BIOL 3583 FA01: Eukaryotic Microbiology

Part 1: Course information

Professor

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Course description and prerequisites

This course is an introduction to the structure, function, evolution and biodiversity of unicellular eukaryotic organisms, including protozoa, microbial fungi and unicellular algae. The ecology of free-living eukaryotic microbes and the immune responses of humans and other animals against pathogenic species will be discussed in detail. Laboratories include experiments with live protozoa and microscopical observations of prepared microbes. Prerequisites of this course are BIOL2013 (Cell and Molecular Biology), BIOL2053 (Microbial Biodiversity), and BIOL2073 (Animal Biodiversity), each with a minimum grade of C-.

Course format, materials, and communications

- lecture material will be presented in-person as 50-min lectures in Slot 2 (i.e., MWF from 9:30 to 10:20) in HSH 019 (see **Section 2.1: Lecture outline** for more details)
- laboratory sections will meet weekly according to the following schedule, and will begin on Monday, September 21 (see **Section 2.2: Laboratory outline** for more details):
  BIOL 3580L FA01: Slot 31 (Monday from 13:00 to 16:00), MAH (BIO) 250
  BIOL 3580L FA02: Slot 40 (Monday from 18:30 to 21:30), MAH (BIO) 250
- students must attain a minimum grade of 60% in the laboratory section of the course to obtain major credit
- this course requires either a computer, tablet, or phone to access PowerPoint lecture slides and Word documents (i.e., syllabus, other documents) from the Moodle page for the course
- there is not a primary textbook for this course; for both lectures and laboratories, I use information gathered from several current textbooks and review papers, supplemented with relevant primary literature from recent journal publications
- I prefer to communicate by e-mail, either to the entire class from Moodle e-mail or to individual students by standard e-mail, and whenever possible on Monday to Friday between 7:00 and 17:00
- please communicate by e-mail **from your Acadia e-mail address**, and not by text or by Teams, and do so whenever possible on Monday to Friday between 7:00 and 17:00
- you are free to send messages outside these times, but I cannot guarantee that I will respond to your message until the next business day
- if I have to cancel a lecture or laboratory section, I will communicate this action, as well as any rescheduling, as soon as possible by Moodle e-mail

Student learning outcomes

- understand how we define a eukaryotic microbe, and learn how these organisms are absolutely crucial cogs in all communities and ecosystems on the planet
- understand the diversity of all major groups, and some minor groups, of free-living and parasitic eukaryotic microbes
- understand structural and functional features of eukaryotic microbes, with emphasis on how these features enable successful colonisation and growth in their habitat
- understand how parasitic eukaryotic microbes of medical and veterinary importance cause disease in humans and non-human mammals
- understand the relationships between unicellular and multicellular eukaryotes on an evolutionary level
- examine eukaryotic microbes, from pond water, culture dishes, or prepared slides, to observe important biological features
- identify common species of eukaryotic microbes to a level of proficiency that would be expected in a scientific laboratory
- you will meet the objectives listed above through a combination of:
  - attending all lectures, taking notes during lecture, and asking for clarification in lecture or during office hours if you are unsure of material
  - studying on a regular basis: for each hour of lecture, students should spend at least one hour rereading or rewriting lecture notes, and reviewing and studying material for tests
  - preparing for, attending, and actively participating in, all laboratories (see **Part 2.2: Laboratory outline**)

Part 2.1: Lecture outline

List of lecture topics

Date	Lecture	Topic
September 9	1	Introduction to Eukaryotic Microbiology
September 11	2	What are eukaryotic microbes?
September 14	3	Cellular organisation of eukaryotic microbes
September 16	4	Evolution and distribution of protists
September 18	5	Morphological features of protists
September 21	6	Motility of eukaryotic microbes
September 23	7	Nutrition in protists
September 25	8	Reproductive strategies of eukaryotic microbes
September 28	9	Molecular biology of protists
September 30		TRUTH AND RECONCILIATION DAY
October 2	11	Ecology of protists
October 5	12	Symbiosis involving eukaryotic microbes
October 7	13	Amitochondriate flagellates: fornicates
October 9	14	Amitochondriate flagellates: parabasalids

