DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of Biology
BIOL 3102 [10311 (10312-3)]
Microbial Eukaryotes: Biodiversity and Evolution
Fall 2020

Instructor: Alastair Simpson alastair.simpson@dal.ca Open-door virtual office: 9:30 am -5:00 pm AT*
Please email to arrange virtual office meeting
via Zoom, Teams, Collaborate Ultra or Phone

Lectures: Mondays, Wednesdays: 10:35 am - 11:25 am AT*

Fridays: 10:35 am - 12:25 pm AT* unless superseded by a lab exercise or test

These lectures are held using Collaborate Ultra and are synchronous and interactive; They are paralleled by asynchronous recorded versions (see course materials #6)

Laboratories: 5 virtual lab exercises; certain Fridays (see timetable): 10:35 am - 12:25 pm AT*

This instruction is synchronous and interactive, delivered via Collaborate Ultra

Tutorials: None

** AT = Atlantic Time: All times in this syllabus are given in Atlantic Time, i.e. ADT in September and October, AST in November and December. Please note that clocks change on different dates in different countries.*

Course Description

Microbial eukaryotes are of tremendous ecological, evolutionary and medical/veterinary importance. This course provides a comprehensive understanding of the biodiversity and evolution of both algal and protozoan eukaryotes, and examines important aspects of their organismal biology, including cell and genome organization, life histories, trophic strategies, locomotion and symbiosis.

Course Prerequisites

BIOL 2020.03 (or BIOA 2001.03) and BIOL 2004.03 (or MICI 2100.03)

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Course Objectives/Learning Outcomes

- Describe the basic biology of the most important major groups of microbial eukaryotes.
- Describe the nature and role of the cytoskeleton in microbial eukaryotes (esp. flagellar apparatus, including replication)
- Explain the composition and synthesis of several important types of mineralised scales and tests of microbial eukaryotes
- Explain, and contrast the cellular basis and relevant hydrodynamic considerations for major forms of i) swimming, ii) gliding and iii) amoeboid locomotion by microbial eukaryotes.
- Describe and contrast major feeding modes for phagotrophic microbial eukaryotes.
- Understand the functions of major structures/life history stages often represented specifically in microbial eukaryotes (e.g. extrusomes, cysts)
- Describe the functions of major types of mitochondrion-related organelles in anaerobic eukaryotes.
- Contrast primary, secondary and tertiary plastid endosymbiosis, including the evolutionary pattern of occurrence, and protein targeting.
- Describe the basic evolutionary tree, and early evolutionary history, of eukaryotes; further, show understanding of major unresolved questions in eukaryote evolution.

Course Materials

The material for the course is that which is covered in the lectures and lab exercises. There is no single textbook or course pack for this course. The following resources will be made available instead:

1) The lecture slides will be made available online **after** each lecture, **in edited form** (i.e. you should take notes during lectures themselves).

2) There will be supplementary notes for most (but not all) of the lectures, especially in Parts 1 and 2 (see **course content**, below). These will be made available online in .pdf format before the relevant part or subsection of the course.

3) There will be a small number of short readings (e.g. review papers) that you will be expected to read during the course. These will be provided in class or online prior to the relevant lecture.

4) Handout/worksheets for each **lab exercise** (see above) will be provided online.

5) The "Handbook of the Protists" edited by Archibald, Simpson and Slamovits (2017) is available from the Dalhousie Libraries as an e-book. It is an *optional* resource, especially for Part 1 of the course.

6) A version of each lecture will be provided online as a Panopto recording. This is an asynchronous parallel to the interactive synchronous lectures. This is in place especially for (but not restricted to) cases where a student cannot participate in a synchronous lecture due to their other activities or technical difficulties. *These asynchronous lecture recordings will cover all the examinable material for the course.*

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Course Materials (cont.)

The course Brightspace site (https://dal.brightspace.com/d2l/home/130320) will be the primary management tool for the course. In particular, note the following:

1) The synchronous lectures and lab exercises will be conducted through the **Collaborate Ultra** tool, accessed via Brightspace
2) All the course materials described above will be housed on the course Brightspace site.
3) Quizzes and Tests will be delivered through Brightspace.

