Evolutionary Concepts

BIOL3671

Course Syllabus

Winter 2023

"There is grandeur in this view of life . . . from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved"

– Charles Darwin

Left: *Acinonyx jubatus*. Credit: CJ Sharp, cc-by-sa-4.0, https://creativecommons.org/licenses/by-sa/4.0/legalcode
Middle: *Lynx canadensis*. Credit: K Williams, cc-by-2.0, https://creativecommons.org/licenses/by/2.0/legalcode
Right: *Felis catus* (Pancake, a 9-year-old European Burmese). Credit: AC Algar

Evolution has shaped, and continues to shape, the living world. All living things that we see, whether it be through our binoculars, down our microscopes, or in our mirrors, are products of evolution, acting generation by generation with no foresight, plan, or intention. Whether we want to understand the rise of antibiotic resistance, the shape of a swallow's wing, or why the tropics harbour so many species, we must study evolution. Furthermore, we must consider evolution if we want to predict how the natural world will respond to the unprecedented pressures we, as human beings, are placing on the planet's natural systems. As Theodosius Dobzhansky famously wrote: "Nothing in biology makes sense except in the light of evolution"[1,2].

This course will introduce you to the fundamentals of evolution across scales of biological organization from genomic change to global biodiversity. To do so, we will travel from a Victorian naturalist's home in England, to the Galapagos Islands, glacial lakes in British Columbia, and to a very important freezer in a Michigan lab. Along the way, we will meet some of the people who have proposed theory, tested hypotheses, and shaped our evolutionary understanding, from Alfred Russell Wallace to Rosemary Grant. Throughout the class, I hope that not only will you gain an understanding of key evolutionary concepts, but also of why it is one of the most beautiful, elegant, and important ideas in the history of humankind.

LAND ACKNOWLEDGEMENT

Lakehead University respectfully acknowledges its campuses are located on the traditional lands of Indigenous peoples.

[1]Dobzhansky, T. 1973. Nothing in biology makes sense except in the light of evolution. *American Biology Teacher* 35, 125–129

[2]Please never use footnotes for citations in my class! We will use (Author, Date) citations throughout.

Lakehead Thunder Bay is located on the traditional lands of the Fort William First Nation, Signatory to the Robinson Superior Treaty of 1850. Lakehead Orillia is located on the traditional territory of the Anishinaabeg. The Anishinaabeg include the Ojibwe, Odawa, and Pottawatomi nations, collectively known as the Three Fires Confederacy.

Lakehead University acknowledges the history that many nations hold in the areas around our campuses, and is committed to a relationship with First Nations, Métis, and Inuit peoples based on the principles of mutual trust, respect, reciprocity, and collaboration in the spirit of reconciliation.

WHAT ABOUT COVID?

We are still in the midst of a global pandemic. This means that we all need to be flexible as the term progresses in terms of safety precautions and possibly the how the class is delivered.

Currently, the university does not require vaccinations against Covid-19 or face coverings (masks). However, vaccination and/or face covering requirements may be reinstated with little notice. The university strongly encourages wearing face coverings (masks) where physical distancing is not possible.

Whether you wear a mask in class is your choice. I ask everyone to respect the choices of others. But remember that effective masking (i.e. properly fitted N-95s or similar) remain one of the most established and effective tools to limit the spread of airborne infectious disease.

I plan to lecture wearing a mask. If you rely on lip-reading or there are other reasons why having me masked may impact your learning, please let me know and we'll work out a solution, or, if you are registered with SAS, you can have your SAS advisor approach me.

Please keep these points in mind:

1) Currently, masks are strongly encouraged in class though the choice is up to you. It is your responsibility to be aware of any changes to the University's Covid-19/masking/vaccination requirements.
2) Check the D2L announcements page regularly, especially for changes to delivery. For example, if I or your GA develop Covid-19 symptoms then lectures or tutorials will be moved online.
3) **If you have Covid-19 symptoms, please do not come to class** (even if you have tested negative on a rapid-test or think it's 'just a cold'). Email me and your GA (if it's a tutorial) and let us know and we will sort something out. We record lectures so that if you have to miss one because of symptoms, you can catch up.

