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. The prerequisites of this course are BIOL2013 (Cell and Molecular Biology), BIOL2043 (Biodiversity of Plants and Algae), BIOL2053 (Microbial Biodiversity), and BIOL2073 (Animal Biodiversity), each with a minimum grade of C-.

Textbooks that will be used as a source of lecture notes and images

There is not one primary textbook for this course. For both lectures and laboratories, I use information a number of current textbooks and review papers, supplemented with relevant primary literature from recent journal publications.

Course requirements

- computer, tablet, or phone to access PowerPoint lecture slides and Word documents (i.e., syllabus, other documents) from the Moodle page for the course

Course structure

- lecture material will be presented as 50-min lectures in Slot 2 (Monday, Wednesday, and Friday from 9:30 to 10:20) in PAT 213 (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 9 (see **Section 2.2: Laboratory outline** for more details):
  BIOL 3580L FA01: Slot 31 (Monday, 13:00 to 16:00), BIO 250
  BIOL 3580L FA02: Slot 40 (Monday, 18:30 to 21:30), BIO 250

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 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 4	1	Introduction to Eukaryotic Microbiology
September 6	2	What are eukaryotic microbes?
September 9	3	Cellular organisation of eukaryotic microbes
September 11	4	Evolution and distribution of protists
September 13	5	Morphological features of protists
September 16	6	Motility of eukaryotic microbes
September 18	7	Nutrition in protists
September 20	8	Reproductive strategies of eukaryotic microbes
September 23	9	Molecular biology of protists
September 25	10	Behaviour of eukaryotic microbes
September 27	11	Ecology of protists
September 30		DAY FOR TRUTH AND RECONCILIATION
October 2	12	Symbiosis involving eukaryotic microbes
October 4	13	Amitochondriate flagellates: fornicates

October 7	14	Amitochondriate flagellates: parabasalids
October 9	15	Euglenozoan flagellates
October 11	16	Sleeping sickness
October 14		THANKSGIVING DAY
October 16		READING WEEK
October 18		READING WEEK
October 21	17	Chagas disease
October 23	18	Amoeboflagellates
October 25	19	Ciliates
October 28	20	Biodiversity of ciliates
October 30	21	Dinoflagellates
November 1	22	Apicomplexa
November 4	23	Gregarines and blood-dwelling Apicomplexa
November 6	24	Malaria parasites
November 8	25	Malaria
November 11		REMEMBRANCE DAY
November 13	26	One-host coccidia
November 15	35	Metabolism of amitochondriate protists (lecture by Alastair Simpson)
November 18	27	Two-host coccidia
November 20	28	Heterotrophic chromists
November 22	29	Autotrophic chromists
November 25	30	Rhizarians
November 27	31	Hacrobians and archaeplastidans
November 29	32	Lobose amoebae and slime moulds
December 2	33	Amitochondriate amoebae
December 4	34	Opisthokonts

Part 2.2: Laboratory outline

Instructor

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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 9	1	Pond life, part 1 (assignment 0%)
September 16	2	Pond life, part 2 (assignment 1%)
September 23	3	Eukaryotic microbes as parasites (assignment 1%)
September 30		DAY FOR TRUTH AND RECONCILIATION
October 7		Lecture test 1 on Lectures 2 to 11 (in lab period, in BIO 250)
October 14		THANKSGIVING DAY
October 21	4	Biodiversity of eukaryotic microbes, part 1 (quiz 2%, assignment 2%)
October 28	5	Biodiversity of eukaryotic microbes, part 2 (quiz 2%, assignment 2%)
November 4		Lecture test 2 on Lectures 12 to 21 (in lab period, in BIO 250)
November 11		REMEMBRANCE DAY
November 18	6	Biodiversity of eukaryotic microbes, part 3 (quiz 2%, assignment 2%)
November 25	7	Biodiversity of eukaryotic microbes, part 4 (quiz 2%, assignment 2%)
December 2	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 ten 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%)
- there is a multiple-choice lab test with 36 questions based on the four biodiversity labs (i.e., labs 4, 5, 6, and 7), worth 12% of overall grade in the course
  - test will conducted at the beginning of Lab 8 (Monday, December 2)
  - all specimens will be shown on projection screen
  - you will have 60 s for each specimen, or two of views of each short ~30 s video, to answer one or two questions

Part 3: Grading policy

Graded course activities

Lecture test 1 on Lectures 2 to 11 on Monday, October 7 (in lab period, in BIO 250)	20%
Lecture test 2 on Lectures 12 to 21 on Monday, November 4 (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 class
- 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 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 (Lecture test 3 is during the exam period and will have some specific changes with regard to time, 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 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
- special considerations to ensure academic integrity, including restrictions on access to other laptop programs, will be in place

5 you will be allowed a crib sheet to use during tests, with specific instructions as follows:
- you can write anything on **one** side 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; writing on an iPad and then printing is fine, but tablet notes cannot be shrunk to a size that I cannot read (i.e., with my glasses on)
- 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
- 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, helping friends move their belongings to another house (!)

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

Equity, diversity, and inclusion

Acadia University is committed to becoming a culturally safe and anti-oppressive community. This can only be achieved where there are simultaneous efforts to eliminate all forms of discrimination and harassment from our campus community, including the elimination of all discrimination, harassment and violence based on one's identity, including but not limited to, gender, race, class, ethnicity, sexual orientation, disability, gender identity, gender expression, and Indigeneity. The policy against harassment and discrimination, and resources for students who believe they may have experienced or witnessed discrimination or harassment, are available here: https://www2.acadiau.ca/student-life/equity-judicial/equity.html

Students requiring accommodations

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 recognize 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 as soon as possible: accessible.learning@acadiau.ca

Use of animals in teaching and research

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

Commitment to integrity

It is standard practice in the Department of Biology to check exams and assignments for cheating and plagiarism. Cheating in the lecture or laboratory sections of the course, including plagiarism, will absolutely not be tolerated. Please read the appropriate sections of the current Acadia University Academic Calendar: https://registrar.acadiau.ca/AcademicCalendars.html

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

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