Ruminant Nutrition

A. Faculty with Ruminant Nutrition Emphasis in 1998 and 2009

<table>
<thead>
<tr>
<th></th>
<th>1998</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R</td>
<td>T</td>
</tr>
<tr>
<td>Joan Eisemann</td>
<td>.70</td>
<td>.30</td>
</tr>
<tr>
<td>Vivek Fellner</td>
<td>.70</td>
<td>.30</td>
</tr>
<tr>
<td>Brinton Hopkins</td>
<td>.20</td>
<td>---</td>
</tr>
<tr>
<td>Gerald Huntington</td>
<td>.70</td>
<td>.30</td>
</tr>
<tr>
<td>Richard Lichtenwalner</td>
<td>.20</td>
<td>---</td>
</tr>
<tr>
<td>Matt Poore</td>
<td>.30</td>
<td>---</td>
</tr>
<tr>
<td>Jerry Spears</td>
<td>.70</td>
<td>.30</td>
</tr>
<tr>
<td>Lon Whittle</td>
<td>.10</td>
<td>---</td>
</tr>
</tbody>
</table>

B. Changes since Previous Review

We have lost two ruminant nutrition faculty members with an extension-research appointment since the last departmental review in 1998. Dr. Richard Lichtenwalner (.20 research, .80 extension) retired in 2007. This position was filled with someone in the beef breeding area. Recently, Dr. Lon Whittle (.10 research, .90 extension) retired and his position has not been filled. We have not added any new faculty members in the ruminant nutrition area since 1998.

C. Recommendations of Previous Review

The last Comprehensive Departmental Review Team (CDRT) recommended that the ruminant nutrition group be proactive in solicitation of outside funding. The level of grant support received by individual faculty is indicated in the faculty CVs. Grant and gift funding for ruminant nutrition research has increased considerably since our last review. However, this is an area that we are continually trying to improve on.

A second recommendation by the CDRT was to ensure that graduate courses are taught on a regular basis. All ruminant nutrition related graduate courses are offered and taught, assuming that a minimum of 5 students register for the class, every other year. A minimum of 5 students are required for a graduate class to be taught.

The final recommendation by the CDRT was to ensure that major aspects of forage utilization are incorporated into the advanced ruminant nutrition course. Since 1998 considerable information on forages has been added to the Applied Ruminant Nutrition course taught by Dr. Huntington and others.

D. Summary of Research, Teaching and Extension Programs of Faculty

Joan Eisemann

Research: Livestock are the primary source of environmental ammonia emissions with cattle contributing more than 40% of the total. From the animal perspective, total dietary nitrogen and its utilization are precursors to ammonia formation. Efficiency of capture of dietary nitrogen in tissue products of cattle is low. One strategy to increase the efficiency of nitrogen use in growing animals is to increase the proportion of absorbed amino acids that are retained in tissues as protein.

Insulin is a regulator that plays a key role in ruminant metabolism. Insulin increases protein synthesis and decreases protein breakdown to result in an overall increase in the efficiency of protein deposition. Increasing sensitivity of tissues to insulin is one specific strategy to enhance the efficiency of amino acid used by cattle. Dietary long chain omega-3 polyunsaturated fatty acids increase insulin sensitivity in cattle. These will be used to define the underlying cellular changes that result in enhanced sensitivity.

Strategies that lead to improved efficiency of amino acid use in growing cattle have the potential to reduce environmental pollution derived from nitrogen metabolism. Increasing the omega-3 fatty acid content of ruminant products would improve the value of ruminant products for human health.

Teaching: Dr. Eisemann teaches ANS 230 (Nutrition of Domestic Animals) every fall. This course is required by all Animal Science majors. She is also the main instructor for “Growth and Development of Domestic Animals” (ANS 453) which is taught every other year. Dr. Eisemann also
teaches “Protein and Amino Acid Metabolism” (NTR 701) and 25% of “Digestion and Metabolism in Ruminants” (ANS 785) every other year.

**Vivek Fellner**

**Research:** The main objectives of Dr. Fellner’s research program are to enhance digestion in the rumen, reduce nutrient waste and improve the efficiency of animal performance. Main accomplishments of his research are as follows: Methane production by microbial action is a dynamic process. It is essential to measure methane rather than use stoichiometric equations for accurate estimates.

Ecological balance in the rumen is delicate, diverse and highly adaptable. Identification of specific microbes is critical to the understanding of metabolic processes in the rumen.

Mineral requirements by rumen microbes may differ from current recommended levels. Much of that variation may be due to ruminal environment.

Pasture or small grains silage can replace almost 60% of corn silage in a total mixed ration without having a negative impact on animal performance.

**Teaching:** Dr. Fellner has taught ANS 404 (Dairy Cattle Management), ANS 230 (Nutrition of Domestic Animals), and ANS 012 (Animal Feeds and Nutrition) as main instructor. He has also team-taught ANS 550 (Applied Ruminant Nutrition) and ANS 785 (Digestion and Metabolism in Ruminants). He incorporated the use of ‘hand-held’ computers as a teaching tool in Dairy Management. He has also used online web-based technology as a hybrid media for course material in a classroom setting. Dr. Fellner has mentored RISE scholars as summer research interns as well as several CALS Honor Students on research projects.