WHO WILL BE TEACHING AND HOW TO I CONTACT THEM?

Instructor:
Dr. Adam Algar (he/him)
aalgar@lakeheadu.ca
CB 4018 or Zoom

Office hours:
I don't have set office hours (I used to have these and students almost never used them). If you want to meet, email me to make an appointment (in person or zoom), or you can stop in to my office and see if I'm free - if I'm busy then we can set up an appointment.

If you'd prefer to have set office hour times, let me know and I'll reconsider.

Graduate Assistants:

Ben Wood (he/him)
jbwood@lakeheadu.ca

Mikayla Lekun (she/her)
mlekun@lakeheadu.ca

Office hours:
GAs are available in the 2nd hour of each tutorial (lab) to answer questions and meet with students.

WHAT ARE THE EXPECTATIONS FOR COMMUNICATION?

What you can expect from me:
I try to be as accessible as possible for my students, given the need to balance teaching, research and other requirements of my role.

Meeting with me: I try to be available after class to answer questions. This time is probably best used for short discussions or questions about the course material. If you have a longer, or more in-depth question or point for discussion, email me for an appointment or set up one up at the end of class. I don't have regular office hours because my experience is that students rarely use them. You can also knock on my office door and see if I'm free – if I'm not, then we can set up an appointment. I'm happy to meet in person or by zoom but if you're coming to my office, I respectfully ask that you wear a mask.

Email: I reliably check and reply to emails between 8:30am and 5:00pm on weekdays (excluding holidays). I do not reliably check or reply to emails in the evenings, on weekends, or on holidays. I do my best to reply to emails within two working days (i.e. excluding weekends and holidays), but it's not always possible. If you've emailed me about something and it has been more than two working days, please send me a polite email reminding me as sometimes an email slips down my inbox by accident. Please don't email me a reminder before two working days has passed. The implication of the above is that **if you email me the day before a due date, then chances are you won't get a reply before the deadline, so plan ahead**. The above also applies to emailing the GAs. Obviously**, if something unforeseen happens that affects your ability to complete assignments, then email me as soon as you can (cc your GA if it's in relation to a News & Views piece).**

What I expect from you:
Other than verbal announcements in class, I will communicate with the class via the Announcements feature on the D2L site for the course. **It is your responsibility to check the D2L site regularly for announcements** especially regarding possible changes to delivery, scheduling, etc. I also expect that you to fully read the syllabus. Similarly, I also expect that you check your university email address regularly.

WHAT WILL I BE LEARNING?

During the course we will focus on

1) Gaining an understanding of fundamental evolutionary processes
2) Reading and critiquing the scientific literature to understand the limits of our current knowledge and learn how ongoing research is expanding that knowledge.
3) Communicating and explaining what you have learned

The course delivery will be split into weekly lectures and tutorials (labs). Lectures will introduce you to fundamental evolutionary concepts, beginning with microevolution and working outward in scale to finish with macroevolution. Tutorials will be mediated by the graduate assistants and will give you an opportunity to engage with cutting-edge research by discussing and critiquing journal articles. The goal is to guide you in critical thinking and in developing an understanding of how research is done, how knowledge develops, and of how to think like a scientist.

WHAT WILL I BE READING?

The optional book for the course is:

Futuyma, D. J., and M. Kirkpatrick. 2022. Evolution (Fifth edition.). Oxford University Press.

This lectures are loosely structured around the chapters and topics in this book – in some cases they follow it closely, in others they diverge. I will not be assigning readings from the book and it is an optional textbook. Primarly, **we will engage with articles from the primary scientific literature,** but the book can be helpful if you want more detail or to review particular concepts. I will not assess topics or details from the book that are not covered in lecture or tutorial.

The fifth edition of the book is available in the bookstore. I have never actually seen the 5th edition (I'm still waiting for my copy) – I use the 4th edition. If you can get a 4th (or 3rd) edition more cheaply, then go for it .

I will also supply a list of journal articles relevant to each week's topic.

HOW WILL I BE EVALUATED?

