(SE=0.11) I + 8.66 (SE=1.74) D + 1.52 (SE=0.24) U + 0.35 (SE=0.08) D^2 with an estimated residual variance of 22.6. A mixed model with the same fixed effects but also with the random effect of study yielded the following equation: M = -17.2 (SE=7.5) + 1.42 (SE=0.09) I + 2.31 (SE=1.23) D + 0.95 (SE=0.17) U + 0.09 (SE=0.05) D^2 with an estimated residual variance of 6.59. A more complete mixed model resulted in an estimated residual variance of 5.70. The marginal milk production response to R and D must account for the marginal effect of R and D on I derived by fitting the following mixed model also with the random effect of *study*: I = 18.1 (SE=1.26) + 0.16 (SE=0.08) D + 0.14 (SE=0.07) U. In a second example of the response in milk production to I and crude protein level in the diet, mixed models methods again reduced the estimated residual variance and generated better estimates of regression coefficients. Using the proper meta-analytic methods resulted in more accurate and precise estimates of production responses to nutrient concentrations in the diet.

Key Words: Meta-analysis, Multiple regression, Milk production response

ASAS/ADSA Teaching Undergraduate and Graduate Education and PSA Extension and Instruction: Teaching II

678 NASA's Reduced Gravity Student Flight Opportunities Program enhances undergraduate experiences and promotes team-building skills.

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A proposal was submitted to NASA's Reduced Gravity Student Flight Opportunities Program (RGSFOP) by 9 undergraduate animal science majors and their advisor. The RGSFOP provides a unique academic experience for students to propose, design, fabricate, fly and evaluate a reduced-gravity experiment of their design. The overall experience includes scientific research, traditional and non-traditional classroom experiences and educational/public outreach activities. Of the 87 applications submitted, 47 proposals were accepted (54%) including the proposal from the Mississippi State Team. The aim of the proposed project entitled "Photonic Emission Kinetics of the Firefly Luciferase Enzyme in Microgravity" was to determine whether enzymatic reactions are altered in microgravity. The students met weekly to design the experiments and learn about working in microgravity. The team then traveled to the Johnson Space Center (Houston, TX) where for two weeks they participated in astronaut training, learned about NASA programs and tested their experiments. The students then flew aboard the Boeing KC-135A reduced gravity trainer aircraft to conduct their experiments during the 20 or more 25-second Zero-gravity maneuvers on each of two flights. Results indicated that there was a significant increase ($P < .05$) in the area under the enzyme reaction curve; illustrating that microgravity altered luciferase kinetics. Upon returning home, students participated in outreach activities including television, radio and newspaper interviews and presentations at departmental, alumni and other university functions. The students also constructed a web-site detailing their activities and continued to meet weekly to discuss their experiences. In addition to learning about scientific research and NASA, the students also learned the foundations of NASA Mission Operations: discipline, competence, confidence, responsibility, toughness and teamwork. In terms of lasting outcomes, the participating students commented that this experience was life-changing for many of them. This was re-enforced by comments from many of their professors indicating a positive change in student attitudes and confidence. In summary, the NASA RGSFOP offers both a unique research and personal growth experience for undergraduate students.

Key Words: Undergraduate education, NASA, Microgravity

679 Engaging students in the learning process in an undergraduate animal breeding course.

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An active learning approach that utilized short lectures, in-class discussions, and written feedback from students was applied to an undergraduate animal breeding course. The approach is based on a textbook that meets course goals in breadth and depth of content. The textbook and special readings, not lectures, define the scope of the course. The course is organized into two-period modules. Each module relates to a specific assignment that students are expected to read before class. Students take a 10-min quiz over the reading assignment at the start of the first period of a module before there is any in-class coverage of the material. The quiz tests for broad understanding rather than mastery of the material and rewards students that have read the assignment. The last question on the quiz is, "What is the most difficult or unclear concept in the chapter?" A 25-min lecture on the important points of the reading follows. For the final 15 min, students are given a discussion question that gives application to the material or reinforces concepts. Groups of 2 to 4 students are formed, and the group writes down their response. Several groups are asked to reveal results of their deliberations, and the instructor comments on the accuracy and applicability of their comments. The second period starts with a 35-min lecture that addresses the concepts that the students indicated on the quiz were most difficult for them and finishes with another 15-min discussion question. Each module has a homework assignment that provides practice with application of concepts presented in the module. With this overall approach, students come to class familiar with the material to be discussed, attend class (something is completed in class and graded every period), have some control in directing the lecture to areas they are less sure about, and learn from the experiences of their classmates during the discussion periods. Students are active participants in their learning, and instructors are well informed by frequent feedback from students. Student comments include: "The organization of the class, homework and quizzes made me keep up with the material." "The discussions are an absolute must." "Discussion took up too much time in class." "This class requires self-teaching."

