



ANSC*6360 Techniques in Animal Nutrition

Research

Winter 2023

Section(s): C01

Department of Animal Biosciences

Credit Weight: 0.50

Version 1.00 - January 10, 2023

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 laboratory and facility tours, and research technique critique and 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 odour-causing and off-flavour 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; virtual via Zoom or face to face (in case of campus-wide shut-down). Instructor will email to notify changes. Please also see WebAdvisor for the latest information.

Class location for face to face classes: ANNU, Room 241

1.4 Final Exam

There is no final exam for this course.

2 Instructional Support

2.1 Instructional Support Team

Instructor: Ming Fan
Email: mfan@uoguelph.ca
Telephone: 1-519-824-4120 x53656
Office: ANNU 224
Office Hours: **Instructor: Ming Z. Fan**

Email: mfan@uoguelph.ca

Office: ANNU 224

Communicating with your Instructor

Your instructor will interact with you in class room or via virtual meetings and on various course matters by email. If you have a complex question you may use Zoom or book a meeting.

3 Learning Resources

3.1 Other Resources

Course syllabus, guidelines and other class related information will be posted on the course site as PDF files by the course instructor through using D2L. Other research papers that may be used for class discussions will be circulated to class students via email by the course instructor.

Course Technologies (1)

CourseLink System Requirements

You are responsible for ensuring that your computer system meets the necessary system requirements. Use the browser check tool to ensure your browser settings are compatible and up to date. (Results will be displayed in a new browser window).

<http://spaces.uoguelph.ca/ed/system-requirements/>
<https://courselink.uoguelph.ca/d2l/systemCheck>

Course Technologies (2)

This course is being offered in face-to-face delivery format. It is still expected that you can access CourseLink (powered by D2L's Brightspace), the University of Guelph's online learning management system (LMS). By using this service, you agree to comply with the University of Guelph's Access and Privacy Guidelines. Please visit the D2L website to review the Brightspace privacy statement and Brightspace Learning Environment web accessibility standards.

<http://www.uoguelph.ca/web/privacy/>

<https://www.d2l.com/legal/privacy/> <https://www.d2l.com/accessibility/standards/>

Technical Support

If you need any assistance with the software tools or the CourseLink website, contact CourseLink Support.

Email: courselink@uoguelph.ca

Tel: 519-824-4120 ext. 56939 Toll-Free (CAN/USA): 1-866-275-1478

Support Hours (Eastern Time):

Monday thru Friday: 8:30 am–8:30 pm

Saturday: 10:00 am–4:00 pm

Sunday: 12:00 pm–6:00 pm

Additional Course Technology

This course will be delivered in a classroom setting using face-to-face format; unless Public Health mandates a move to online learning due to Covid-19. Check your system requirements to ensure you will be able to participate.

<https://opened.uoguelph.ca/student-resources/system-and-software-requirements>

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 13

Topics: First Class Meeting

Introduce each other and discuss course delivery and requirements

Nutritional Chemical Analyses: Proximate Nutrient Analysis I: Free and Bound Water, Dry Matter (DM) and Gross Energy (GE)

Fri, Jan 20

Topics: Nutritional Chemical Analyses: Proximate Nutrient Analysis

I: Free and Bound Water, Dry Matter (DM) and Gross Energy (GE)

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

Fri, Jan 27

Topics: Nutritional Chemical Analyses: Proximate Nutrient Analysis II: Nitrogenous Compounds and Crude Fat (ether extract)

- 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, Feb 3

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

- Crude fiber content
- The Van Soest fiber components
- Total dietary fiber (TDF), insoluble dietary fibre (IDF) and soluble dietary fiber (SDF) components

Fri, Feb 3

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, Feb 10

Topics: Instrumental Analysis II: Lipid Compounds

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

Fri, Feb 10

Topics: Instrumental Analysis III: Volatile Compounds

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

Fri, Feb 17

Topics: Instrumental Analysis IV: Amino Acid Profile

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

Fri, Feb 17

Topics: Instrumental Analysis V: Sugars and Starch Components

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

Mon, Feb 20 - Fri, Feb 24

Topics: Winter Break - No Classes Scheduled!

Fri, Mar 3

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

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

Fri, Mar 3 - Fri, Mar 10

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 10

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 17

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 24

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 31

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 7

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 Marking Schemes & Distributions

Name	Scheme A (%)
Class participation - Part 1	10
Class participation - Part 2	10
Students' assignments of technical critique of published research papers	50
One research technique protocol development assignment	30
Total	100

6.2 Assessment Details

Class participation - Part 1 (10%)

Due: Fri, Jan 13 - Fri, Feb 17

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

Class lecture participation and discussions *before the Winter Break*

Class participation - Part 2 (10%)

Due: Fri, Mar 3 - Fri, Apr 7

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

Class lecture participation and discussions *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 their final grades.

Samples of technical critiques will be distributed to course students at the beginning of the class.

One research technique protocol development assignment (30%)

Due: Fri, Apr 21

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

6.3 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 **March 03, 2023**. 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 21, 2023** 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.

Marking rubrics for students' class participation will be provided to class students at the beginning of the semester.

Specific guidelines regarding how to conduct technical critique of published research papers as well as marking rubrics will be provided to class students at the beginning of the semester.

Specific guidelines regarding how to develop a research technique protocol development assignment and marking rubrics will be provided to class students at the beginning of the semester.

7 Course Statements

7.1 Grading Policies

Students' assignments of technical critique of published research papers are to be submitted to the instructor as a Word file via the Dropbox on the CourseLink site by following the suggested due dates. Students' finalized research technique protocol development assignments as a Word file are to be submitted to the instructor via the Dropbox on the CourseLink site by following the suggested due dates. There will be a 5% reduction of grades for each day of late submission.

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. By enrolling in a course, unless explicitly stated and brought forward to their instructor, it is assumed that students agree to the possibility of being recorded during lecture, seminar or other "live" course activities, whether delivery is in-class or online/remote. If a student prefers not to be distinguishable during a recording, they may:

1. turn off their camera
2. mute their microphone
3. edit their name (e.g., initials only) upon entry to each session
4. use the chat function to pose questions.

Students who express to their instructor that they, or a reference to their name or person, do not wish to be recorded may discuss possible alternatives or accommodations with their instructor.

Online Behaviour

Inappropriate online behaviour will not be tolerated.

Examples of inappropriate online behaviour include:

- Posting inflammatory messages about your instructor or fellow students
- Using obscene or offensive language online
- Copying or presenting someone else's work as your own
- Adapting information from the Internet without using proper citations or references

- Buying or selling term papers or assignments
- Posting or selling course materials to course notes websites
- Having someone else complete your quiz or completing a quiz for/with another student
- Stating false claims about lost quiz answers or other assignment submissions
- Threatening or harassing a student or instructor online
- Discriminating against fellow students, instructors and/or TAs
- Using the course website to promote profit-driven products or services
- Attempting to compromise the security or functionality of the learning management system
- Sharing your user name and password
- Recording lectures without the permission 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 make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

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>

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

8.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- <https://news.uoguelph.ca/return-to-campus/how-u-of-g-is-preparing-for-your-safe-return/>
- <https://news.uoguelph.ca/return-to-campus/spaces/#ClassroomSpaces>

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