Course Assessment

Component	Weight (% of final grade)	Date/Time
Tests/quizzes		
Test 1	20%	2 October, 2020; 10:35 am - 12:25 pm AT
Test 2	26%	20 November, 2020; 10:35 am - 12:25 pm AT
Test 3	17%	In final exam period. Date/Time TBA; 2 hours
Quizzes (best 6 of 9)	12% total	Most Mondays 10:35 am AT (see **Calendar)**
Assignments		
Lab exercise reports (5)	25% total	Following each Lab (see **Calendar**)

Other course requirements

There are no other course requirements in addition to the assessment components above

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	**B+** (77-79)	**C+** (65-69)	**D** (50-54)
A (85-89)	**B** (73-76)	**C** (60-64)	**F** (<50)
A- (80-84)	**B-** (70-72)	**C-** (55-59)	

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Course Policies

Late Assignments: The due dates for lab assignments will normally be the Friday following the lab exercise, unless otherwise posted on the worksheet. Late assignments will be penalised 0.5 marks (out of 5) for every part or whole week late, and any commitments made by the instructor to return the marked assignment by a certain date (e.g. prior to a test) will not apply. *If you know in advance that you will be unable to complete an assignment on time due to circumstances beyond your control, please contact the instructor so that a reasonable alternative due date can be agreed.*

Missed Tests: the policy for rescheduling a missed test will be as follows:

> A student requesting an alternative time shall be granted that request only in exceptional circumstances. Such circumstances include illness (with student declaration of absence - SDA) or other mitigating circumstances outside the control of the student. Varsity sport is a legitimate circumstance, providing reasonable prior warning (a week or more) is given to the instructor. Elective arrangements, such as travel plans, are not considered acceptable grounds for granting an alternative examination time.

Missed tests will be rescheduled as soon as practical after the original test, and will be similar in format to the original test.

Use of SDAs: Up to three SDAs will be accepted during the course in Fall 2020

Missed Quizzes: 'Quizzes' cannot be taken after the original time. Please note, however, that only 6 of your quiz marks will count to your final grade, so up to 3 quizzes can be missed without reducing your maximum possible mark for the course. *If you know in advance that you will miss a significant number of quizzes, please contact the instructor so that alternative arrangements can be made.*

Cancelled classes: If a synchronous lecture is cancelled. it will normally be given in the next available lecture slot. The remaining lecture schedule will be adjusted as needed.

In the unlikely event that a lab exercise has to be cancelled, we will similarly attempt to shift the lab schedule (including adding an extra Friday to the lab schedule), which likely will involve also changing the lecture schedule. If it is impossible to reschedule a lab, the other lab assignments will be evenly reweighted such that the total lab mark remains as 25% of the total course mark.

Policy on Collaboration: This policy is relevant for the completion of the lab exercise reports. Some of the actual work is inherently collaborative (example: the entire class making similar measurements, then sharing them to generate a larger dataset). However, unless explicitly stated otherwise in the worksheet, all components of all lab reports are to be done individually, and will be marked as the individual work of the student submitting the report.

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Course Content

1) Lectures:

The lecture component of the course is divided into three Parts, described below (see **Calendar** on the next page for a full listing of planned lecture titles).

Part 1 (Lectures 1-11): **Introduction to microbial eukaryote biodiversity -** An overview/revision of the diversity of microbial eukaryotes, emphasising the particular biology of some important and relatively well-studied groups.

Part 2 (Lectures 12-22): **Microbial eukaryotes as organisms -** The organization of the cytoskeleton, and examination of cell biological features particular to microbial eukaryotes (mineral scales, cysts, extrusomes, etc); Locomotion and nutrition (especially feeding).

Part 3 (Lectures 23-29): **Topics in microbial eukaryote evolution -** e.g. How we infer deep eukaryote evolution; Endosymbiosis, and the evolution and cell biology of the endosymbiotic organelles (plastids, mitochondria etc), emphasizing special kinds of these organelles found in various microbial eukaryotes; Current controversies in understanding the diversity and evolution of microbial eukaryotes, including the nature of its fossil record, and the extant diversity of protists.

The synchronous lectures will begin at 10:35 am AST, using the Collaborate Ultra platform within Brightspace. Monday and Wednesday lectures run for 50 minutes. Friday lectures are scheduled **for an hour and 50 minutes** (10:35 am-12:25 pm), though we will take an intermission in the middle, if using the full time.

Note that there are synchronous lectures on only **some** Fridays because there is often a Lab Exercise or Test scheduled instead (see below).

Each of the three Tests (see **Assessment**, above) follows immediately after one of these Parts. It will examine you on that particular Part. Material from Part 1 is 'assumed knowledge' for Parts 2 and 3, but will **not** be directly tested in Tests 2 and 3.

2) Lab exercises:

There are five lab exercises scheduled. In most cases these simulate as closely as practical the labs we would run in a normal year. The synchronous session to describe and discuss the exercise will be held on various Fridays through the semester, in place of a lecture (see **Calendar** on the next page).

The lab exercise work sheets will be made available with each lab exercise (see below) and will normally be due to be submitted on the Friday of the following week.