Key Words: Active learning, Animal breeding, Teaching

680 Research Proposal Writing and Student Peer Panel Evaluation as an Instructional Component for a Microbiology Graduate Course in Poultry Science.

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Proposal writing is a vital experience for Poultry Science graduate students seeking academic careers, but graduate programs provide minimal opportunities to develop successful proposal writing skills. Proposal writing is emphasized in a graduate microbiology course taught in the Poultry Science Department, Texas A&M University. Based on a survey of enrolled students in the year 2000, only 28.5% of the students had previous experience in class proposal writing, but none possessed experience in proposal writing for funding. In addition, 71 % of the students had some experience at scientific writing but less that 30% had published scientific papers. The proposals for the course were written on a research problem that utilized information and concepts from the course and included a student peer panel evaluation as part of the course grade. The proposals were judged on the clarity of hypothesis presentation, the appropriateness of the experimental approaches and research relevance in basic and applied science. Overall, students found the experience an important one for developing writing skills in scientific style. However, peer panel evaluation received a mixed response as students found it difficult to understand proposals that fell out of their area of study (21%) and had little preparation in order to offer constructive criticism of other proposals (43%). Based on survey responses of students (36%), it is apparent that further improvement in the student peer panel evaluation needs to be made to increase the relevance of this exercise. In conclusion, proposal writing and in-class evaluation as part of a graduate course in Poultry Science provided graduate students with additional writing and communication skills required for future careers in research.

Key Words: Proposal writing, Communication skills, Peer panel evaluation

681 Evaluation of student performance in an introductory animal science course by pre-test and post-test scores.

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AGS 101 is an introductory course emphasizing farm animal industries, breeds, numbers, distribution, nutrition, heredity, reproduction, health, and products. Students enrolling in this introductory course come from a wide range of diverse backgrounds and experiences. In addition, this

course, AGS 101 is a general education requirement for all agriculture majors at Southwest Missouri State University. A pre-test examination containing 29 multiple choice questions was given to all students enrolled in each of six sections over the past three years. The same examination was utilized at the end of the semester to assess the knowledge level of each student. Information was additionally gathered concerning major, class rank, gender, FFA background, GPA, and final course grade. Initial data results point to a significant increase in scores from pre-test ($\mu = 38\%$) to post-test ($\mu = 59\%$) examinations. Highest pre-test scores were found on dairy specific questions (63%) and equine specific questions (48%). Highest post-test scores were found on genetics specific questions (73%) and dairy specific questions (67%). Area specific questions indicated students improved (pre- vs post-test) from highest to lowest as follows: 1) genetics (29%), 2) reproduction (25.7), 3) beef (25.5%), 4) meats (23.6%), 5) nutrition (23%), 6) sheep (19%), 7) horse (11%) and 8) dairy (4%). Generally, students who indicated previous high school FFA experience had a higher mean pre-test score than did students without high school FFA experience. Likewise students indicating animal science or pre-veterinary science as their major scored higher on the initial pre-test examination. While the mean post-test examination score improved in all classes, students without previous high school FFA experience improved their post-test examination scores by a greater percentage. A similar relationship was noted for animal science and pre-veterinary science majors as compared to other departmental majors.

Key Words: Pre-test, FFA, Examination

682 Assessment of student learning in animal science programs: how do we know that they know? R. C. Rhodes III*, *University of Rhode Island*.