October 12		THANKSGIVING DAY
October 14		READING WEEK
October 16		READING WEEK
October 19	15	Euglenozoan flagellates
October 21	16	Sleeping sickness
October 23		Annual meeting of the Atlantic Canada Association of Parasitologists
October 26	17	Chagas disease
October 28	18	Amoeboflagellates
October 30	19	Ciliates
November 2	20	Biodiversity of ciliates
November 4	21	Dinoflagellates
November 6	22	Apicomplexa
November 9	23	Gregarines and blood-dwelling Apicomplexa
November 11		REMEMBRANCE DAY
November 13	24	Guest Lecture by Alastair Simpson, Dalhousie University
November 16	25	Malaria parasites
November 18	26	Malaria
November 20	27	One-host coccidia
November 23	28	Two-host coccidia
November 25	29	Heterotrophic chromists
November 27	30	Autotrophic chromists
November 30	31	Rhizarians
December 2	32	Hacrobians and archaeplastidans
December 4	33	Lobose amoebae and slime moulds
December 7	34	Amitochondriate amoebae
December 9	35	Opisthokonts

Part 2.2: Laboratory outline

Instructor

Dr Todd Smith (he/him/his)
Biology Building, room 334 (office), room 341 (research laboratory)
phone: (902) 670-3122 (office)
e-mail: todd.smith@acadiau.ca
office hours: Wednesday from 11:30 to 16:30

Teaching assistants

BIOL3580L 01: none this year
BIOL3580L 02: none this year

Outline

The laboratories in this course will feature examination of eukaryotic microbes, either alive in pond water, alive in pure cultures, alive in freshly dissected invertebrates, or preserved on microscope slides, to observe biological features that are found in this group of organisms.

List of laboratory topics

Date	Lab	Topic
September 14		NOT A LAB
September 21	1	Pond life, part 1 (assignment 0%)
September 28	2	Pond life, part 2 (assignment 1%)
October 5		Lecture test 1 on Lectures 2 to 11 (in lab period, in BIO 250, 20%)
October 12		THANKSGIVING DAY and READING WEEK
October 19	3	Eukaryotic microbes as parasites (assignment 1%)
October 26	4	Biodiversity of eukaryotic microbes, part 1 (quiz 2%, assignment 2%)
November 2	5	Biodiversity of eukaryotic microbes, part 2 (quiz 2%, assignment 2%)
November 9		Lecture test 2 on Lectures 12 to 21 (in lab period, in BIO 250, 20%)
November 16		NOT A LAB
November 23	6	Biodiversity of eukaryotic microbes, part 3 (quiz 2%, assignment 2%)
November 30	7	Biodiversity of eukaryotic microbes, part 4 (quiz 2%, assignment 2%)
December 7	8	Laboratory test on Labs 4, 5, 6, and 7 (12%)

Laboratory quizzes, assignments, and test (30% of the overall grade in the course)

- there are two assignments for each of the biodiversity labs (i.e., Labs 4, 5, 6, and 7)
  - pre-lab multiple-choice quiz with six questions (2% x 4 labs = 8%)
  - open-book hand-in assignment with six questions (2% x 4 labs = 8%)
- there is only an open-book, hand-in assignment for Pond life, part 2 (Lab 2, 1%) and for Eukaryotic microbes as parasites (Lab 3, 1%)
- laboratory test is a bell-ringer evaluation with 36 questions based on 30 specimens from the four biodiversity labs (i.e., Labs 4, 5, 6, and 7) that will be shown on the projection screen, worth 12% of overall grade in the course
  - you will have 60 s, or two of views of each short ~30 s video, to answer one or two multiple-choice questions for each specimen

