apparent N and OM digestibility occurred with the diet that contained the HSP and HRUP, leading to a significant interaction between SP and RUP (P = 0.05), while P was apparently more digestible for HRUP (P = 0.02). Diets that are balanced to contain high SP and RUP appear to improve the apparent N digestibility when fed to 16-18 month-old Holstein heifers in both medium and high forage diets.

Key Words: Protein, Heifers, N digestibility

Ruminant Nutrition: Growing cattle

90 Influence of energy source and RDP on intake and digestion in beef steers fed grass hay based diets.

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A 5 x 5 Latin square was used to determine effects of supplemental energy source (ENG; corn vs soyhulls) and rumen degradable protein (RDP) addition on intake and digestion in steers fed grass hay. Steers (686.2 ± 51.4 kg BW) were housed in individual pens during each 14 d adaptation period and individual stalls during each 7 d collection period. Treatments were arranged as a 2 x 2 factorial plus one and consisted of control (CON; grass hay, 7% CP); grass hay plus 0.4% BW soyhulls (SH; 13.5% CP); grass hay plus 0.4% BW SH and 0.15% BW sunflower meal (35% CP); grass hay plus 0.4% BW corn (9.5% CP); and grass hay plus 0.4% BW corn and 0.2% BW sunflower meal. Diets supplemented with RDP were formulated to have a 0 RDP balance with the NRC model. Preplanned contrasts included main effects of ENG and RDP, ENG x RDP interaction, and CON vs supplemented (SUP) treatments. Supplementation increased total DMI compared to CON (1.67 vs 1.45% BW; $P < 0.001$), but forage DMI was greater ($P < 0.001$) for CON compared to SUP (1.45 vs 1.25% BW). Addition of RDP to SH increased ($P = 0.02$) forage DMI, while addition to corn decreased ($P = 0.02$) forage DMI. No time x treatment interaction was present for ruminal pH ($P = 0.79$). Ruminal pH was higher ($P < 0.001$) for CON vs SUP (6.69 vs 6.56). There was an ENG x RDP interaction ($P < 0.001$) for ruminal pH; pH increased with RDP addition to SH (6.58 vs 6.63), but decreased with RDP addition to corn (6.60 vs 6.46). Supplementation increased ammonia compared with CON ($P < 0.001$; 0.46 vs 1.46 mM). Likewise, addition of RDP increased ruminal ammonia ($P < 0.001$; 2.46 vs 0.35 mM). Total tract DM digestibility (TTDMD) was higher ($P = 0.01$) for SUP compared to CON (55.4 vs 50.7%). Addition of RDP to SH decreased TTDMD ($P = 0.04$; 57.86 vs 55.11%), while RDP addition to corn increased DM digestion ($P = 0.04$; 52.56 vs 56.14%). An ENG x RDP interaction occurred ($P = 0.03$) for total tract NDF disappearance that was similar to DMD. Rates of in situ DM disappearance were not different ($P = 0.34$). For moderate quality forages, intake and digestion appear to respond differently to RDP addition depending on energy source. Additional research is needed to determine RDP level and responses in diets using SH as the supplemental energy source.

Key Words: Soybean hulls, Protein supplementation, Digestion

91 Protein utilization of pearl millet grain supplements by growing steers.

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Bermudagrass hay (H; 'Tifton 85') was fed with supplement treatments (TRT) to steers to determine effects of corn-soybean meal or hybrid pearl millet grain (PM; 'TifGrain 102') on post-weaning transition performance and protein utilization. Supplements (SUP) contained rolled corn, soybean meal, PM (90.9% DM, 15.2% CP; finely ground), and vitamin/mineral premix, respectively (%): SCS = 87.8, 10.0, 0.0, 2.2; SPM = 0.0, 0.0, 97.8, 2.2. The DM, CP, and TDN (% DM), respectively, of SUP were: SCS = 88.0, 15.3, 84.5; SPM=88.8, 15.2, 82.5. Each SUP had salt (0.75%), $CaCO_3$ (0.75%), and provided premix vitamins A, D and E (24,000, 8,000, and 400 IU/d, respectively), lasalocid (150 mg/d) and Se (2.0 mg/d). Steers were randomly assigned to TRT, and initial (IBW) and final BW were means of two daily unshrunk weights. Steers (n = 42; 3 pens of 7 steers/TRT; age 11 mo; BW 310.6 ± 33.8 kg) of British (BR), Charolais × BR, Brahman × BR breeding were fed each SUP (1.945 kg DM/d) with free-choice H (91.5% DM; 10.3% CP) in a feedlot. Steer performance was unaffected (P > 0.10) by TRT (Table). Plasma urea nitrogen (PUN, mg/100ml; 4 steers/pen), plasma amino acids (PAA) and total essential amino acids (TEAA, umol/100ml; 3 steers/pen) were determined at 4h and 8h after SUP feeding. Both PUN and PAA were unaffected ($P > 0.10$) by sampling time and TRT × time interactions. Similar performance, higher PUN, and similar PAA for SPM indicate that PM was comparable to corn-soybean meal as a SUP for transition steers fed hay as the basal diet.

