

**Course Syllabus ANFS 454-654**  
**RUMINANT NUTRITION & METABOLISM - 3 credits, Fall 2015**  
**INSTRUCTOR: Limin Kung, Jr.**  
**Townsend Hall 002**

**COURSE DESCRIPTION:** This class will cover the basic nutritional aspects of ruminant animals. Emphasis will be placed on understanding biochemical and microbiological processes as they relate to ruminant nutrition and physiology. Practical aspects of ruminant nutrition will be taught relative to basic scientific principles. Emphasis will be placed on dairy cows.

**PREREQUISITES:** An introductory course in animal nutrition is required. Students should be familiar with general nutrition concepts. Completion of classes in introductory biochemistry and microbiology are useful.

**OBJECTIVES:**

1. to understand basic nutrition and metabolism in ruminants and how they differ from monogastric animals
2. to understand the importance of microbial metabolism to the ruminant animal
3. to understand how microbes metabolize feeds (outside and inside of the animal) and the effects this has on the animal
4. to understand the basic reasons for applied nutritional management decisions

**TIME:** Tuesday and Thursday, 11:00 to 12:15

**Note:** There will be 2 lectures that will be replaced by “mini labs”. It is anticipated that two of the mini labs will require about 1 to 2 h of “time outside of the class” for their completion.

**LOCATION:** Townsend Hall 002

**OFFICE HOURS:** Arranged as needed and by appointment.

**CONTACT INFO:** [LKSILAGE@UDEL.EDU](mailto:LKSILAGE@UDEL.EDU) or 302 831 2522

**TEXT:** Required: None.

**Reading Materials and Notes**

Power point presentations will be available for you at each class. Because there is no required text book, there will also be a substantial amount of handouts that will supplement the lectures. You are expected to read this material before hand so that lectures make more sense. In addition, there will some questions on the exams from the information in the handouts that were not covered in class.

## **SUGGESTED REFERENCES:**

Journals with emphasis on livestock:

Journal of Animal Science  
Journal of Dairy Science  
Animal Production  
Animal Feed Science and Technology  
Canadian Journal of Animal Science  
Animal Feed Sci. Tech.  
Livestock Production Science

Journals with occasional articles related to livestock:

Grass and Forage Science  
Journal of the Science of Food and Agric.  
British Journal of Nutrition  
Journal Agric. Science, Cambridge

Nutrient Requirements Council (NRC) Publications for Livestock – Dairy, Beef, Small Ruminants

## **PRESENTATIONS**

Prepare a 10-12-minute power point presentations based on a journal article that you will be assigned and present this in class.

## **PROTOZOA LAB WRITE UP**

Write up a lab report showing images of different protozoa you found, estimate their relative abundance and size, describe how they differ, try to classify them and describe what their functions are.

## **GRADING:**

|                                |      |
|--------------------------------|------|
| Exam 1                         | 30%  |
| Exam 2                         | 30%  |
| Powerpoint presentation        | 5%   |
| Protozoa lab write up          | 5%   |
| Final exam (not comprehensive) | 30%  |
| Total                          | 100% |

Final grades will be assigned based on a curved scale as needed.

### **Program Student Learning Outcomes**

Students will learn and appreciate similarities and differences in the nutritional metabolism of ruminants and learn how these relate to the metabolism of the various species (meets UD Gen Ed goal #6). Learning the fundamentals of animal nutrition will allow students to develop the ability to integrate academic knowledge with experiences in animal agriculture (meets UD Gen Ed goal #7). Students will also demonstrate knowledge of the major core concepts in the animal and food sciences (meets the content goal of ANFS).