Part 3: Grading policy

Graded course activities

Lecture test 1 on Lectures 2 to 11 (not 10) on Monday, October 5 (in lab period, in BIO 250)	20%
Lecture test 2 on Lectures 12 to 21 on Monday, November 9 (in lab period, in BIO 250)	20%
Lecture test 3 on Lectures 22 to 35 during exam period on date TBA in room TBA	30%
Laboratory quizzes, assignments, and test (see Part 2.2: Laboratory outline)	30%

Grading system (for all courses at Acadia University that use a numerical grading scheme)

A+	90-100	C+	67-69
A	85-89	C	63-66
A-	80-84	C-	60-62
B+	77-79	D+	57-59
B	73-76	D	53-56
B-	70-72	D-	50-52
		F	0-49

Part 4. Course policies

Lectures

1 PowerPoint slides for each lecture are posted on Moodle before each lecture
   - download or print off slides, take supplementary notes during lecture
   - research has shown that students who take notes by hand perform significantly better in situations that evaluate their ability to retain information

2 not **all** the information in the lecture is included on slides
   - you are expected to attend every lecture in person whenever possible; please do not skip lectures, or you will miss material that I provide verbally (i.e., not on slides)

3 when using electronic devices during lectures, limit their use to classroom material **only**
   - using these devices for other purposes (e.g., social media) will negatively impact your ability to learn, and is rude and disrespectful to other students

4 do not chat about topics unrelated to the course to other students during lectures
   - this behaviour is disruptive to me, and is disruptive to students who are not involved in the conversation

Tests

1 there will be three tests on lecture material (i.e., Lecture tests 1 to 3 in Part 3: Grading policy), and lab material will **not** be included on these tests

2 tests are based on topics covered on slides in lecture, information provided verbally in lecture, and any assigned readings or articles

3 for some test questions, you will be asked to apply what you have previously learned in lecture to new situations

4 format of Lecture tests 1 and 2 will be as follows (i.e., Lecture test 3 is during the exam period and will have some specific changes with regard to date, location, and timing):

- tests will be run in your regularly scheduled lab period (i.e., Monday afternoon or Monday evening), in your regular lab room (i.e., BIO 250)
- time for these tests is 120 min (i.e., 2 hr), which should ensure that you have enough time to write a 90-min test, i.e., time should not be a factor for completing the test
- tests will be run on Moodle on your laptop, and can be accessed between 13:00 and 15:00 (afternoon lab) or between 18:30 and 20:30 (evening lab) in BIO 250
- questions consist of long-answer questions and multiple-choice questions, and you may navigate between questions as often as you wish during the time limit
- there is **not** a penalty for changing your answer or choosing a wrong answer on the multiple-choice questions
- any test that is still open at the time limit will be submitted automatically, i.e., you do not have to submit the test before time expires

5 you will be allowed a crib sheet to use during tests, with specific instructions as follows:

- you can write anything on **two** sides of **one** 8.5" x 11" sheet of paper that is to be kept on your desk when writing and then handed to me when you leave the test room
- all writing must be transcribed **by hand** at a size that I can read (i.e., with my glasses on); ask me before the test if you are not sure about the size of your writing
- you are **not** allowed to cut and paste textbook diagrams or other media (e.g., photos) from lecture slides onto the sheet, i.e., everything must be written or drawn by hand

Missed tests or laboratories

1 if a **legitimate** activity is scheduled at the same time as a test or laboratory, please inform me at least two weeks prior to the scheduled date so that we can set a new time for the test

- list of legitimate activities: varsity or club games, essential appointments
- list of illegitimate activities: varsity or club practices, vacations, lack of time to study due to other commitments

2 if you are unable to write a test or attend a laboratory due to a sudden medical or compassionate issue, provide the Registrar with a Declaration of Cause for Absence form: https://registrar.acadiau.ca/files/sites/registrar/Forms/Forms/Declaration of Cause fillable.pdf

