Last Updated: August 2021

Experimental Methods in Agricultural and Food Sciences
Course Number: AGRI 2400
Faculty of Agricultural and Food Sciences

Academic Session: Fall 2021
Credit Hours: 3
Prerequisites: AGRI 1600 or HNSC 1200 or HNSC 1210 or the former AGRI 1500

Location:
Lecture: Online via Webex
Lab: Online via Webex

Meeting Days and Class Hours:
Lecture: MWF 8:30 – 9:20 AM
Lab: RF 2:30 – 5:25 PM, R 5:45 PM – 8:40 PM

Instructor Information

Name & Title:	Jordan Bannerman, Instructor, Department of Entomology
Email Address:	jordan.bannerman@umanitoba.ca
Office Location:	Animal Science/Entomology Building 206
Office Phone Number:	204-480-1021 (Messages left at this number are also emailed to me) Toll free 1-800-432-1960 ext. 1021
Office Hours:	Online (and potentially in-person) availability: 10:30 AM – 12:30 PM Monday and Wednesday (For a virtual appointment, book on Cisco Webex appointments tab), or by appointment via email

Course Description

Undergraduate Calendar Description
Experimental design and data analysis using examples relevant to agricultural, food and human nutritional sciences. Ethics in research; critical thinking in data analysis; quantitative data analysis methods; applications of statistical analyses. Prerequisite: AGRI 1600 or HNSC 1200 or HNSC 1210 or the former AGRI 1500.

Instructional Methods
Online lectures and laboratories using a combination of synchronous and asynchronous delivery. Lectures focus on core concepts: scientific method, ethics, experimental design, and data analysis. Labs promote hands-on learning using data relevant to agricultural, food and human nutritional sciences.

Course Objectives and Learning Outcomes
On completing this course, students should be able to
- implement the scientific method
- recognize the underlying principles of experimental design

- integrate ethical considerations into experimental design
- demonstrate the basic concepts of sampling
- apply critical thinking to quantitatively evaluate hypotheses
- design experiments to test scientific hypotheses
- formulate and perform appropriate statistical tests to evaluate hypotheses
- construct reports based on statistical analysis

Description of Examinations

***Lecture*:** There is one midterm, worth 20% and a cumulative final examination worth 30%. Both tests focus on course content delivered in the lecture portion of the course. Respondus lockdown browser is required.

Description of Assignments

Labs 2 thru 9 each include a mandatory assignment that will each be due at the beginning of the next scheduled lab. Altogether, these assignments are worth 50% of your overall course grade. For further details please review the "Lab assignment general guidelines" document on the course page.

Grade Evaluation

Midterm…… 20%
Final…… 30%
Lab Assignments…….. 50%

Letter Grade Equivalency:

A+ = >90%; A=80-89%; B+ =75-79%; B=70-74%; C+=65-69%; C=60-64%; D=50-59%; F=<50%.

Important Dates

First day of course……September 8, 2021
Voluntary withdrawal date…….. November 22, 2021
Fall Term Break…… November 8-12, 2021
Final day of course…….…… December 10, 2021
Exam period…… December 11-23, 2021

Texts, Readings, Materials

Required Texts: There are no required textbooks for this course.

Optional Texts: There are a variety of books that you might find useful (in addition to free materials available online), but most have strengths and weaknesses that I will highlight as best I can:

- McKillup, S. 2010. **Statistics explained**. 2nd ed. Cambridge University Press. Cambridge, UK. 403 pp.
  - Easy to understand coverage of most course topics but lacks sufficient depth for some.
  - Very conceptual in nature, taking a limited-math approach to most topics.
  - Best resource to understand why we are following the procedures we discuss.
  - Agriculture-based examples for some topics.
- Gotelli, N.J., and Ellison, A.M. 2013. **A primer of ecological statistics**. 2nd ed. Sinauer Associates, Inc. Publishers. Sunderland, MA. USA. 614 pp.
  - My favorite book for the topics covered in this course.
  - Coverage of some topics more advanced than ideal for a student's first experimental methods course.
  - Includes coverage of many topics not covered by this course.
  - Few agriculture-based examples.
- Quinn, G.P. and Keough, M.J. 2002. **Experimental design and analysis for biologists**. Cambridge University Press. Cambridge, UK. 537 pp.
  - Insufficient coverage of the 'basics' of scientific method and experimental design.
    - For most basic topics, this book primarily acts as a guide to where to find detailed coverage of most topics.
  - Excellent coverage of basic and advanced statistical analyses
  - Better suited for advanced or graduate level biostatistics courses

- There are many other statistics books for life scientists that are suitable for this course. Look to ensure the book covers the scientific method, experimental design, probability, ANOVA, and regression at minimum. If you are considering purchasing a textbook and want my opinion, please email me to discuss it.

Course Philosophy and Policies

Students' Learning Responsibilities

Students should approach this course with academic integrity, take responsibility for their actions and honor their academic commitments. Regular attendance to lectures and labs is essential for success in this course. Students are encouraged to ask for assistance whenever they feel it is necessary. Students should treat their fellow students with respect and foster a cooperative learning environment where other's ideas are heard and discussed.