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Calendar

	Date	Day	Time (AT)	Activity	Quiz
Sept	9	Wed	10:35-11:25	Lecture 1: Orientation, Introduction	
	11	Fri	10:35-12:25	Lecture 2: Archaeplastida, 'Minor' algae	
	14	Mon	10:35-11:25	Lecture 3: Stramenopiles 1	(practice)
	16	Wed	10:35-11:25	Lecture 4: Stramenopiles 2	
	18	**Fri**	**10:35-12:25**	**LAB EXERCISE 1**	
	21	Mon	10:35-11:25	Lecture 5: Alveolates 1	***
	23	Wed	10:35-11:25	Lecture 6: Alveolates 2	
	25	Fri	10:35-12:25	Lecture 7: Alveolates 3; Rhizaria	
	28	Mon	10:35-11:25	Lecture 8: Amoebozoa	***
	30	Wed	10:35-11:25	Lecture 9: Opisthokonts; Excavates 1	
Oct	**2**	**Fri**	**10:35-12:25**	**LAB EXERCISE 2**	
	5	Mon	10:35-11:25	Lecture 10: Excavates 2	***
	7	Wed	10:35-11:25	Lecture 11: Miscellaneous groups	
	9	**Fri**	**10:35-12:25**	**TEST 1**	
	12	*Mon*	*Dal closed*	*None - Thanksgiving*	
	14	Wed	10:35-11:25	Lecture 12: Form 1	
	16	Fri	10:35-12:25	Lecture 13: Form 2	
	19	Mon	10:35-11:25	Lecture 14: Form 3	***
	21	Wed	10:35-11:25	Lecture 15: Motility 1	
	23	**Fri**	**10:35-12:25**	**LAB EXERCISE 3**	
	26	Mon	10:35-11:25	Lecture 16: Motility 2	***
	28	Wed	10:35-11:25	Lecture 17: Motility 3	
	30	Fri	10:35-12:25	Lecture 18: Motility 4; Cysts	
Nov	2	Mon	10:35-11:25	Lecture 19: Contractile Vacuoles	***
	4	Wed	10:35-11:25	Lecture 20: Extrusomes	
	6	**Fri**	**10:35-12:25**	**LAB EXERCISE 4**	
	9..13	*M-F*	*Study break*	*None*	
	16	Mon	10:35-11:25	Lecture 21: Feeding/Nutrition 1	***
	18	Wed	10:35-11:25	Lecture 22: Feeding/Nutrition 2	
	20	**Fri**	**10:35-12:25**	**TEST 2**	
	23	Mon	10:35-11:25	Lecture 23: Intro. to protist evolution	
	25	Wed	10:35-11:25	Lecture 24: Protist origins +fossils	
	27	**Fri**	**10:35-12:25**	**LAB EXERCISE 5**	
	30	Mon	10:35-11:25	Lecture 25: Mitochondrion 1	***
Dec	2	Wed	10:35-11:25	Lecture 26: Mitochondrion 2	
	4	Fri	10:35-12:25	Lecture 27: Plastids	
	7	Mon	10:35-11:25	Lecture 28: Special topics 1	***
	8	**Tues**	**10:35-11:25**	**Lecture 29: Special topics 2**	

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Faculty of Science Course Syllabus (Section B)
Fall 2020

BIOL 3102
Microbial Eukaryotes: Biodiversity and Evolution

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Missed or Late Academic Requirements due to Student Absence

As per Senate decision instructors may not require medical notes of students who must miss an academic requirement**, including the final exam,** for courses offered during fall or winter 2020-21 (until April 30, 2021). Information on regular policy, including the use of the Student Declaration of Absence can be found here: **https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html.**

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.
Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).
Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.
Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness
Statement: http://www.dal.ca/cultureofrespect.html

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).
Information: https://www.dal.ca/campus_life/communities/indigenous.html

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Important Dates in the Academic Year (including add/drop dates)
https://www.dal.ca/academics/important_dates.html

University Grading Practices
https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Student Resources and Support

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: https://www.dal.ca/faculty/science/current-students/academic-advising.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: https://libraries.dal.ca/

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: https://libraries.dal.ca/services/copyright-office.html

Fair Dealing Guidelines https://libraries.dal.ca/services/copyright-office/fair-dealing.html

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html

Student Advocacy: https://dsu.ca/dsas

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: https://www.dal.ca/dept/safety/programs-services/biosafety.html

Chemical Safety: https://www.dal.ca/dept/safety/programs-services/chemical-safety.html

Radiation Safety: https://www.dal.ca/dept/safety/programs-services/radiation-safety.html

Scent-Free Program: https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html