COLLEGE OF
AGRICULTURAL SCIENCES
COLORADO STATE UNIVERSITY

College of Agricultural Sciences Undergraduate Research Fellowship

Project Application

The College of Agricultural Sciences has developed an Undergraduate Research Fellowship for up to ten students per year from across the College. We aim to provide opportunities for undergraduates to find purpose, mentorship and community within their academic discipline and we aspire to facilitate self-discovery through research engagement and increase access for all undergraduates to impactful science.

Student are encouraged to compete for the Fellowship by identifying a project of interest from the list available online. Each fellowship will last for one semester (Fall, Spring, or Summer) and will pay the Fellow $2,000/semester for the hours worked. At approximately $13/hour, students will be allotted 10 hours per week over a 15-week semester to complete their unique project. Project leaders will be given $300 to assist with purchasing project supplies. All Fellows are encouraged to present their final project at the Multicultural Undergraduate Research Art and Leadership Symposium (MURALS) or the Celebrate Undergraduate Research and Creativity (CURC) Showcase in spring of each year

INSTRUCTIONS FOR SUBMITTING A FELLOWSHIP PROJECT

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
Octavio Guimaraes

b) Justification or broad impact of project on the field of science it resides within.
Improve feed quality and preservation. With the intense population growth, it's our job as scientists to find a sustainable and very efficient way to produce livestock in order to provide protein to the world.

c) Tasks to be completed during approximately 150-hour fellowship.
The inoculant treatments consist of: Control (no inoculant) and 2) Inoculant will be applied at a rate of 100,000 CFU per gram of ensiled forage. At the time of corn silage harvesting, the inoculant applicator on the harvester will be turned off and approximately 1,000 kg of green chop will be obtained. The 1,000 kg of non-inoculated green chop will be placed in a feed truck mixer box (that should be properly cleaned with a power washer prior to use in this experiment) and mixed thoroughly for 12 min at 15,000 rpm. Approximately 500 kg of non-inoculated (control) green chop will be discharged from the feed truck and packed into 50 experimental silos containing approximately 10 kg of green chop per silo (see experimental silo packing section below for details). After the control green chop corn silage is packed, the remaining silage on the feed truck is inoculated with 100,000 cfu per gram of

silage with treatment. Inoculant is then mixed with 3 L of ultra-pure water and administered via a pressurized hand-held sprayer while the silage is mixing in the feed truck (total mixing time was 12 minutes at 15,000 rpm). Post inoculation, 50 experimental silos will be packed with the inoculated silage. The remaining silage in the field is also going to be inoculated with the same type of inoculant and stored in a 1000ton concrete silage bunker. Silage samples from the 1000ton concrete bunker as well as the 100 experimental silos will be assayed for silage fermentation characteristics 30 days post-harvest. At the end of the 30day fermentation period, all experimental silos will be opened, mixed thoroughly, and samples will be obtained for chemical analysis and in vitro DM digestibility. The remaining fermented corn silage is then repacked into each experimental silo and left uncovered for 72 h. After the 72h time period, samples are obtained for yeast/mold counts.

In vitro dry mater digestibility: Two crossbred feedlot steers (approximately 580 kg and 6.5 yr. of age, fitted with ruminal and duodenal fistulae) will be utilized to examine in vitro dry matter digestibility of corn silage from each experimental silo. Rumen fluid will be collected from each steer approximately 2 h post feeding of a forage-based diet. Rumen fluid will be filtered through 4 layers of cheesecloth twice before being added to a pre-warmed (39°C) thermos. Equal amounts of rumen fluid (≈ 1.0 L) is collected from each steer and combined. A modified McDougall's (McDougall, 1948) buffer solution (19.60 g $NaHCO_3$, 7.40 g Na_2HPO_4, 1.14 g KCl, 0.94 g NaCl, 0.24 $MgSO_4*7H_2O$ per 2 L H_2O) will be mixed at a ratio of 3 to 1 buffer to rumen fluid. Preceding rumen fluid collection, corn silage samples from each of the experimental silos will be dried in a forced air oven at 60°C for 24 h. Samples is then ground through a 2 mm screen using a Wiley mill. Pre-labeled 50 ml conical tubes will be weighed, and 0.50 ± 0.02 g of sample is added to each digestion tube. Samples will be ran in duplicate (2 samples per experimental silo; n = 400). All glass ware, tubes with substrate, and other needed items is going to placed in a dry oven to maintain temperature at 39°C 12 h prior to use (decontamination purposes). The combined mixture of buffer and rumen fluids will be flushed with CO_2, and 30 ml of buffer rumen fluid mixture will be added to each conical tube containing dietary substrate or no substrate (blank). Conical tubes are then capped with a rubber stopper fitted with a rubber one-way valve to maintain anaerobic conditions. During the in vitro simulated rumen incubations, samples needs to be gently swirled approximately every 4 h. After the 48h incubation, tubes will be removed from the water bath, microbial fermentation terminated and centrifuged as described by Engle and Spears (2000). The supernatant will be discarded and the in vitro tubes containing the undigested residue will be placed in a forced air oven at 60°C for 48 h.

d) Major skills and competencies that will be developed during the project execution
Students will be able to learn data input, various laboratory analysis and feed analysis. In addition to that the student is going to learn a very important laboratory technique regarding the livestock feeding arena which is the study of in-vitro dry matter digestibility.

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?
The student will be trained in all the activities surrounding the project itself. Starting from learn how to drive heavy farm equipment to laboratory analysis.

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

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?
The Ruminant Animal Nutrition Group has weekly meetings which the student will be participating. The student will also be working closely to approximately another 4-5 graduate students.

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)?
Start with introduction meeting and project strategy followed by weekly meeting to support research success and weekly reports.

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

Please send your completed project application to Adelle.Thompson@colostate by Nov. 15.

All available projects will be posted on the CAS Undergraduate Research Fellowship webpage and advertised to our undergraduates. Undergraduate applications will be due by December 10 and Spring 2020 Fellows will be announces before the end of the Fall 2019 semester.

If you have any questions, please contact Addy Elliott, Assistant Dean of Academic Advising and Student Success at Adriane.Elliott@colostate.edu or 970-491-6984.