	Steer	performance	(34-d)	
Item	SCS	SPM	SE	$P <$
IBW, kg	309	311	7.37	ns
ADG, kg	0.95	0.96	0.08	ns
DMI, kg	7.40	7.33	0.22	ns
DM/gain	7.90	7.68	0.71	ns
Plasma	PUN and	PAA	(D 28)	
Item	SCS	SPM	SE	$P <$
PUN	3.54	5.92	0.26	0.01
LYS	17.31	16.65	0.71	ns
MET	6.24	5.20	0.45	ns
THR	21.75	19.24	0.96	ns
TEAA	218.1	215.67	4.91	ns

Key Words: Steer, Millet, Hay

92 Use of rice mill feed and soyhulls in backgrounding diets for beef calves.

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Rice mill feed compared favorably with broiler litter for producing economical gains when blended with corn and fed to stocker calves. Two trials were conducted to evaluate the use of soyhulls in broiler litter and rice mill feed (RMF)-based diets. Trial 1. Forty continental cross steers (initial BW = 257 kg) were fed one of four diets over a 112-day period (five steers/pen; two pens/diet). On a dry matter basis, diets were as follows: 1) 47% broiler litter:53% soyhulls, 2) 70% RMF:30% soyhulls, 3) 60% RMF:40% soyhulls and 4) 50% RMF:50% soyhulls.All diets were fed free-choice, and bermudagrass hay also was offered free-choice. Daily gains were higher (P<.05) for diet 4 than for the other 3 diets (1.1, 1.0, 1.2 and 1.5 kg/d, respectively). Trial 2. Sixteen Angus x Charolais steers (initial BW = 292 kg) were fed the same four diets while housed in individual metabolism stalls for a 10-day period. Nutrient digestibilities for the four diets were determined. Daily dry matter intake was lower (P<.01) for diet 1 (5.0 kg/d) than for diets 2, 3 and 4 (7.8, 7.9 and 7.9 kg/d, respectively). Nutrient digestibilities for the four diets were as follows: DM; 72.8, 64.2, 73.2, 69.2, OM; 74.3, 67.8, 75.6, 71.0, CP; 73.0, 72.6, 81.6, 70.8, NDF; 71.7, 55.8, 66.6, 63.6 and ADF; 66.2, 51.3, 62.0, 63.6. Digestibilities for DM, OM and ADF did not differ among diets (P.>10). However, CP digestibility was greatest (P<.10) for diet 3 and NDF digestibility was lowest (P<.10) for diet 2. Soyhulls can be blended with rice mill feed to produce acceptable backgrounding diets for growing beef calves.

Key Words: Beef cattle, Rice mill feed, Soyhulls

93 Effects of supplementing corn or soybean hulls to steers consuming bermudagrass hay on intake and apparent nutrient digestibilities.

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Effects of supplementing bermudagrass hay with corn or soybean hulls (SBH) on nutrient digestibility was evaluated using six crossbred steers (initial BW 182 ± 24.8 kg) fitted with rumen cannulae. Steers were placed in a latin rectangle arrangement and allowed ad libitum access to bermudagrass hay and assigned to one of three treatments: no supplement; supplemented with SBH; or supplemented with corn. Corn and SBH were fed to provide 161% of the maintenance energy requirement. In addition, soybean meal was added to the ration to meet National Research Council protein requirements because of the increased energy intake due to supplementation. For each of the three periods, steers were acclimated to their respective treatments for 14 days; after which, they were placed into individual stalls for 14 days. Steers were given