Gen. Ed. goals:

ANFS **Learning goals:** [http://ag.udel.edu/anfs/anfs\\_undergrad.html](http://ag.udel.edu/anfs/anfs_undergrad.html)

### **Course Student Learning Outcomes**

The primary objective of this class is to underscore the importance of microbial metabolism and the biochemical utilization of feedstuffs in lactating dairy cows. Specific objectives of the class include:

1. Be able to understand how metabolism of nutrients is different in lactating cows vs monogastric animals
2. Understand the mechanisms of eating, digestion, absorption and utilization of nutrients and the factors that affect these processes.
3. Understand how nutrition affects the various aspects of life in dairy cows.
4. Be able to describe how microbes supply nutrients to dairy cows

### **Course Policies**

#### **Class Attendance**

Attendance to class and labs are mandatory based on University policy. If you are absent from class, you are responsible for obtaining the material. The following is taken from University of Delaware policies:

*Absences on religious holidays listed in University calendars is recognized as an excused absence. Nevertheless, students are urged to remind the instructor of their intention to be absent on a particular upcoming holiday.*

*Absences on religious holidays not listed in University calendars, as well as absences due to athletic participation or other extracurricular activities in which students are official representatives of the University, shall be recognized as excused absences when the student informs the instructor in writing during the first two weeks of the semester of these planned absences for the semester. Absences due to similar events which could not have been anticipated earlier in the semester will be recognized as excused absences upon advance notification of the instructor by an appropriate faculty adviser or athletic coach.*

*Absences due to serious illness or death within a student's family, or other serious family emergency, are recognized as excused absences. **To validate such absences, the student should present evidence to the Dean's Office of his or her college. The Dean's Office will then provide a letter of verification to all of the student's instructors for the term.***

*Absences due to serious personal illness (e.g., hospitalization, surgery, or protracted medical illness or*

convalescence) shall also be recognized as excused absences. **To validate such absences, the student should present evidence of the illness to the Dean's Office of his or her college.** Supportive evidence will be provided on the student's request by the Student Health Service directly to the respective Dean. Students who experience long-term absences of a week or more should consult with their Assistant Dean; in such cases, it may be possible to negotiate with faculty for the opportunity to take an incomplete grade, or a withdrawal may be more prudent. The student's Assistant Dean will give guidance in these matters.

For relatively minor, short-term illnesses of students (e.g., colds and flu, where attendance in class is undesirable) or their immediate family, the University system depends upon reasonable communication between students and faculty. If possible, students should report such illnesses before the affected class, following the directions of the instructor provided at the start of the term. (Rev. 5/96)

Absence due to short-term military duty in the National Guard or active reserve is recognized as an excused absence. To validate such an absence, the student should present evidence to the Dean's Office of his or her college. The Dean's Office will then provide a letter of verification to all of the student's instructors for the term.

**All excuses must be received by Kim Yackoski (Dean of Students) and Dr. Kung within 2-3 days of the incident. Excuses will not be honored after exams are graded.**

### **Academic Honesty**

Students should familiarize themselves with the Student Guide to University Policies at: <http://www.udel.edu/stuguide/10-11/code.html>

Please read: <http://www.udel.edu/stuguide/10-11/code.html#honesty>

### **Disruptive Behavior in the Classroom or Lab**

Please read: <http://www.udel.edu/stuguide/10-11/code.html#disrupt>

Disruptive behavior in class will not be tolerated. Some (not all) examples of disruptive behavior include:

- Making or receiving phone calls or text messaging in class
- Leaving class to receive a phone call and returning
- Taking photos in class
- Routinely arriving late for class\*; routinely leaving early before class ends\*
- Rude or disrespectful behavior towards students, the TAs, or the lecturer
- Talking in class
- Passing items back and forth
- Reading non-class material during lecture
- Sleeping
- Using an electronic device to do anything but take notes (e.g. surfing the web, chatting, viewing videos, playing games, anything non-class related is unacceptable).

\*Please let me know if you have special circumstances relative to this topic

Students who participate in disruptive behavior will be reported to the Office of Student Conduct.

### **Special Accommodations**

Please inform me in private if you have a certifiable disability so that appropriate measures can be made to assist you. Please do this by the third lecture period. Do not wait until the first exam.

### **Support Services**

If you are struggling in class, please contact me or one of the TAs as soon as possible. Arrangements can be made for tutoring through the Academic Enrichment Center. The earlier you seek help the better.

