ANIMAL SCIENCE 4150/5150

Physiology of Ruminant Digestion

Spring Semester 2014
MWF 8:00 – 8:50 AM
AS/MB Rm 104

INSTRUCTOR: Paul Ludden, Ph.D. (Ruminant Nutrition)

CONTACT INFO: Office: AB 123B; 766 – 4213
Cell: 760 – 2514 (No calls after 9:00 PM)
Email: ludden@uwyo.edu

OFFICE HOURS:

Students are always welcome to seek the instructor's assistance on any aspect of the course. Although formal office hours will not be held, I will generally be available at any time I am in my office. Email and/or phone communication with the instructor is also welcome. If extensive assistance is required, an appointment with the instructor is recommended.

COURSE OBJECTIVE:

Animal Science 4150/5150 is designed to provide students with an appreciation for the uniqueness and complexity of digestion in ruminants. The course will cover both evolutionary and physiological development of digestive function, as well as the digestion, absorption, and metabolism of nutrients in the ruminant animal with particular emphasis on ruminal function. An understanding of basic microbiology, microbial growth, and fermentation, and the most recent attempts at modeling ruminal metabolism will be discussed. Ultimately, attention will be given to application of these nutritional principles to practical feeding situations and designing supplementation strategies for ruminant livestock.

COURSE MATERIAL:

No single text will cover the course in its entirety, but most material for the course will be drawn from the textbook below, which is optional for this course. Graduate students in ruminant nutrition and other students with a future career interest in nutrition are strongly encouraged to purchase this text for use as a future reference text.

Nutritional Ecology of the Ruminant. 2nd Ed., (1994; P.J. Van Soest)
(ISBN: 0-8014-2772-X). Available from the University Bookstore

Supporting reference material will be derived from miscellaneous textbooks (especially the books listed below), symposium proceedings, scientific journal articles, etc.

The Ruminant Animal: Digestive Physiology and Nutrition., (1988; D.C. Church).
(ISBN: 0-8813-3740-4)

The Rumen Microbial Ecosystem. 2nd Ed., (1997; P.N. Hobson and C. S. Stewart).
(ISBN: 0-7514-0366-0)

COURSE STUDIO HOMEPAGE:

A Course Studio Homepage has been created for the course, and is available through your WYOWEB account. This homepage will be used for posting of lecture/lab notes (PPT slides), as well as any handouts etc.. Please note that all such postings will occur after the lecture/lab and should be used as a supplement to normal note-taking, etc. You may also receive occasional course announcements via this homepage. Contact the instructor if you need help accessing the Course Studio Homepage for the course.

GRADING:

QUIZZES: (50 pts)

Several 10-point quizzes (minimum of 7, but actual number TBD) will be given at random throughout the semester. Quizzes will be **unannounced** (i.e. "Pop Quizzes"), and will emphasize the most recent material covered in the course. No make-up quizzes will be given under any circumstances (including University-approved absences). However, only the student's 5 best quiz scores (up to 50 total points) will contribute to the final grade in the course (i.e. a minimum of 2 low quiz scores dropped from calculation of the final grade).

MID-TERM EXAMINATIONS: (300 pts)

Three mid-term exams (100 pts ea) will be given. Exams will primarily consist of short answer and essay questions that require the integration/application of material covered in class. All exams will focus on the most recent material, but because of the nature of the course may (will) rely on the comprehensive knowledge of material. Mid-term exams are tentatively scheduled for **Monday February 17, Friday March 14, and Friday April 25**. Note that some (i.e. most) students may need more than one hour to complete the mid-term exams. Consequently, exams will be **available at 7:00 AM** on the day of scheduled exam.

