

Course Outline Form: Winter 2018

General Information

Course Title: ANSC 6360 * Techniques in Animal Nutrition Research

Course Description: Lectures, research facility tours, and research technique protocol development practices are combined and used to teach theory, various techniques and procedures to analyze nutrient composition in feedstuffs, digesta, feces and animal products such as carcass, meat, eggs, and milk as well as some typical odor-causing and/or off-flavor volatile compounds in manure wastes and animal products. The course will also cover principles and experimental approaches to measure digestive and post-absorptive utilization and metabolism of major dietary nutrients, i.e., energy, protein/amino acids, carbohydrates and minerals, and essential nutrient requirements in monogastric animals, e.g., poultry, swine, cats, dogs, major aquaculture species of fish and shrimps and horses, and ruminants, e.g., beef and dairy cattle, goats, sheep, and cervid species.

Credit Weight: 0.50

Academic Department (or campus): Animal Biosciences

Campus: Guelph

Semester Offering: Winter

Class Schedule and Location: 8:30 am – 11:20 pm on Fridays; room 101, Animal Science/Nutrition Building (ANNU)

Instructor Information

Instructor Name: Ming Z. Fan, Ph.D., Professor of Nutritional Ecology

Instructor Email: mfan@uoguelph.ca

Office location and office hours: room 224, #70 Animal Science & Nutrition Building (ANNU)

GTA Information

GTA Name:

GTA Email:

GTA office location and office hours:

Course Content

Specific Learning Outcomes:

- 1) Class students would acquire basic skills in collection, processing and storage of various samples to conduct original animal nutrition, metabolism and physiology research.
- 2) Class students would have basic understanding and have access to procedures for various proximate nutrient analyses of samples to conduct animal nutrition research.
- 3) Class students would develop basic understanding and have access to procedures for various instrumental nutrient analyses of samples to conduct animal nutrition research.
- 4) Class students would develop basic understanding and have access to methodology to design and conduct feed nutrient bioavailability research in animals.
- 5) Class students would develop basic understanding and have access to methodology to design and conduct nutrient requirement, nutrient utilization and nutrient metabolism research in animals.
- 6) Class students would develop basic understanding and have access to protocols to design and conduct whole body physiology research such as gut permeability and stress responses in animals.
- 7) Class students would gain experience and confidence to adopt and design essential techniques, procedures or protocols in animal nutrition and metabolism research.
- 8) Class students would develop confidence and expertise to critically review and effectively assess technical aspects of original nutritional research work published in peer-reviewed research journals.

Lecture Content:

First Class Meeting:

Jan. 12, 2018: to introduce each other and discuss course delivery and requirements

Nutritional Chemical Analyses:

Topic 1 Proximate Nutrient Analysis I: Water, Dry Matter and Gross Energy
Jan. 12, 2018

- Principles and procedures for sample preparations for proximate nutrient analysis
- Dry matter, organic matter and gross energy

Topic 2 Proximate Nutrient Analysis II: Nitrogen Compounds and Crude Fat
Jan. 12, 2018

- Total nitrogen content (crude protein, CP, content)
- Various true protein content (peptide-based) assays
- Various non-protein nitrogenous (NPN) compounds
- Measurements of crude fat (ether extract) content

- Topic 3**
Jan. 19, 2018
- Proximate Nutrient Analysis III: Fiber Components
- Crude fiber content
 - Van Soest fiber components
 - Total dietary fiber and soluble fiber components
- Topic 4**
Jan. 19, 2018
- Instrumental Analysis I: Macro- and Micro-Minerals
- Sample preparation
 - Analyses of mineral elements by spectrophotometry, atomic absorption spectrometry and inductively coupled plasma spectrometry
- Topic 5**
Jan. 26, 2018
- Instrumental Analysis II: Lipid Compounds
- Basics of gas chromatography (GC)
 - Sample preparation and data processing
- Topic 6**
Jan. 26, 2018
- Instrumental Analysis III: Volatile Compounds
- Basics of gas chromatography-mass spectrometry (GC-MS)
 - Sample preparation and data processing
- Topic 7**
Feb. 2, 2018
- Instrumental Analysis IV: Amino Acid Profile
- Basics of high performance-liquid chromatography (HPLC)
 - Sample preparation and data processing
- Topic 8**
Feb. 9, 2018
- Instrumental Analysis V: Sugars and Starch Components
- Procedures for monosaccharide and disaccharide sugar components
 - Analysis of starch content in biological samples