Discussion of ideas, concepts, and methods are a valuable part of science and I encourage you to discuss topics with your peers and instructors. **However, all assessments must be completed individually**. Late submissions will be penalized 5% per day, including weekends and holidays, unless you have a valid reason (e.g. family, medical) and request an extension. Quizzes that are submitted late will receive a mark of zero unless you request an extension for a valid reason.

Normally the request for an extension should be made before the due date. I aim to ensure that all students can achieve their best possible results, so if you have particular circumstances affecting your assessments, please speak to me as soon as you can. **For students registered with Student Accessibility Services, you are welcome to speak with me but can also communicate via your accessibility advisor, who will inform me of any agreed accommodations. Please don't hesitate to feed back to me regarding accessibility and accommodations that are, or aren't, in place so that we can make adjustments.**

Open Book Quizzes (Best 4 of 5): 4 × 10% = 40%
Scheduled throughout term (see introductory lecture) these open book quizzes will draw on lecture and tutorial material. There are 5 throughout the term and your top 4 will contribute to your final mark.

News & Views Pieces (Best 2 of 3): 2 × 10% =20%
These short writing assignments will follow the structure of 'News & Views' pieces in the journal *Nature*. Each one will be based on a single tutorial reading and has an 800 word limit; you must include the word count on your submission. Please read the section on word limits below very carefully. Tutorials have been divided into three blocks and you can submit up to one News & Views from each block. Your best two will contribute to your final mark. More information will be presented in the first tutorial.

Tutorial participation: 5%
Show up at the tutorials, prepared, and contribute to the discussion. Being able to speak up in a group is an important skill that will serve you well throughout your life. If you are unable to attend a tutorial because of a valid reason (e.g. self-isolating, or have symptoms), then email your GA and cc me, as early as possible to let them know.

Final Paper: 35%
The final paper will address the question 'Are human effects on evolution predictable?'
This is a purposefully broad question that can be approached in a number of ways – you will need to decide what you think is the most effective. You will need to make decisions about what to include, and what to exclude and how to structure your narrative. You have the option to keep it broad or narrow in on one particular type of human influence, e.g. deforestation, anthropogenic climate change, urbanization, antibiotic resistance, etc. To develop your argument, you are expected to use, but are not limited to, examples and evidence across the breadth of concepts and scales covered in class, from microevolution to macroevolution (as appropriate). You are also expected to go beyond the assigned and recommended readings for the course to find relevant examples and references from the primary scientific literature. **The paper must not exceed 2500 words**. Please read the section on word limits below very carefully. Start planning early and take advantage of opportunities in the tutorials to discuss your essay with the GAs. We will use part of the tutorial time to help build your paper-writing skills and assist you in developing your paper.

Word Limits

- Written assignments have strict word limits.

- Word limits **exclude** the title, reference list and any figures or tables (and their captions) you choose to include.
- The marker will not read beyond the word limit, so if you exceed it, your mark will reflect an incomplete piece of work.
- You must report the word count on your paper; we will be sensible regarding the fact that different software can give slightly different word counts.
- Falsely reporting a lower word count to make your essay appear within the limit will be considered academic dishonesty and investigated as a potential breach of academic integrity.

Mark Schemes
Rubrics for written work will be circulated in class.

Due Dates:
All times are listed in local Thunder Bay time.

News & Views
Block 1: 23:59 Friday, February 10
Block 2: 23:59 Friday, March 10
Block 3: 23:59 Monday, April 3

Open-book Quizzes
Quiz 1: 23:59 Wednesday, February 1
Quiz 2: 23:59 Wednesday, February 15
Quiz 3: 23:59 Wednesday, March 8
Quiz 4: 23:59 Wednesday, March 22
Quiz 5: 23:59 Friday, March 31

Final Paper
23:59 Tuesday, April 11

WHEN IS CLASS?

All times are listed in local Thunder Bay time

Lectures (BB2006)
Monday 12:30pm-2:30pm

Tutorials (CB3010A)
You must attend your assigned section.