their respective supplements each morning and allowed ad libitum access to hay day. Dry matter intake of hay was not different (P > 0.2) among the treatments, ranging between 2.19 and 2.60 kg/d. However, total DMI of steers receiving SBH and corn was increased (P < 0.01; 3.60 and 3.50 kg/d, respectively) compared to steers not supplemented (2.27 kg/d). Steers not supplemented digested less DM and OM (P < 0.01; 52.9 and 53.4%, respectively) than those consuming corn (62.0; 62.8%, respectively) or SBH (65.7 and 66.7%, respectively). Crude protein digestibility for steers consuming hay only was decreased (P < 0.01; 49.2%) compared to steers consuming corn or SBH (64.7 and 67.5%, respectively). Neutral detergent and acid detergent fiber digestion was increased with SBH supplementation, (P < 0.01; 63.9 and 64.4%, respectively) compared to corn supplementation (52.8 and 49.6%, respectively) and non-supplemented steers (53.9 and 50.3%, respectively). Hemicellulose digestibility ranged between 55.5 and 61.1% and was not different (P > 0.05) among the three treatments. Supplementation of SBH or corn increased the digestibility of OM and protein by steers consuming bermudagrass hay. Additionally, supplementing bermudagrass hay with SBH increased fiber digestion compared to corn supplementation.

Key Words: Bermudagrass hay, Energy supplementation, Soybean hulls

94 Effect of level of added bypass protein to corn and citrus pulp supplements on performance of growing cattle. D. O. Alkire*, B. R. Austin, T. A. Thrift, and W. E. Kunkle, *University of Florida, Gainesville, FL USA*.

Fifty individually fed Angus x Brahman crossbred steers and heifers (250 kg initial BW) were utilized to evaluate the effects of citrus pulp or corn supplementation with varying levels of bypass protein on performance. Calves were stratified by weight, sex, and breed type and randomly assigned to treatment. Treatments consisted of corn or citrus pulp supplements with added bypass protein (SoyPLUS®). Five levels of bypass protein were evaluated including 0, .055, .11, .165, and .22 kg per head per day. These levels were utilized in both corn and citrus pulp supplements for a total of ten isonitrogenous and isoenergetic treatments. All calves were offered a basal diet of low quality bahiagrass hay (ad libitum) and fed the assigned supplement once a day. Hay and supplement were individually fed for 84 days using Calan gates. Average daily gain (ADG) and body condition score (1-9 scale) was evaluated every twenty eight days. Hay and supplement intake were recorded daily and refusals were recorded weekly. All data were analyzed using the proc GLM function of SAS. ADG increased linearly (P=.001) as level of supplemented bypass protein increased. ADG for the highest level of added bypass was improved by .393 kg over the control ADG. Type of supplementation had a significant effect (P=.0006) on total hay intake. Calves supplemented with corn consumed .7 kg more hay per animal per day than those supplemented with citrus pulp. Increasing levels of bypass protein caused a significant decrease in hay intake (P=.005). Hay intake for the highest level of bypass was .8 kg less per animal per day than the control. Body condition was not affected by type of supplementation or inclusion level of bypass protein. Adding bypass protein to corn and citrus pulp supplements fed to growing cattle increased gain.

Key Words: Beef Cattle, Bypass protein, Supplementation

95 Effect of supplemental energy form and frequency on forage intake and digestibility. T. W. Loy*, J. C. MacDonald, T. J. Klopfenstein, and G. E. Erickson, *University of Nebraska, Lincoln*.