Major Nutrition Techniques in Studies with Animals:

- Topic 9**
Feb. 16, 2018
- Nutrition Techniques I: Bioavailability of Nutrients in Feed ingredients for Animals
- The slope-ratio assay (growth assays)
 - Digestibility studies

Feb. 19 - 23, 2018 Winter Break – No Classes Scheduled

- Topic 10**
Feb. 16, 2018
March 2, 2018
- Nutrition Techniques II: Determination of Nutrient Digestion and Digestibility in Animals
- 1) Monogastric animals:
 - Ileal and fecal nutrient digestibility in poultry, swine and horses
 - Metabolizable energy in poultry, swine and horses
 - 2) Ruminant animals:
 - Whole tract nutrient digestion and digestibility studies in ruminants
 - *In vitro* and *in situ* degradation or digestion in ruminants
-
- Topic 11**
March 2, 2018
- Nutrition Techniques III: Determination of Gut Permeability
- Principles and practices for measuring *in vivo* and *in vitro* transcellular gut permeability
 - Principles and practices for measuring *in vivo* and *in vitro* paracellular gut permeability
-
- Topic 12**
March 9, 2018
- Nutrition Techniques IV: Determination of Energy Utilization and Requirements in Animals
- 1) Major experimental approaches for the measurements:
 - Direct calorimetric technique
 - Comparative slaughter technique
 - Indirect calorimetric techniques
 - Other emerging techniques
 - 2) Major approaches for data analyses:
 - Linear factorial approach
 - Curve-linear dynamic factorial approach
-
- Topic 13**
March 16, 2018
- Nutrition Techniques V: Determination of Crude Protein and Amino Acid Utilization and Requirements in Animals
- 1) Major experimental approaches for the measurements:
 - The classical comparative slaughter and mass balance approach
 - The modern *in vivo* amino acid flux measurement approach
 - 2) Major approaches for data analyses:
 - Broken line analysis and linear analysis based factorial approach
 - Curve-linear analysis based factorial approach
-
- Topic 14**
March 23, 2018
- Nutrition Techniques VI: Determination of Amino Acid Metabolism in Animals
- 1) Major *in vitro* experimental approaches for the measurements:
 - The classical metabolic pathway-based approach
 - The current micro-array and proteomic approach
 - 2) Major *in vivo* experimental approaches for the measurements:
 - The localized organ or tissue amino acid tracer infusion approach
 - The whole body amino acid flux measurement approach

March 30 2018 Good Friday Public Holiday – No Classes Scheduled

Topic 15 Nutrition Techniques VII: Determination of Protein Metabolism
April 6, 2018 in Animals
1) Techniques for measuring fractional protein synthesis rates
2) Techniques for measuring protein degradation rates

Labs:

None

Seminars:

None

Course Assignments and Tests:

Assignment or Test	Due Date	Contribution to Final Mark (%)	Learning Outcomes Assessed
Class participation (class lecture discussions and Lab - tour attendance) before the Winter Break	Feb. 19, 2018	10	Outcomes #1 to 8
Class participation (class lecture discussions and Lab - tour attendance) after the Winter Break	April 9, 2018	10	Outcomes #1 to 8
Students' assignments of technical critique of published research papers*	Mondays on a weekly basis during the semester	50	Outcomes #1 to 6 and 8
One research technique protocol development assignment	April 18, 2018	30	Outcomes #1 to 6 and 7

***Note:** Students have the flexibility to choose 10 out of the 15 topics discussed in class for their technical critique assignments with each assignment worth of 5% to the final mark. Samples of technical critique will be distributed to course students at the beginning of the class.

