore, the objective of this experiment is to investigate the effects of Cu on microbial fermentation products and biohydrogenation of unsaturated fatty acids using in vitro fermentation techniques.

Significance of the proposed work: Due to the negative human health impacts of consuming diets high in dietary saturated fatty acid content, several attempts have been made using by-pass lipids (lipids that are protected from ruminal fermentation: i.e. calcium lipid soaps) to increase unsaturated and decrease saturated fatty acid composition of beef consumed by humans. However, little success has been achieved in this area because of the complexity of the rumen environment. This experiment could potentially offer a practical means for altering the fatty acid composition in beef by determining if Cu alters microbial biohydrogenation of unsaturated fatty acids.

c) Tasks to be completed during approximately 150-hour fellowship

The Fellow will be exposed to various animal handling and laboratory techniques throughout the experiment. Briefly, the Fellow will gain experience in working with fistulated steers, rumen fluid collection, sample handling, and processing, in vitro fermentation techniques, gas sampling, laboratory techniques to measure lipid biohydrogenation and gas composition, data management, statistical analysis, manuscript preparation, and data presentation.

d) Major skills and competencies that will be developed during the project execution
This project will allow the Fellow gain valuable experience in conducing basic research using beef cattle as a model. The intent of this project is to expose the Fellow to proper experimental design, animal handling techniques, sample preparation, laboratory analysis, and interpretation and presentation of research findings. The interpretation and application of the experimental data will require the Fellow to collectively utilize the knowledge gained from the courses they have taken as an undergraduate. Traditional courses offer a basic background pertaining to specific subject matter. This project is designed to bridge the gap between information learned in traditional courses and practical application of knowledge.

STEP 2) Please share the following to best describe how the Fellowship Mentor plans to support the Fellow throughout the Fellowship:

a) What training will the new Fellow receive to on-board them to community practices?
In order to work in our laboratory several standard trainings must be taken prior to working (Trainings: Animal Care and Use; hazardous waste; occupational health and risk; and responsible conduct in research). Once all of these trainings have been completed the Fellow will be trained in specific animal handling and laboratory techniques. Our standard practice of onboarding into our research group consists of a group meeting with all staff, faculty, graduate students, and undergraduate students that are currently working our laboratory. We have standard introductions and then we discuss safety, the Principles of Community, reporting structure, and expectations. We also discuss what to do if you anyone in our group is struggling with a concept, technique, or collogue to resolve the issue.

b) Who will the Fellow be working with directly?
Terry Engle and Octavio Guimaraes

c) Are there weekly/monthly group meetings that may provide additional training and/or connection for the Fellow with the other student employees working on related projects?
Yes – We have weekly meetings with our entire research group where we discuss what everyone is doing, who needs help, etc. This is also a time for students, staff, and faculty to discuss challenges they have had with specific research projects/techniques/assays, etc. so that collectively we can help to resolve the issues.

d) What specific mentorship is the Fellowship Mentor willing to provide the Fellow (for example, an introduction meeting and two additional meetings throughout the Fellowship)?

Beyond the weekly group meetings, I will meet with the Fellow separately to discuss the specifics of their research, data analysis, and writing. I believe that data interpretation and manuscript preparation is a team effort and I will work with the Fellow to help them prepare their manuscript and presentation. If funding is available, we support travel to the National Animal Science Meetings in the summer. Last summer we were able to bring 4 graduate students and 4 undergraduate students to the Animal Science Meeting s in Austin, TX where they were able to present their data and interact with academic and industry leaders in agriculture. Our hope is to do the same in the summer of 2020.

e) Are you interested in receiving a copy of Critical Mentoring: A Practical Guide by Torie Weiston-Serdan from the CAS Student Success Team to access current best practices for mentoring undergraduates?
Yes!