TERM PAPER: (100 pts) – ANSC 4150 Only

Students will prepare an **5-7-page review paper** addressing the benefits and/or drawbacks to a particular feeding strategy for ruminants. Such topics could range from entire feeding regimens or grazing practices, to supplementation strategies to grazing/forage-fed ruminants, or feed additives that impact nutrient utilization, and may include any ruminant of interest (i.e. livestock or wildlife). Topics will be chosen by the student, but must be approved by the instructor. Note that any single topic will not be approved for more than one student, so it is strongly advised that you identify your topic as soon as possible as topics will be approved on a first come/first approved basis. Papers should be a thorough investigation of the chosen topic. While a wealth of supporting information may come from class presentation and handouts, **a minimum of 5 citations from scientific journals**, including original research or review articles, must be incorporated into your paper. Thus, your class notes should not serve as your primary resource when preparing your paper, and non-scientific literature (i.e. textbooks, internet/web sites, etc.) is NOT considered a scientific citation. You are also strongly encouraged to follow Journal of Animal Science Style and Form when preparing your paper (please see the Journal of Animal Science or the instructor for more details). A rough draft (optional) of the report will be due by the end of class on Monday **April 21** with the final draft due to the instructor no later than 5:00 PM on Friday **May 2**.

GRANT PROPOSAL (200 pts) – ANSC 5150 Only

Students enrolled in ANSC 5150 will prepare a grant proposal to investigate a research idea in ruminant nutrition that includes an aspect of ruminal metabolism as the major focus. Functionally, the proposal represents an extension of the Term Paper required for undergraduate credit (see above), except that a more in-depth review (more citations) will be needed. Topics for grant proposals must be discussed and approved by the instructor no later than Monday **Feb 17** (day of Exam 1). Proposals will be prepared according to the Request for Proposals (RFP) for the UW Ag Experiment Station Competitive Grants Program (for details on proposal preparation and requirements refer to http://www.uwyo.edu/uwexpstn/). Complete proposals will be due to the instructor no later than 5:00 PM on Friday **May 2**.

FINAL EXAM: (150 pts)

The Final Exam will be an **oral exam** to be completed during Finals Week (May 5 – 9). The Final Exam will be in a case study format that will require the integration and application of concepts covered in class. Details of the case study(s) will be handed out during the last week of class, and you will have a minimum of 1 week to synthesize an appropriate answer using any resources at your disposal (except for other faculty, etc.). Students will meet with the instructor during Finals week for a semi-formal discussion of the case study(s) and associated questions. Students may bring any notes, illustrations, diagrams, etc needed to the exam. Oral Final Exams will be completed in small groups (2-3 students) determined by the instructor.

CLASS PARTICIPATION: (50 pts)

This is the easiest way to earn points in the course. Class attendance and active participation in class discussion are an integral part of this course, and are required for full participation credit. Come to each class prepared to actively participate in each lecture and earn easy points for your efforts.

GRADUATE PARTICIPATION (50 pts) – ANSC 5150 Only

Students enrolled in ANSC 5150 are expected make an additional contribution to the course discussions and take a leadership role in the class. These participation points are in addition to the participation points for all students enrolled in the course.

GRADING SUMMARY:

TOTAL POINTS (ANSC 4150):

Graded Item	Points	Grade*	%	Pts Needed
Mid-Term Exams	300	A	90%	≥ 585
Quizzes	50	B	80%	520 – 584
Term Paper	100	C	70%	455 – 519
Final Exam	150	D	60%	390 – 454
Class Participation	50	F	< 60%	< 390
Total	650			

TOTAL POINTS (ANSC 5150):

Graded Item	Points	Grade*	%	Pts Needed
Mid-Term Exams	300	A	90%	≥ 720
Quizzes	50	B	80%	640 – 719
Term Paper	200	C	70%	560 – 639
Final Exam	150	D	60%	480 – 559
Class Participation	50	F	< 60%	< 480
Graduate Participation	50			
Total	800			

*****Minimum percentage grade/points required for each letter grade may be lowered (but will not be raised) at the discretion of the instructor.

MAKE-UP POLICY:

No make-up quizzes will be given (see quiz section). Make-up exams will be given ONLY upon proof (in writing) of a justifiable absence and at the discretion of the instructor, and will only be considered with an official University Authorized Absence Form (i.e. Yellow Slip) issued by the Dean of Students Office. Unless the absence is due to an emergency, students MUST notify the instructor before the absence such that appropriate make-up arrangements can be made. All make-up exams must be completed before the second class period following the scheduled exam to facilitate handing them back to the class in a timely fashion.

