



# **ANSC\*6360 Techniques in Animal Nutrition**

## **Research**

Winter 2020

Section(s): C01

Department of Animal Biosciences

Credit Weight: 0.50

Version 1.00 - January 06, 2020

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## **1 Course Details**

### **1.1 Calendar Description**

Theory and/or practices of techniques to evaluate feedstuffs and determine nutrient utilization in poultry, swine and ruminants is covered through lectures, short laboratories and a major project.

### **1.2 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 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

### **1.3 Timetable**

Fridays 11:30 am - 2:20 pm

Animal Science/Nutrition Building (ANNU) Room 241

### **1.4 Final Exam**

Not Applicable

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## 2 Instructional Support

### 2.1 Instructional Support Team

<b>Instructor:</b>	Ming Fan
<b>Email:</b>	mfan@uoguelph.ca
<b>Telephone:</b>	1-519-824-4120 x53656
<b>Office:</b>	ANNU 224
<b>Office Hours:</b>	Thursday 10:30 am - 11:30 am
	Friday 10:30 am - 11:30 am

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## 3 Learning Resources

### 3.1 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.

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## 4 Learning Outcomes

### 4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Class students will acquire basic skills in collection, processing and storage of various samples to conduct original animal nutrition, metabolism and physiology research.
2. Class students will have basic understanding and have access to procedures for various proximate nutrient analyses of samples to conduct animal nutrition research.
3. Class students will develop basic understanding and have access to procedures for various instrumental nutrient analyses of samples to conduct animal nutrition research.
4. Class students will develop basic understanding and have access to methodology to design and conduct feed nutrient bioavailability research in animals.
5. Class students will 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 will 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 will gain experience and confidence to adopt and design essential techniques, procedures or protocols in animal nutrition and metabolism research.
  8. Class students will develop confidence and expertise to critically review and effectively assess technical aspects of original nutritional research work published in peer-reviewed research journals.
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## 5 Teaching and Learning Activities

### 5.1 Lecture

**Fri, Jan 10**

**Topics:** First Class Meeting

Introduce each other and discuss course delivery and requirements

**Fri, Jan 10**

**Topics:** Nutritional Chemical Analyses: Proximate Nutrient Analysis I: Water, Dry Matter and Gross Energy

- Principles and procedures for sample preparation for proximate nutrient analysis
- Dry matter (DM), organic matter (OM) and gross energy (GE)

**Fri, Jan 17**

**Topics:** Nutritional Chemical Analyses: Proximate Nutrient Analysis II: Nitrogen Compounds and Crude Fat

- 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

**Fri, Jan 24**

**Topics:** Nutritional Chemical Analyses: Proximate Nutrient Analysis III: Fiber Components

- Crude fiber content

- Van Soest fiber components
- Total dietary fiber (TDF) and soluble fiber components

**Fri, Jan 24**

**Topics:** Instrumental Analysis I: Macro- and Micro-Minerals

- Sample preparation
- Analyses of mineral elements by spectrophotometry, atomic absorption spectrometry and inductively coupled plasma (ICP) spectrometry

**Fri, Jan 31**

**Topics:** Instrumental Analysis II: Lipid Compounds

- Basics of gas chromatography (GC)
- Sample preparation and data processing

**Fri, Jan 31**

**Topics:** Instrumental Analysis III: Volatile Compounds

- Basics of gas chromatography-mass spectrometry (GC-MS)
- Sample preparation and data processing

**Fri, Feb 7**

**Topics:** Instrumental Analysis IV: Amino Acid Profile

- References:**
- Basics of high performance-liquid chromatography (HPLC)
  - Sample preparation and data processing

**Fri, Feb 7**

**Topics:** Instrumental Analysis V: Sugars and Starch Components

- Procedures for monosaccharide and disaccharide sugar components
- Analysis of starch content in biological samples

**Fri, Feb 7**

**Topics:** Nutrition Techniques I: Bioavailability of Nutrients in Feed ingredients for Animals

- The slope-ratio assay (growth assays)
- Digestibility studies

**Mon, Feb 17 - Fri, Feb 21**

**Topics:** Winter Break ! - No Classes Scheduled

**Fri, Feb 7 - Fri, Feb 28**

**Topics:** 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

**Fri, Mar 6**

**Topics:** 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

**Fri, Mar 13**

**Topics:** 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

## **Fri, Mar 20**

**Topics:** 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

## **Fri, Mar 27**

**Topics:** 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

**Fri, Apr 3**

**Topics:** Nutrition Techniques VII: Determination of Protein Metabolism in Animals

1) Techniques for measuring fractional protein synthesis rates

2) Techniques for measuring protein degradation rates

## 6 Assessments

### 6.1 Assessment Details

**Class participation (10%)**

**Due:** Tue, Feb 18

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 8

Class lecture discussions and Lab - tour attendance *before the Winter Break*

**Class participation (10%)**

**Due:** Sun, Apr 5

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 8

Class lecture discussions and Lab - tour attendance *after the Winter Break*

**Students' assignments of technical critique of published research papers (50%)**

**Due:** Mondays on a weekly basis during the semester

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 8

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.

**One research technique protocol development assignment (30%)**

**Due:** Thu, Apr 16

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7

## 6.2 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, 2020**. 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 16, 2020** 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.

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## 7 Course Statements

### 7.1 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.

### 7.2 Course Policy on Group Work

*Not applicable.*

### 7.3 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.

## 8 University Statements

### 8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

## 8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

## 8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

## 8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

## 8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website  
<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website  
<https://www.ridgetownc.com/services/accessibilityservices.cfm>

## 8.6 Academic Integrity

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 encourages academic integrity. 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.

Undergraduate Calendar - Academic Misconduct  
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct  
<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

## 8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

## 8.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

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