Assessment, a key element in accountability and accreditation, is a process that has been widely incorporated into the strategic plans of academic organizations with a goal of improving institutional effectiveness. As education is the primary endeavor of academic institutions, focus of assessment efforts has typically been on the processes of teaching and learning. However, the dilemma faced by many academic units including departments of animal science is the "what" and "how" of assessment. What should our students know when they graduate from our programs? How do we assess what they know? What evidence is available that animal science students have great depth of understanding in their subject area? The key to success of an assessment effort is the clear articulation of what we want students to know. Hence, we must define in broad terms, the objectives of our animal science programs. Equally imperative is the definition of desired, specific academic outcomes. Once objectives and outcomes are established, evidence is then collected to document outcomes. Importantly, a variety of outcome indicators should be used in the assessment of student learning in the animal sciences. Examples of outcome indicators include: capstone experiences (e.g., senior thesis, internships, directed or independent research studies), portfolios (e.g., a compendium of papers written by a student in conjunction with reflections on writing), standardized tests (e.g., GRE), locally developed tests (e.g., a department-generated exit examination), professional licensing or certification (e.g., ARPAS certification), grade point average, graduation rates, job placements, graduate school acceptances, professional school acceptances, employer surveys, etc. For successful completion of the assessment, outcome data is evaluated and, afterward if needed, academic objectives and outcomes are revised. The assessment process should benefit all stakeholders: improved learning by students; shared purpose and focus of faculty and reaccreditation of the institution for administrators are all tangible endpoints. Ultimately, assessment is meant to be a continuous process that leads to improvement of institutional effectiveness.

Key Words: Assessment, Student, Learning

683 Utilizing a group project to teach principles of reproductive management. G. A. Perry* and M. F. Smith, *University of Missouri, Columbia, MO*.

Reproductive Management (senior level course; ∼40 to 50 students/semester) students at the University of Missouri are required to develop a detailed plan for improving reproductive efficiency in a beef herd over a 5 yr period. The objectives of this exercise are to: 1) improve reproductive efficiency through implementation of reproductive management principles, 2) integrate economic principles of reproductive management, and 3) understand the constraints of different geographical locations on approaches to reproductive management. Groups of 3 to 4 students are provided with the reproductive and economic records of a farm/ranch at different locations within North America. Students create reproductive management plans consisting of 1) detailed discussion of farm/ranch environment (climate, terrain, forage and grain availability, and stocking rate; season for breeding and calving; and justification for choice of breed), 2) assessment of current level of reproductive performance, 3) identification and economic justification of specific (measurable) objectives, 4) discussion of alternatives for accomplishing specific objectives, 5) prediction of reproductive performance (pregnancy rate, pounds of calf weaned per cow exposed, and cost per pound of calf weaned) in response to implementation of specific management practices, and 6) an annual reproductive and economic summary. Students obtain livestock marketing information for their assigned location via the Internet. Excel spreadsheets were developed to calculate the reproductive efficiency of postpartum cows and replacement heifers based on the groups# management decisions as well as a yearly economic summary for each of the 5 yr. Management decisions are justified in a written report, and oral presentations are given to the class upon completion of the project. Greater than 80% of students indicate that this exercise increased their understanding of how management decisions affect the reproductive efficiency and profitability in a beef operation and gave them added confidence as they apply for beef management positions.

Key Words: Reproductive Management, Problem Solving, Group Project

684 Dairy Challenge: A competitive and educational experience in evaluation of dairy herd management. L.E. Davis*[1], F.M. Martsolf[2], J.J. Domecq[1], and M.S. Weber[1], [1]*Michigan State University, East Lansing,* [2]*Cargill Animal Nutrition, Mentone, IN*.

The Dairy Challenge event allows students to apply knowledge gained in the classroom by competitively evaluating the management practices of commercial dairy farms. Michigan State University, with the generous support of Cargill Animal Nutrition, has implemented the annual program in the Department of Animal Science. Participants in the Dairy Challenge will do the following: 1) critically evaluate dairy herd management practices and make recommendations for improvements; 2) visit local farms and gain knowledge of different farms' management practices; 3) interact with company representatives from the industry, and increase their understanding of the role of companies in the dairy industry; 4) evaluate herd records, and gain knowledge in PC-DART and computer presentation tools; and 5) improve speaking, presentation, and problem-solving skills. Teams of three or four undergraduate students consist of second-year Agriculture Technology and/or upper level students in the four-year program in the College of Agriculture and Natural Resources. Students critically evaluate a commercial dairy farm using herd records from the past year, a description of the farm, and a tour of the facilities. The farmer and the herd's nutrition consultant answer questions pertaining to management of the farm. Teams give a 30-minute presentation that is scored on their description and assessment of the management practices and recommendations for improvements in facilities and management. Additionally, scoring is based on apparent level of preparation, speaking, presentation skills, and responses to questions asked by judges. The judges for this event are university and dairy industry specialists, including a dairy extension agent, nutrition consultant, dairy business specialist, technical service specialist, and the farm manager. This event allows students to interact with dairy farmers and representatives from the dairy industry, and challenges the knowledge and skills gained by the students during their academic career.

Key Words: Dairy Management, Teaching, Evaluation