ACADEMIC DISHONESTY:

The University of Wyoming is built upon a strong foundation of integrity, respect and trust. All members of the University community have a responsibility to be honest and the right to expect honesty from others. An act is academically dishonest when, and only when, it is an act attempted or performed in order to misrepresent one's involvement in an academic task in any way. Any form of academic dishonesty is unacceptable to our community and WILL NOT BE TOLERATED in this course. Likewise, you should not be expected to tolerate academic dishonesty by your fellow classmates. Suspected violations of standards of academic honesty should be immediately reported to the Instructor, Department Head, or Dean. Any student suspected of academic dishonesty will be dealt with appropriately and promptly, which may include immediate dismissal from the course with a failing grade and prosecution to the fullest extent of University policy. For more information regarding policies on academic dishonesty at the University of Wyoming, please refer to UW Regulation 6-802 or the General Bulletin.

DISABILITY STATEMENT:

If you have a physical, learning, or psychological disability and require accommodations, please let the instructor know as soon as possible. You are encouraged to contact University Disability Support Services (room 330 Knight Hall) for assistance. Students in the College of Agriculture may also seek the assistance of the Office of Student Success (Rm 139 Ag C) through the College's Academic and Student Programs Office (Rm 160 Ag C).

USE OF ELECTRONIC DEVICES DURING CLASS TIME:

Although cell phones/smartphones, etc. are an important part of our daily lives, they also represent a significant distraction to the learning environment of the classroom. Consequently, all use of any such devices must cease (turned off or placed on vibrate/silent) upon the start of each lecture/lab or exam. If necessary to immediately respond to a call, text message, etc., students are asked (or will be asked) to discretely leave the classroom or wait until the lecture/lab period is over to do so. In the event of a University emergency (i.e. UW-ALERT activation), the instructor will notify the class accordingly. VIOLATIONS OF THIS POLICY WILL NOT BE TOLERATED! If necessary to do so, you may use your cell phone/smartphone as a calculator in laboratory or lecture activities, but this will NOT be allowed under any circumstances on exams.

UNDERGRADUATE STUDENTS RESERVING THIS COURSE FOR GRADUATE CREDIT

If you are an undergraduate student who wishes to reserve this course for graduate credit, you must 1) meet all requirements for and enroll in ANSC 5150, and 2) submit the proper request form to the Graduate School prior to the semester in which the coursework is taken. Please see the instructor for further information.

IMPORTANT DATES:

Jan	20	NO CLASS – MLK Holiday
Feb	17	Exam #1 (tentative)
Mar	14	Exam #2 (tentative)
	17 – 21	NO CLASS – Spring Break
	24 – 31	NO CLASS
Apr	18	NO CLASS – Easter Break
	21	Optional rough draft of term paper due in class
	25	Exam #3 (tentative)
May	2	Course wrap-up; Course evaluations
	2	Final draft of Research Project Report due by 5:00 PM
	5 – 9	Oral Final Exams (Schedule TBD)

COURSE TOPICS AND GENERAL OUTLINE:

I. Introduction to Ruminants
   A. Importance of Ruminant Animals to the World
   B. Classification/Taxonomy
   C. Evolutionary Development of the Ruminant
   D. Feeding Strategies; Types of Ruminants

II. Growth and Development of the Ruminant Digestive System
   A. Digestive Anatomy Development: Fetal → Adult
   B. Influence of Diet on Digestive System Development
   C. Pre-Ruminant Nutrition; Milk Replacer Composition
   D. Salivary Function and Production
   E. Anatomy of the Ruminant Gastrointestinal Tract
   F. Rumen Motility and Rumination

III. Microbiology of the Rumen
   A. Classification of Ruminal Microbes – Bacteria, Protozoa, Fungi
   B. Microbial Interdependence
   C. Microbial Attachment and Physiology of Feed Degradation
   D. Microbial Growth; Microbial Efficiency

IV. Ruminal Fermentation
   A. Carbohydrate Chemistry and Digestion
   B. Biochemical Pathways of Ruminal Fermentation
   C. Fermentation Balance
   D. Modification of Ruminal Fermentation
   E. Effective Degradability of Nutrients

V. Integrated Ruminant Nutrition
   A. Ruminant Nitrogen/Protein Metabolism; Metabolizable Protein System
   B. Associative/Substitution Effects
   C. Synchronization of Ruminal Digestion
   D. Other topics (time permitting)