Additional Notes (if required):

Specific Requirements for a Research Technique Protocol Development Practice Assignment

1) Selection of a topic: to select a research technique topic focusing on reviewing an analytical procedure or animal nutrition study protocol that has been reported in the literature. Students are encouraged to select a technique topic relevant to their graduate program or thesis research projects.

2) Suggested schedules: your technique protocol title should be finalized in discussion with the course instructor by **Feb. 26, 2018**. Students are encouraged to consult with the course instructor to improve the quality their protocols and maximize their learning opportunities. Your finalized protocol is to be submitted by **April 18, 2018** for marking.

3) Suggested format:

- A cover page including your protocol paper title, student name, student ID, as well as course name and year;
- Pages and lines to be numbered with line numbering re-starting on each page; and are double-line spaced with 1" margins; using 12-point font size and Times New Roman font type;
- An Abstract section (limit to one page in double space);
- An Introduction section: to discuss the importance of your procedure or technique in animal nutrition and metabolic research;
- Specific details of your chosen procedures and techniques to be reviewed: basic principles behind, major steps, and major equipment and facilities needed etc.; and
- Major references Cited.

Note: Sample research technique protocols will be provided to students via course site posting by the instructor throughout the duration of this course delivery.

Final examination date and time:

Not applicable.

Final exam weighting:

Not applicable.

Course Resources

Required Texts:

None

Recommended Texts:

None

Lab Manual:

None

Other Resources:

Lecture notes and sample procedure and protocol files will be posted as PDF files on the course site by the instructor by using D2L.

Field Trips:

Not applicable.

Additional Costs:

None

Course Policies

Grading Policies:

Students' assignments of technical critique of published research papers are submitted to the instructor as a Word file via email by following the suggested due dates. Students' finalized research technique protocol development assignment as a hard copy of printout is submitted to the instructor as a Word file via email by following the suggested due date.

Course Policy on Group Work:

Not applicable.

Course Policy regarding use of electronic devices and recording of lectures:

Electronic recording of classes is expressly forbidden without consent of the instructor. When recordings are permitted they are solely for the use of the authorized student and may not be reproduced, or transmitted to others, without the express written consent of the instructor.

University Policies

Academic Consideration:

The University of Guelph is committed to supporting students in their learning experiences and responding to their individual needs and is aware that a variety of situations or events beyond the student's control may affect academic performance. Support is provided to accommodate academic needs in the face of personal difficulties or unforeseen events in the form of Academic Consideration.

Information on regulations and procedures for Academic Consideration, Appeals and Petitions, including categories, grounds, timelines and appeals can be found in [Section VIII \(Undergraduate Degree Regulations and Procedures\) of the Undergraduate Calendar](#).

Academic Misconduct:

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring.

University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Detailed information regarding the Academic Misconduct policy is available in [Section VIII \(Undergraduate Degree Regulations and Procedures\) of the Undergraduate Calendar](#).

Accessibility:

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Student Accessibility Services (SAS), formerly Centre for Students with Disabilities (CSD), as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208 or email sas@uoguelph.ca or visit the [Student Accessibility Services website \(http://www.uoguelph.ca/csd/\)](http://www.uoguelph.ca/csd/).

Course Evaluation Information:

End of semester course and instructor evaluations provide students the opportunity to have their comments and opinions used as an important component in the Faculty Tenure and Promotion process, and as valuable feedback to help instructors enhance the quality of their teaching effectiveness and course delivery.

While many course evaluations are conducted in class others are now conducted online. Please refer to the [Course and Instructor Evaluation Website](#) for more information.

Drop period:

The drop period for single semester courses starts at the beginning of the add period and extends to the Fortieth (40th) class day of the current semester (the last date to drop a single semester courses without academic penalty) which is listed in [Section III \(Schedule of Dates\) of the Undergraduate Calendar](#).

The drop period for two semester courses starts at the beginning of the add period in the first semester and extends to the last day of the add period in the second semester.

Information about Dropping Courses can be found in [Section VIII \(Undergraduate Degree Regulations and Procedures\) of the Undergraduate Calendar](#).

Additional Course Information

Not applicable.