**Brinton Hopkins**

**Research:** Dr. Hopkins conducts applied research in dairy cattle nutrition with dairy calves, heifers and lactating cows. Recent research projects include: Effect of feeding supplemental rumen-protected niacin (Niashure™) on milk yield and milk composition in early lactation Holstein cows; Effects of the addition of cottonseed hulls to the starter and supplementation of live yeast or manannoligosaccharide in the milk for young calves; Supplementing limited methionine diets with rumen-protected methionine, betaine, and choline in early lactation Holstein cows; Lactoferrin supplementation to Holstein calves during the preweaning and postweaning phases; Effects of amounts and degradability of dietary protein on lactation, nitrogen utilization and excretion in early lactation Holstein cows; Effect of whole and extruded cottonseed on milk yield and composition and blood gossypol; Milk production and plasma gossypol of cows fed cottonseed and oilseed meals with or without rumen-undegradable protein; Effects of the method of calf starter delivery and weaning age on starter intake and growth of Holstein calves fed milk once daily; and Effects of method of colostrum feeding and colostrum supplementation on concentrations of Immunoglobulin G in the serum of neonatal calves.

**Extension:** Dr. Hopkins provides leadership for the North Carolina 4-H Dairy Youth Program. He coordinates many educational activities in which youth learn important life skills as they increase their knowledge of dairy farming and the dairy industry. He has developed and expanded statewide educational activities and events including dairy cattle judging, dairy quiz bowl contests, dairy skillathon contests, dairy poster contests, demonstrations, presentation, cumulative records projects, dairy cattle fitting and showmanship contests, junior dairy shows, and multi-state dairy youth education retreats. In addition, Dr. Hopkins leads the extension educational program in nutrition and management of dairy calves and replacement heifers. The main objectives in the extension program include, 1) using nutritional and management strategies to reduce morbidity and mortality in neonatal calves, and 2) improving the growth and productivity of dairy calves.

**Gerald Huntington**

**Research:** Dr. Huntington’s research studies nitrogen metabolism in forage-fed cattle. His approaches include feeding studies, and intensive measure of nitrogen balance and urea metabolism. Developing opportunities for undergraduates to participate in research programs is a priority. Specific projects since 1998 include measures of urea production, excretion, and recycling in beef steer fed forage-based diets, (fescue, orchardgrass, and switchgrass). Studies in collaboration with Dr. Joe
Burns, USDA agronomist, include effects of AM vs PM harvesting times on nutritive value and sustained voluntary intake of warm-season grass hays and silages, and use of NIRS to predict intake and digestibility in cattle. A 5-year project in collaboration with Drs. Poore, Cassady, Whisnsnt, Ashwell, and Hansen has studied relationships between feed efficiency and behavioral and metabolism in Angus bulls.

**Teaching:** Dr. Huntington’s teaching focuses on beef cattle, practical nutrition, and digestive physiology and metabolism in ruminants. He teaches Beef Cattle Management every spring semester; Applied Ruminant Nutrition and Digestion every other fall, and Digestion and Metabolism in Ruminants every other spring, and coordinates contributions of other faculty for the remaining portions of those courses. He is faculty liason for the Beef Education Unit.

**Matt Poore**

**Research:** Dr. Poore’s research has determined the value of byproduct feeds including corn stover, cotton gin trash, sweetpotatoes, soyhulls, wheat midds, corn gluten feed, whole cottonseed and cotton textile mill byproduct. Economic analyses have shown that utilization of byproduct feeds greatly reduces feed cost per unit of production. Utilization of stockpiled fescue with varying endophyte status by growing beef calves has been a recent emphasis. Supplementation strategies for cattle fed forage-based diets are currently being evaluated. Use of cattle in swine and poultry waste management systems using forages to receive waste nutrients has been conducted with a current major emphasis on nutrient runoff from sites receiving different management strategies.

**Extension:** Dr. Poore has developed and delivered an educational program for improved nutritional management of beef cattle, sheep and goats in North Carolina. Aspects of the program include optimal supplementation of protein, energy and minerals, forage resource management, use of byproduct feeds and body condition scoring. Program activities include field days demonstrations, producer conferences and publications. A major emphasis is on use of cattle in systems utilizing forages as receivers for waste nutrients, and the influence on water quality. Recent activity associated with drought response and recovery is a major ongoing effort.

**Jerry Spears**

**Research:** Dr. Spears's research is focused on mineral metabolism of domestic animal. His research program is primarily centered around trace minerals with emphasis on elucidating metabolic functions, bioavailability (and factors affecting bioavailability), and requirements of trace minerals. Recent research has examined trace mineral transporters and their regulation in cattle and pigs. Future research will be centered around defining dietary and genetic factors that affect gene and protein expression of copper transport and chaperone proteins in cattle and determining the bioavailability of trace minerals from a variety of feedstuffs using an in vitro simulated digestion system.

**Teaching:** Dr. Spears teaches two graduate nutrition courses (ANS, NTR 775, "Mineral Metabolism" and ANS, NTR 708, "Energy Metabolism") which are 3-credit-hour courses (taught every other year) that provide detailed coverage of energy and mineral metabolism in animals and humans. He is liason of the beef cattle educational unit at Butner.