WD1: Fridays 8:30am-10:30am
WD2: Fridays 10:30am-12:30pm
WD3: Thursdays 8:30am-10:30am
WD4: Thursdays 10:30am-12:30pm
WD5: Fridays 12:30pm-2:30pm

WHAT WILL WE COVER?

The topics and timings below are a guide and are subject to change

Week	Start Date	Topic	Assessment
1	Jan 9	Introduction: Darwin's grand idea	
2	Jan 16	Natural Selection	
3	Jan 23	Evolution at a single locus	
4	Jan 30	Phenotypes, fitness, and adaptation	Qz1 (w2-w3)
5	Feb 6	Ecoevolutionary Dynamics	NV1 (blue)
6	Feb 13	Why moose have big antlers	Qz2 (w4-w5)
7	Feb 20	Winter break (no classes)	
8	Feb 27	Evolution in space	
9	Mar 6	Speciation	NV2 (green); Qz3 (w6,w8)
10	Mar 13	Macroevolution	
11	Mar 20	Adaptive Radiation	Qz4 (w9-w10)
12	Mar 27	Convergence and Contingency (no tutorial)	Qz5 (w11-w12),
13	Apr 3	No classes or tutorials	NV3
14	Apr10	No classes tutorials	FP

Qz: open book quizzes, NV: News & Views, w: week, colours: NV blocks, FP: Final Paper

HOW SHOULD I MANAGE MY TIME?

Between the quizzes, News & Views pieces (N&Vs) and the final paper, you will be busy. Although your mark will only be based on 4 quizzes and 2 N&Vs, I strongly recommend not skipping a quiz or a N&V early in the semester as the workload ramps up toward the end. I also strongly recommend not leaving your final paper until the last minute/day/week. To achieve a good mark, you will have to work on it throughout the semester, gathering evidence and examples on which to base your conclusion. Start early and take advantage of the time available with the graduate assistants during the tutorials to ask questions and discuss ideas.

If you are struggling with the lecture content, readings, quizzes or with writing, please contact one of us to discuss – we are here to help!

WHAT ELSE DO I NEED TO KNOW?

Diversity, Equity & Inclusion

In this class I want us to:

- Develop an environment of mutual respect and safety in, and out of, the classroom and tutorial room for all participants, regardless of culture, ethnicity, gender identity, national origin, race, sex, sexual orientation, socio-economic status, religion, mental and physical ability, experience, or other aspects of identity or background.
- Foster an environment where the merit of ideas, hypotheses, and data are rigorously evaluated and challenged, but the merit of individuals is never in question.

You are expected to abide by the following principle in class, tutorials and online:

- Be respectful in all of your interactions
  - Remember that others have different life experiences, perspectives, backgrounds, strengths, and challenges
  - Challenge ideas, inferences, and evidence but not individuals
  - Listen and learn. Do not dominate discussions.
  - Be willing to change your mind if another argument, dataset, or set of evidence is stronger
  - Racist, sexist, or other discriminatory behaviour will not be tolerated. Nor will harassment or bullying of any kind.

Throughout the course we will focus on a scientific approach based on the hypothetico-deductive method. This is just one way of knowing.

- There are other ways of knowing and learning about the world. Our focus on scientific method has no bearing on the value of other forms of knowing.

Science and the study of evolution have a history of discrimination and colonialism that still exists.

- The theory and empirical work that forms the basis of the course has been done overwhelmingly by white males of European descent.
- Some of these researchers had racist, sexist and other discriminatory views. And some of this research was used to strengthen and perpetuate hatred, racism, prejudice, sexism, colonialism and discriminatory world views.
- Discussion of these ideas, and researchers, is not meant – in any way – to indicate an acceptance of these views, or to excuse them.

I am still learning about diversity, equity and inclusion. and trying to improve.

- If I make mistakes, please draw these to my attention and feel free to discuss any concerns that you have with me.

