Evolutionary Concepts

BIOL3671

Course Syllabus

Winter 2025

"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 10-year-old European Burmese). Credit: AC Algar

Evolution has shaped, and continues to shape, the living world. All living things that we see, whether 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 are placing on the planet's natural systems. As Theodosius Dobzhansky (1973, *American Biology Teacher* 35, 125-129*)* famously wrote: "Nothing in biology makes sense except in the light of evolution"

This course will introduce you to the fundamentals of evolution across scales of biological organization from genomic change to global biodiversity. We will travel from a Victorian naturalist's home in England, to the Galápagos 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.

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.

WHO WILL BE TEACHING AND HOW TO I CONTACT THEM?

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

Office hours:
I don't have set office hours because students almost never use them. Instead, email me to make an appointment or stop by my office and see if I'm free – if I'm busy then we can set up an appointment.

Graduate Assistants:
Justin Wiens (he/him)
jwiens@lakeheadu.ca

Melissa Henderson (she/her)
mhender8@lakeheadu.ca

Office hours:
GAs are available in the 2nd hour of each lab/tutorial to answer questions and meet with students. Email if you want an additional appointment.

WHEN AND WHERE IS CLASS?

All times local time in Thunder Bay, Ontario.

Lectures
Thursdays, 2:30pm-4:30pm, RB1044

Labs (Tutorials)
W1: Fridays, 8:30am-10:30am, CB3010a
W2: Fridays, 10:30am-12:30pm, CB3010a
W3: Thursdays, 8:30am-10:30am, CB3010a
W4: Thursdays, 10:30am-12:30pm, CB3010a
W5: Thursdays, 12:30pm-2:30pm, CB3010a

You **must** attend your assigned lab section. Exceptions are only possible with approval **in advance** (unless made infeasible by the circumstances) and with a **valid** reason (e.g. family, medical)

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 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 (or speak to me after class) and we can set up a time to meet.

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 reminder as sometimes an email slips down my inbox by accident. Please don't send 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**. If something unforeseen happens that affects your ability to complete an assessment, then email me as soon as you can.

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

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 labs. Labs are more like tutorials (but are mandatory to attend), so I will refer to them as tutorials throughout the course. 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. Mostly **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, and is priced at $274.99 (hard copy) and $84.99 (180 day digital access) as of 17 December 2024. Prices are subject to change . The 4th edition is absolutely fine and earlier editions are also likely to be okay although I haven't looked at them closely.

I will sometimes supply a list of journal articles relevant to each topic for your own perusal.

The scientific articles used in this course are either available open-access from publishers, or through Lakehead's library, which pays a lot of money so that students (and researchers) do not have to directly pay for them.

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**.

Open Book Quizzes (Best 4 of 5): 4 × 10% = 40%
These are really problem sets, but I refer to them as quizzes to avoid confusion as this is the terminology that D2L uses. They are scheduled throughout term and will draw on lecture and lab/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 × 12.5% =25%
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. medical, family), then email your GA and me, as early as possible to let them know.

Final Paper: 30%
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.

Rubrics

Rubrics for written work will be circulated in advance of due dates.

Due Dates:

- Due dates are subject to change, but will never be earlier than listed below
- All times below are local time in Thunder Bay.

News & Views

Block 1: 23:59 Friday, Feb 7
Block 2: 23:59 Friday, March 7
Block 3: 23:59 Friday, March 28

Open-book Quizzes

Quiz 1: 23:59 Wednesday, January 29
Quiz 2: 23:59 Wednesday, February 12
Quiz 3: 23:59 Wednesday, March 5
Quiz 4: 23:59 Wednesday, March 19
Quiz 5: 23:59 **Thursday, March 27**

Final Paper

23:59 Friday, April 4

Individual work

Discussion of ideas, concepts, and evidence are a valuable part of science and I encourage you to discuss them your peers and instructors. However, **all assessments must be completed individually**.

Late Penalties and Extensions

- Late submission of written work (News & Views, Final Paper) will be penalized 5% per day (including weekends and holidays).
- Open-book quizzes must be completed by the deadline or receive a mark of zero (0%).

The preceding penalties will be strictly applied unless there is a valid reason (e.g. medical, family). Normally, requests for an extension or penalty waiver should be made before the due date, unless the circumstances underlying the request make this infeasible.

Assignment & Exam Integrity

By taking this course, you agree to the following:

I understand and agree that:
(a) Unless otherwise allowed by the course instructor, I must complete the assignments in this course without the assistance of anyone else.
(b) Unless otherwise allowed by the course instructor, I must not access any sources or materials (in print, online, or in any other way) to complete any course exam.

I further understand and agree that, if I violate either of these two rules, 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.

GenAI Use Prohibited

Generative artificial intelligence (Generative AI or GenAI) is a category of AI systems capable of generating text, images, or other media in response to prompts. These systems include ChatGPT and its variants Bing (built by OpenAI) and Bard (built by Google) among several others. Other Generative AI models include artificial intelligence art systems such as Stable Diffusion, Midjourney, and DALL-E.

Any use of GenAI systems to produce assignments for this course is not permitted. All work submitted for evaluation in this course must be the student's original work. The submission of any work containing AI generated content will be considered a violation of academic integrity ("Use of Unauthorized Materials").

Accommodations 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

I aim to ensure that all students can achieve their best possible results, so if you have circumstances affecting your assessments, please speak to me as soon as you can.

For students registered with Student Accessibility Services, 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 to 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.

WHAT WILL WE COVER?

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

Week	Start Date	Topic	Assessment
1	Jan 6	Introduction: Darwin's grand idea	
2	Jan 13	Natural Selection	
3	Jan 20	Evolution at a single locus	
4	Jan 27	Phenotypes, fitness, and adaptation	Qz1 (w2-w3)
5	Feb 3	Ecoevolutionary Dynamics	NV1 (blue)
6	Feb 10	Why moose have big antlers	Qz2 (w4-w5)
7	Feb 17	Winter break (no classes)	
8	Feb 23	Evolution in space	
9	Mar 3	Speciation	NV2 (green); Qz3 (w6,w8)
10	Mar 10	Macroevolution	
11	Mar 17	Adaptive Radiation	Qz4 (w9-w10)
12	Mar 24	Convergence and Contingency. No tutorial	NV3, Qz5 (w11-12)
13	Mar 31	Reserve lecture slot. No tutorial	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 a large portion of 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, including the study of evolution, has a history of discrimination and colonialism that still exists. We will bear this in mind throughout the course, especially as:
- 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, the ideas, and achievements of others. And if you obtain your degree through dishonesty you are stealing future jobs, academic positions and/or other opportunities from others who have earned them.

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 in university study. Students are strongly advised to familiarize themselves with the Student Code of Conduct - Academic Integrity ("The Code") - and, in particular, sections 26 and 83 through 85. Non-compliance with the Code will NOT be tolerated in this course and the Code will be adhered to in terms of disciplinary action. The

Code provides a full description of academic offences, procedures when Academic Integrity breaches are suspected and sanctions for breaches of Academic Integrity.

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, BIOL3671 and potentially the associated lab, instruction 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.