3 I will attempt to reschedule a missed test at some point **after** the regularly scheduled date, but not **before**

4 if you or the Registrar do not provide me with a legitimate reason for missing a test or laboratory, you will be assigned a mark of zero for that test or laboratory

5 I do not provide opportunities for make-up tests for poor performance, nor do I drop the lowest test mark or adjust the values of previously written tests

Part 5. University policies

University policies

University policies, including important calendar dates and the last day to drop a course and receive a W, are available in the Acadia University Academic Calendar: https://registrar.acadiau.ca/AcademicCalendars.html

Academic integrity

Academic integrity demands responsible use of the work of other scholars. It is compromised by academic dishonesty such as cheating and plagiarism. A student who is uncertain whether or not a course of action might constitute cheating or plagiarism should seek in advance the advice of the instructor involved. The following are considered infractions of academic integrity and may lead to sanction:

- cheating is copying or the use of unauthorized aids or the intentional falsification or invention of information in any academic exercise
- plagiarism is the act of presenting the ideas or words of another person as one's own; students are required to acknowledge and document the sources of ideas that they use in their written work
- self-plagiarism is also a form of plagiarism, i.e., it is the presentation of the same work in more than one course without the permission of the instructors involved.
- a student who knowingly helps another to commit an act of academic dishonesty is equally guilty

Penalties are levied in relation to the degree of the relevant infraction. They range from requiring the student to re-do the piece of work, through failure on that piece of work, to failure in the course, and to dismissal from the University. See page 40 of the Acadia University Academic Calendar at https://registrar.acadiau.ca/AcademicCalendars.html for more information.

Copyright and intellectual property

Spoken and written course content, including the syllabus, lectures, laboratories, assignments, quizzes, tests, and exams, are the intellectual property of the instructor and may only be copied for personal use. Sharing these materials or uploading them where other people may access them is a violation of copyright. If you wish to make audio, video, or photographic recordings in class, you must first obtain the consent of the instructor and of any other persons (e.g., guest speakers, other students) who may be captured in such recordings. In the case of personal use by students with disabilities, the instructor's consent shall not be unreasonably withheld. Information on copyright and course content from Acadia University is available through Vaughan Memorial Library: http://libguides.acadiau.ca/c.php?g=433650&p=5027078

Accessible Learning Services

Acadia University is dedicated to improving access to campus life for all students with disabilities. Although we attempt to ensure that all courses are accessible, we recognise that there are barriers that need to be addressed on an individual basis. Students who require accommodations to complete coursework or otherwise fully participate in class should contact Accessible Learning Services at accessible.learning@acadiau.ca as soon as possible. More information is also available at the Acccesible Learning Services website.

Use of animals in teaching and research

The use of animals in teaching and research at Acadia University is undertaken in accordance with guidelines on the care and use of animals published by the Canadian Council on Animal Care (CCAC). For more information, please visit the CCAC website at http://www.ccac.ca

Artificial intelligence (AI) policy

Students are not allowed to use generative AI (Gen AI) tools, including AI chatbots (e.g., ChatGPT, Google Gemini, Claude, CoPilot) AI image generators (e.g., DALL-E, Midjourney, Stable Diffusion, Adobe Firefly), AI code generators (e.g., CoPilot, Tabnine, Cody), or AI audio or music generators (e.g., Amper, AIVA, Soundful), **on any assignment in this course unless specific permission is granted**. Gen AI output 1) imitates or summarises existing content without permission of original content owners, 2) has ethical, social, and human costs during RLHF (Reinforcement Learning from Human Feedback), 3) has an absolutely enormous carbon footprint, consuming huge amounts of power and water, and, in order to build more data centres, massive tracts of land, 4) greatly weakens the ability of humans to create, to reason, to think critically and show judgement, to solve complex problems, and to retain memories, and 5) is inequitable in that some students with challenging financial situations cannot access the same Gen AI tools as other students.