Ten ruminally canulated heifers (BW = 416 kg, SD = 24) were used to test the effect of supplemental energy form and frequency on forage DMI and digestibility. Five treatments were arranged in a replicated 5 x 4 Latin rectangle (n = 8), and included no supplement (CON); DRC fed daily (DRC-D); DRC fed on alternate d (DRC-A); dry distillers grains (DDG) fed daily (DDG-D); and DDG fed on alternate d (DDG-A). Supplements were fed at 0.40% BW, with alternate heifers fed 0.80% BW every-other d. Chopped grass hay (8.2% CP) was fed to attain ad libitum DMI, and intake pattern was measured. Rumen fluid samples were collected prior to feeding, and at 2, 4, 6, 8, and 10 h post-feeding; and pH was measured. Rate and extent of in situ disappearance were calculated, with two incubations per period on heifers in alternate-d treatments. The 48-h time point began on a supplement d for one incubation, and a non-supplement d for the other. Data were analyzed using the mixed procedure of SAS. Contrasts of CON vs supplemented, daily vs alternate, and DRC vs DDG were included. Control heifers had higher ($P < 0.01$) hay DMI than supplemented heifers (1.88% vs 1.66% BW, respectively); although total DMI was lower ($P < 0.01$) for CON. Hay DMI did not differ ($P = 0.45$) between DRC and DDG treatments. Hay DMI tended to be lower ($P = 0.08$) for DDG-A and DRC-A than for treatments supplemented daily. Hay and total DMI were lower ($P < 0.01$) on supplementation d for DDG-A and DRC-A. Heifers in alternate-d treatments ate fewer ($P < 0.01$) and larger ($P < 0.01$) meals, and spent less ($P < 0.01$) time eating than those supplemented daily. Average rumen pH was greater ($P = 0.05$) for CON than supplemented heifers (6.30 vs 6.19, respectively). CON heifers had higher ($P \leq 0.04$) rate and extent of NDF disappearance than supplemented heifers. Rate of hay NDF disappearance was lower ($P = 0.02$) for DRC than for DDG. Supplementation decreased hay DMI, and changed digestion kinetics. Supplementation frequency affected amount and pattern of DMI. Rate of hay NDF disappearance was greater for DDG than DRC.

Key Words: Supplementation, Forage, Intake

96 Nitrogen metabolism of beef steers fed either Gamagrass or Orchardgrass hay with or without a supplement. K. Magee*, M. Poore, J. Burns, and G. Huntington, *North Carolina State University*.

This experiment evaluated ruminal protein:energy synchronization in steers fed either gamagrass (Tripsacum dactyloides) or orchardgrass (Dactylis glomerata) hays with or without a soyhull/corn supplement. A N balance trial was conducted to compare the effects of the supplement and hay on N intake, N digestion, and N metabolism. The supplement consisted of 50:50 corn:soyhulls mix with 50 g molasses per kg of corn:soyhulls mixture. The supplement contained 11.3% CP, 33.4% NDF, 25.1% ADF, and 0.87 kg was fed at 0830 and 1600 followed by hay offered in two equal portions. Steers had ad libitum access to water and a trace mineralized salt block throughout the study. Hay compositions were 8.3% CP, 46.6% NDF, and 26.7% ADF for gamagrass and were 11.9% CP, 46.25 % NDF, and 26.55% ADF for orchardgrass. Steers were individually fed, blocked into two weight groups, and randomly assigned to either gamagrass or orchardgrass hay (4 steers per hay). Within hays, steers were assigned to receive supplement or no supplement in a switch back design. Ad libitum DM intake for each steer was equal to their intake during the last 8d of the 21-d adaptation period. Steers were then placed in metabolism crates for an 8-d adjustment followed by a 5-d balance trial. During the balance trial, steers were fed 90% of ad libitum intake. Effects were significant at P ≤ 0.10. Compared with gamagrass, orchardgrass had a lower ad libitum DMI (4.62 vs 5.37 kg/d), higher N intake (96.6 vs 81.1 g/d), similar fecal N (36.1 vs 34.5 g/d), higher N digestibility (62.4 vs 57.4 %), similar N retained (27.2 vs 27.7 g/d), and lower digestible DMI (3.20 vs 3.53 kg/d). Compared with no supplement, supplement increased digestible DM intake (3.70 vs 3.03 kg/d), total DM intake (5.87 vs 5.07 kg/d), N intake (96.9 vs 80.8 g/d), fecal N (39.4 vs 31.1 g/d) and N retained (31.7 vs 23.2 g/d). Supplement (1.74 kg/d) decreased hay ad libitum intake by 0.73 kg/d. Supplement tended (P < 0.11) to improve N retained as a percentage of N intake or percentage of N digested more for orchardgrass than for gamagrass hay. We believe that the increase in digestible OM intake is due in part to the presence of soyhulls in the supplement.