Academic Integrity

I have no tolerance for academic dishonesty and breaches of Academic Integrity. To me, it is theft. Theft of the hard work, ideas, and achievements of others. If you obtain your degree through dishonesty you are stealing future jobs, academic spots and other opportunities from others who have earned them. Thus, a breach of Academic Integrity is a serious offence. **The principle of Academic Integrity, particularly of doing one's own work, documenting properly (including use of quotation marks, appropriate paraphrasing and referencing/citation), collaborating appropriately, and avoiding misrepresentation, is a core principle of university study. You must read the Student Code of Conduct – Academic Integrity** – for a full description of academic offences, procedures when Academic Integrity breaches are suspected and sanctions for breaches of Academic Integrity.

Link to the Student Code of Conduct and Policy on Academic Integrity:
https://www.lakeheadu.ca/students/student-life/student-conduct

I assume that you have completed Lakehead's online resource, AIM (Academic Integrity Matters course). If you have not, then you should complete it:
https://www.lakeheadu.ca/students/academic-success/student-success-centre/skills-for-success-seminars/thunder-bay/node/45182

Furthermore, by signing up for the course, you agree that**:**
Unless otherwise allowed by the course instructor, I must complete the assignments in this course without the assistance of anyone else. I further understand and agree that, if I violate either of this rule, or if I provide any false or misleading information about my completion of course assignments or exams, I may be prosecuted under the Lakehead University Student Code of Conduct – Academic Integrity, which requires students to act ethically and with integrity in academic matters and to demonstrate behaviours that support the University's academic values.

Accommodation and Accessibility
Lakehead University is committed to achieving full accessibility for persons with disabilities/medical conditions. Part of this commitment includes arranging academic accommodations for students with disabilities/medical conditions to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability/medical condition and think you may need accommodations, you are strongly encouraged to contact Student Accessibility Services (SAS) and register as early as possible. For more information, please email sas@lakeheadu.ca or visit https://www.lakeheadu.ca/faculty-and-staff/departments/services/sas

The Student Accessibility Services will get in touch with me about your accommodations. Thus there is no requirement that you speak to me about them directly, but you are welcome to do so if you wish, especially if you have any concerns about getting accommodations in place early. Also, please feel free feed back to me during the semester regarding accessibility and accommodations, either directly or through your Accessibility Advisor, so that we can make changes or adjustments that will improve accessibility and better implement accommodations.

Copyright Compliance
By taking the course you sign up to the following statement:
I understand and agree that all instructional, reference, and administrative materials to which I am given access in this course (the "course materials"), whether they consist of text, still or kinetic images, or sound, whether they are in digital or hard copy formats, and in whatever media they are offered, are protected in their entirety by copyright, and that to comply with this copyright and the law.
(a) I may access and download the course materials only for my own personal and non-commercial use for this course; and
(b) I am not permitted to download, copy, store (in any medium), forward or share, transmit, broadcast, show, post or play in public, adapt, or change in any way any text, image, or sound component of the course materials for any other purpose whatsoever except as expressly authorized, and only to the extent authorized, in writing, by the course instructor.
I further understand and agree that, if I infringe the copyright of the course materials in any way, I may be prosecuted under the Lakehead University Student Code of Conduct – Academic

Integrity, which requires students to act ethically and with integrity in academic matters and to demonstrate behaviours that support the University's academic values.

Recording Lectures and Class Activities

In Evolutionary Concepts, BIO3671, and the associated lab instruction in the classroom will be recorded, where possible, for confidential access by students registered in the course but who are unable to attend class due to the pandemic or other necessity. To the greatest extent possible only the image and voice of the instructor will be recorded for this purpose but, due to class interaction, the images and voices of students present in the classroom may be incidentally recorded and, thus, be available for access by course students in remote locations. These recordings, however, are strictly confidential and may be used only by the instructor and students registered in the course and only for purposes related to the course. They may otherwise not be used or disclosed. Students in the classroom who are concerned about being recorded in this fashion may request the instructor to exclude them from the recording to the greatest degree possible on the understanding that total exclusion cannot be guaranteed. The recordings are made under the authority of sections 3 and 14 of The Lakehead University Act, 1965. Questions about the collection of the images and sounds in the recordings may be directed to the Chair of the Department of Biology, Lakehead University, 955 Oliver Rd, Thunder Bay, ON, P7B 5E1, +1 (807) 343-8010 ext 8460.