How this course fits into the curriculum

This course is intended to provide the requisite experimental design and applied statistical background for students in all degree programs in the Faculty of Agricultural and Food Sciences. Students would typically take this in Fall or Winter Term of their second year. This course is a pre-requisite for ABIZ 3120 (Commodity Futures Markets), ABIZ (3080 Introduction to Econometrics), ABIZ 3540 (Financial Risk Management), FOOD 4510/HNSC 4280 (Food Product Development), HNSC 2000 (Research Methods and Presentation), HNSC 3260 (Food Quality Evaluation), HNSC 4270 (Sensory Evaluation of Food), HNSC 4290 (Food Nutrition and Health Policies). This course is a pre- or co-requisite for ABIZ 2520 (Introduction to Management Sciences).

Inquiries to Instructor

Students are encouraged to contact their instructor by e-mail or phone whenever assistance is required. You are required to obtain and use your U of M email account for all communication between yourself and the university.

UM Learn (https://universityofmanitoba.desire2learn.com/d2l/login)

Course materials (i.e. lecture notes and lab materials) will be uploaded to UM Learn, it is your responsibility to learn how to access this page.

Late Assignments

Penalties for late submission of assignments are 10% of the maximum grade per day late. For assignments submitted electronically, the timestamp/date when the e-mail is received into my inbox or the assignment is uploaded to Dropbox will be used as the assignment submission date.

Missed Assignments

Assignments ten or more days late will receive a mark of zero. When assignments are missed and excused through written notification such as a doctor's note, evidence of death in the family, or other circumstances beyond the control of the student, a new due date for the assignment may be arranged by contacting the instructor.

Recording of Classes

All synchronous online course lectures and labs will be recorded and posted. Jordan Bannerman holds copyright over the course materials, presentations and lectures which form part of this course. No additional audio or video recording of lectures or presentations is allowed in any format without Jordan Bannerman's permission. Course materials, both paper and digital, are for the participant's private study and research only, and are not to be distributed to others.

Academic Integrity

Plagiarism or any other form of cheating in examinations, term tests or academic work is subject to serious academic discipline. Cheating on examinations or tests may take the form of copying from another student or using unauthorized materials during an exam. Academic misconduct on exams and assignments can also include impersonation, duplicate submission, and inappropriate collaboration. A student found guilty of contributing to cheating in examinations or assignments is also subject to serious academic discipline. Electronic detection tools may be used to screen assignments in cases of suspected academic misconduct. Students should acquaint themselves with the University's policy on plagiarism, cheating, exam impersonation and duplicate submission at http://umanitoba.ca/student-supports/academic-supports/academic-integrity

Course schedule, Fall 2021

Week	Date	Tentative Lecture Topic	Lab topic
1	Sept 8	Course introduction, Why scientists need statistics	No Lab
	Sept 10	Scientific method	
2	Sept 13	Data and study types	Lab 1 – Software introduction
	Sept 15	Principles of experimental design	
	Sept 17	Principles of experimental design	
3	Sept 20	Principles of experimental design	Lab 2 – Experimental design
	Sept 22	Research ethics – Animals	
	Sept 24	Research ethics – Humans	
4	Sept 27	Data collection	Lab 3 – Data visualization
	Sept 29	Visualization	
	Oct 1	Probability to aid decision making	
5	Oct 4	A simple statistical analysis using chi-square	No Lab
	Oct 6	Distributions of random variables	
	Oct 8	The normal distribution	
6	Oct 11	Thanksgiving	Lab 4 – Summary statistics
	Oct 13	Using samples to infer characteristics of a population	
	Oct 15	Using samples to infer characteristics of a population	
7	Oct 18	Tests for comparing means of one and two samples	Lab 5 – *t* tests
	Oct 20	Tests for comparing means of one and two samples	
	Oct 22	Tests for comparing means of one and two samples	
8	Oct 25	**Midterm**	No Lab
	Oct 27	Error, power, and biological significance	
	Oct 29	Error, power, and biological significance	
9	Nov 1	Single-factor analysis of variance	Lab 6 – Analysis of variance 1
	Nov 3	Single-factor analysis of variance	
	Nov 5	Single-factor analysis of variance	
10	Nov 8	Fall Break	No Lab
	Nov 10		
	Nov 12		
11	Nov 15	Multiple comparisons for analysis of variance	Lab 7 – Analysis of variance 2
	Nov 17	RCB analysis of variance	
	Nov 19	RCB analysis of variance	
12	Nov 22	Two-factor analysis of variance	Lab 8 – Analysis of variance 3
	Nov 24	Two-factor analysis of variance	
	Nov 26	Split plot and Latin square designs	
13	Nov 29	Linear regression and correlation	Lab 9 – Correlation and regression
	Dec 1	Linear regression and correlation	
	Dec 3	Linear regression and correlation	
14	Dec 6	Chi-Square revisited	No Lab
	Dec 8	Other non-parametric tests	
	Dec 10	Flex	