Key Words: Beef cattle, Forages, Nitrogen metabolism

97 Supplemental protein to enhance nutrient utilization of steers fed high fiber hay. N. N. Paiva*, M. A. Froetschel, and G. M. Hill, *The University of Georgia, Athens, Georgia*
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A metabolism trial was conducted to determine effects of incremental levels of rumen undegradable protein (RUP) on nutrient utilization of growing steers fed bermudagrass hay (10.2% CP, 76.4% NDF). Six Holstein steers (217 13.8 kg) were used in a replicated 3 x 3 Latin Square designed experiment. Incremental levels of RUP (26.5, 35.3 and 44.0% of CP) were fed as supplements at 1.63 kg/hd/d. Supplements were isonitrogenous (25.9% CP) and fed in the form of pressed molasses blocks. RUP was controlled by feeding different ratios of SBM, corn gluten feed, poultry protein meal and soy hulls. Steers were fed treatments for 14 d. On d 10 to 14, steers were placed in metabolism crates for total fecal and urine collection. Jugular blood was sampled before and after feeding on d 10 and 14, respectively. Hay and DM intake increased (3.95 to 4.27 kg DM/d and 5.56 to 5.92 kg/d) with RUP (P < 0.05). Fiber digestion responded linearly to RUP supplementation (P < 0.05);

however DMD, OMD and DE were not affected (P > 0.10). Treatment did not affect N retention (P > 0.10; 49.46 5.22 g/d) but there was a trend for more digested N to be retained. Blood urea nitrogen (BUN) increased after feeding (P < 0.05; 14.15 vs. 16.3 mg/dl) and tended to be negatively related to RUP. In a 63-d 2 x 2 factorial feedlot trial, British and Brahman x British steers (n = 48; 556 2 kg initial BW; age 9 mo.) were ranked by BW, randomly allocated to one of 8 pens and fed two levels of RUP (26.5 vs. 44 % of CP) and two types of supplement form (meal and pressed blocks). Bermudagrass Hay (13.1% CP) was offered free choice and supplements were fed at 1.5 kg DM/hd/d. Blood samples were collected on d 21 and 63. Intake was not affected by treatments. Steer ADG (0.67 0.05 kg) did not respond to RUP or form. BUN was lowered with RUP (14.1 vs. 12.1 mg/ dl; P < 0.01). A trend for interaction between RUP levels and form was also observed. Despite indications that RUP improved nutrient metabolism of cattle fed high fiber hay, animal performance was not affected.

Key Words: Protein supplementation, Fiber, Growing steers

98 Effects of ammonia load on methionine utilization in growing steers limit-fed soybean hull-based diets. M. S. Awawdeh*, E. C. Titgemeyer, K. C. Candler, and D. P. Gnad, *Kansas State University, Manhattan*.

Six ruminally cannulated Holstein steers (203 kg BW) housed in metabolism crates were used in a 6x6 Latin square to study effects of rumen ammonia load on methionine (Met) utilization. Steers were fed the basal diet (83% soybean hulls, 8% wheat straw, and 0.3% urea) twice daily at 2.5 kg DM/d. Periods were 6 d, with 2 d for adaptation and 4 d for fecal and urine collection to determine N retention. Treatments were arranged as a 3x2 factorial and were continuously infused into the rumen (0, 40, or 80 g/d urea to supply ammonia load) and into the abomasum (2 or 5 g/d Met). Basal ruminal infusions contained 200 g/d acetate, 200 g/d propionate, and 50 g/d butyrate to provide energy without increasing microbial protein supply. Basal abomasal infusions contained: a mixture (255 g/d) of all essential amino acids except Met, 10 mg/d vitamin B-6, 10 mg/d folate, 0.1 mg/d vitamin B-12, and 300 g/d glucose. Rumen ammonia concentrations were 4.5, 21.5, and 19.7 mM when 0, 40, and 80 g/d urea were infused, respectively. Urea infusions linearly increased plasma urea (P<0.01) from 4.5 to 7.8 mM for 0 and 80 g/d urea, respectively. Fecal N was similar among treatments. There was no urea x Met interaction for fecal, urine, or retained N. Urea infusions did not (P=0.2) affect retained N (25.2, 23.4, and 25.7 g/d for 0, 40, and 80 g/d urea, respectively), but increased (P<0.01) urine N excretion (48.5, 67.3, and 84.6 g/d for 0, 40, and 80 g/d urea, respectively). Increasing Met from 2 to 5 g/d decreased (P<0.01) urinary N excretion and increased (P<0.01) N retention from 22.0 to 27.5 g/d. Serum insulin and IGF-1 concentrations were similar among all treatments. The efficiencies of deposition of supplemented Met between 2 and 5 g/d were 22.5% and 18.4% when steers received 0 or 80 g/d urea, respectively. In our model, regardless of whether Met was limiting, increasing ammonia load did not impact whole body protein deposition in growing steers. (Supported by NRI Competitive Grants Program/CSREES/USDA, Award No. 2003-35206-12837.)