### **Faculty Statement on Disclosures of Instances of Sexual Misconduct**

If, at any time during this course, I happen to be made aware that a student may have been the victim of sexual misconduct (including sexual harassment, sexual violence, domestic/dating violence, or stalking), I am obligated by federal law to inform the university's Title IX Coordinator. The university needs to know information about such incidents to, not only offer resources, but to ensure a safe campus environment. The Title IX Coordinator will decide if the incident should be examined further. If such a situation is disclosed to me in class, in a paper assignment, or in office hours, I promise to protect your privacy

I will not disclose the incident to anyone but the Title IX Coordinator.  
For more information on Sexual Misconduct policies, where to get help, and reporting information please refer to [www.udel.edu/sexualmisconduct](http://www.udel.edu/sexualmisconduct).

At UD, we provide 24 hour crisis assistance and victim advocacy and counseling. Contact 302-831-2226, Student Health Services, to get in touch with a sexual offense support advocate

RUMINANT NUTRITION - ANSC 454 /654- Fall 2015  
PROPOSED LECTURE SCHEDULE – Version Sept 1, 2015  
Subject to change based on lecture coverage

- Sept 1 Orientation - a brief overview of comparative physiology
- Sept 3 Ruminant evolution and development
- Sept 8 Basic fiber chemistry and factors related to availability (NDF, ADF, ADL, plant structure, grasses vs legumes)
- Sept 10 Fermentation of fiber by rumen microbes
- Sept 15 Practical aspects of fiber requirements (effective fiber)  
(Last day of free drop add)
- Sept 17 Metabolism of non-fiber carbohydrates in the rumen by rumen microbes  
(sugars and starches to VFA)
- Sept 22 Metabolism of non-fiber carbohydrates in the rumen (continued)
- Sept 24 Practical aspects of non-fiber carbohydrate requirements (differences by grain type, particle size, acidosis)
- Sept 29 Rumen Lab - meet at Dairy to collect ruminal fluid - in vitro demo and microscope work
- Oct 1 Exam 1
- Oct 6 Metabolism of nitrogenous compounds in the rumen by microbes  
(RUP, RDP, MCP, NPN)
- Oct 8 Practical aspects of nitrogen requirements for lactating cows  
(Protected amino acids, requirements)
- Oct 13 Absorption of compounds from the rumen  
(role of ruminal pH, CoA synthetases, fate of VFA at the tissue level)
- Oct 15 Absorption of compounds from the rumen and fate in the tissues
- Oct 20 Metabolism of lipids in the rumen (biohydrogenation, CLA)  
(Last day to withdraw without grade penalty or dean's approval)
- Oct 22 Practical aspects of lipid requirements  
(sources of fats, levels, protected fats, C16 fats)
- Oct 27 Rumen microbial interactions  
(methanogenesis, protozoa)
- Oct 29 Exam 2
- Nov 3 Harvesting forages for ruminants – factors to consider prior to ensiling

- (harvest maturity, hay vs silage, wilting)
- Nov 5 Microbial processes in silage fermentation  
(types of fermentations, factors affecting fermentation – DM, buffering capacity)
- Nov 10 Practical silo management (meet at dairy – bunker density, particle size determination, microwave DM, temp probes, use of sample corers)
- Nov 12 Ruminant nutritional metabolic issues and toxicities  
(ketosis, milk fever, PEM)
- Nov 17 Ruminant nutritional metabolic issues and toxicities  
(mycotoxins - binders, nitrate poisoning)
- Nov 19 Feed additives for ruminants (buffers, DFM, enzymes, niacin)
- Nov 24 Thanksgiving Break
- Nov 26 Thanksgiving Break
- Dec 1 Feeding lactating cows relative to production and stage of lactation  
(lactation, BW, energy balance curves; dry cow and transition cow nutritional management, TMR)
- Dec 3 On farm nutritional management evaluation (meet at dairy – check list -> % of cows ruminating, time budgets, waters, stall useage, TMR audits)
- Dec 8 Open – catch up – new, hot topics
- Dec 10 Open – catch up – new, hot topics
- Dec 14 Start of finals week Final exam date to be announced