If you as a student are struggling and feeling pressure in this course or others, do not resort to chatbots as a shortcut to completing assignments. Please arrange to meet with me to discuss your challenges so that we can discuss solutions that will help you succeed.

Part 6. Program level outcomes

Foundations of knowledge		**Course specific examples**	**Proficiency** 1-Introduction 2-Reinforcement 3-Proficient
Scientific method, inquiry, and hypothesis testing	Find, understand, and apply information from the literature; understand how to use the scientific method to examine problems from different perspectives	Emphasis throughout course on observation, hypothesis testing, methodologies (developmental, molecular biological, ecological), data analysis, and interpretation	2
Historical concepts and contributions by important figures	Explain foundational concepts in biology, Two-eyed Seeing, and ethical implications of scientific discoveries	Foundational concepts in eukaryotic microbiology; contributions to field by important historical figures, with emphasis on contributions by women and BIPOC	2
Biodiversity and ecology	Understand the genetic, taxonomic and ecosystem levels of biodiversity; focus on SW Nova including the Acadian Forest and Bay of Fundy ecosystems	Heavy emphasis on biodiversity of eukaryotic microbes and the ecological role that they play in all environments, including human, veterinary, terrestrial, and aquatic	3
Genetics and evolution	Understand the chemical basis of heredity, genetics, and genomics; integrate concepts across disciplines to understand evolution	Three-lecture unit on endosymbiosis, molecular genetics of eukaryotic microbes, and various symbioses between protists and their symbionts or hosts	2
Human and environmental health	Understand form and function in health and disease within a One Health framework, integrating human and environmental health	Heavy emphasis on effects of parasitic protists of humans, veterinary animals, and wildlife; importance of protists in environments subject to climate change	3
Lab and field skills			
Experimental design	Gain experience in applying the scientific method	Labs focus on knowledge of protist structures and life history adaptations as a means for identification, which build toward a final lab test on identification proficiency	2
Safety	Work safely and productively in lab and field settings	Investigation of live specimens from biological supply companies to augment static material; safety in handling live and preserved material is consistently emphasised	2
Lab skills	Gain experience with basic and advanced lab techniques and understand their application in research, health science, and industry	Lab skills acquired by students include protist identification for various careers; dissection of insects for isolation of parasitic protists; microscopical techniques	3
Field skills	Gain experience in basic and advanced field skills and understand their application in ecology, conservation biology, and environmental change	Two labs devoted entirely to the collection of pond water for analysis of protozoa and algae; one collection as a group, led by the Instructor, the second one individually	2
Data acquisition, analysis, and interpretation	Collect data, present results both qualitatively and quantitatively, and interpret outcomes in light of the literature	Analysis of organisms collected in pond water samples and comparison between two collections; correlation between biodiversity of protists and abiotic factors (i.e., salinity, O2	2
Statistical analysis	Use R and or other programs to analyze biological data	Use of Excel and statistical techniques to determine significance of correlations between biodiversity and abiotic factors in water samples from various locations	2

Professional skills			
Ethical practices	Demonstrate ethical conduct, apply principles of academic integrity, and understand the principles of EDI in science	Biomedical and environmental ethics; emphasis on inequities of health care and resource distribution among and within nations, and effects on environments	2
Collaboration and group work	Work effectively in groups within and across disciplines	Students work in pairs or as a four-person bench in laboratory sections; resolution of conflicts is encouraged at student level before intervention by TA's or Instructor	2
Critical thinking	Analyze and evaluate information to make science-based decisions	Tests do not involve regurgitation of material, but rather application of knowledge and concepts from lectures and laboratories to answer novel, critical-thinking questions	2
Computer proficiency	Use common and discipline- specific software	Expectation and enhancement of proficiency with websites, databases, Word, Excel, and PowerPoint for both lectures and laboratory sections	2
Scientific communication	Communicate science effectively to both scientific and general audiences	Emphasis in lectures and laboratories of disseminating novel results in literature and on using multiple sources to build lectures and lab exercises	2