Key Words: Methionine, Ammonia, Amino acids

Teaching/Undergraduate & Graduate Education

99 A partnership of universities and agri-business for an effective dairy herd management learning experience for undergraduates: the Dairy Challenge. M. Tomaszewski*[1], M. S. Weber Nielsen[2], D. K. Beede[2], D. Thorbahn[3], M. Budine[4], and D. Selner[5], [1]*Texas A&M University, College Station,* [2]*Michigan State University, East Lansing,* [3]*Select Sires, Plain City, OH,* [4]*Cargill Animal Nutrition, Mentone, IN,* [5]*Shawano, WI*.

The North American Intercollegiate Dairy Challenge contest allows undergraduate students to apply knowledge gained in the classroom in an evaluation of the management practices of commercial dairy farms. University faculty partnered with industry representatives to develop the competition. Participants in the Dairy Challenge do the following: 1) visit local dairy farms and gain knowledge of different farms' management practices; 2) evaluate herd records, and utilize knowledge of dairy herd management software and computer presentation tools; 3) critically evaluate dairy herd management practices and make recommendations for improvements; 4) test their speaking, presentation, and problem-solving skills; 5) work as a team to build consensus and tag-team speaking formats; and 6) meet and interact with potential employers from the dairy industry during the contest. Teams of four undergraduate students critically evaluate a commercial dairy farm using herd records, a description of farm operations, and tour of the farm facilities. The farmer answers questions pertaining to management of the farm in a group interview with all teams and in a separate interview with each individual team. Teams give a 20-minute presentation that is scored on the description and assessment of the management practices and recommendations for improvements in management and facilities. Additionally, scoring is based on apparent level of preparation, speaking, presentation skills, and responses to judges' questions. The judges are university specialists and dairy industry professionals. This capstone experience allows students to interact with dairy farmers and representatives from the dairy industry, and expands their knowledge and skills gained during their academic career.

Key Words: Undergraduate, Dairy herd management, Industry

100 Undergraduate research: a win-win proposition. C. M. Wood*, *Virginia Tech*.

Experiential learning is an important component of the undergraduate program in the Animal and Poultry Sciences (APSC) Department at Virginia Tech. Undergraduate research has become an increasingly important facet of that learning. Reasons include: many students are interested in the sciences, specifically veterinary medicine, and they are encouraged to gain such experience; faculty have become more aware of the valuable resource these students represent; and students can earn credit toward their degrees. Undergraduate APSC students become involved in research projects on and off campus via several routes: volunteering in research labs and at the animal units; interning at branch stations throughout Virginia; participating in programs at other universities and institutions; and studying abroad. To earn direct credit for undergraduate research, students must have junior standing and at least a 2.75 GPA. They must take ownership of their project, from planning the design, to conducting the research, to final write up and presentation. Students that do not meet those criteria, but put substantial effort into on-going research projects, can earn independent study credit. All such proposals must meet quality standards before they are approved. In five years (Fall 1998 - Spring 2003), 81 students working with 18 APSC faculty will have earned 157 credits for undergraduate research. Of those students, 18 were non-majors. Projects have ranged from botanicals in poultry feed to conformation analysis in horses. Students have presented the results of their research projects at regional and national meetings. One student will present results in Europe this summer. At least 40 of the 81 have continued on to graduate or professional school. Involving undergraduates in research conducted by faculty members can be beneficial to both parties. Faculty gain help in conducting research, and can recruit outstanding students into graduate programs. Students learn to apply principles learned in the classroom, gain valuable work experience, obtain a wider exposure to career possibilities; and often get a jump start in graduate school.

Key Words: Research, Undergraduate education

101 Biotechnology for the animal science classroom - Development of an inquiry-based curricula for undergraduate and graduate students. S. T. Willard*, T. R. Smith, and P. L. Ryan, *Mississippi State University, Mississippi State, MS*.

The objective of this educational program was to develop a pilot course to instruct graduate and undergraduate students on the theories and practices behind laboratory-based biotechnological procedures. A course was created under the "Special Topics" option to accommodate both graduate (n = 6) and junior/senior level undergraduate (n = 6) students as a split-level course. Graduate students were randomly paired with an undergraduate student as laboratory partners. The six laboratories consisted of (I) Restriction Digest of DNA, (II) DNA Fingerprinting, (III) PCR, (IV) Protein Fingerprinting, (V) Bacterial Transformation and (VI) an Immunocytochemistry laboratory. After each module,