Biology 3330: Molecular biology of development

Course outline

ADE section

2024A

A zebrafish (*Danio rerio*) embryo, which is a useful model for studying cell fate and other developmental processes in vertebrates. **Ledford H** (2018) Nature.

THE BASICS

About the instructor

My name	Dr. David Law
My office	Simcoe Hall/OA 3004, in Orillia
My email	dlaw@lakeheadu.ca. I check my email daily Monday to Friday, and will try to respond to your questions as quickly as possible during those days.
Office hour	No preset office hour since this is a web course; email me or make an appointment here for a Zoom meeting.
My phone number	None; email me or make an appointment here for a Zoom meeting.
Call me	Dr. Law or David
My preferred pronouns	He, him, you

About the class

- The course runs for 6 weeks: Tuesday July 2 to Monday August 12, 2024.
- All material is posted on MyInfo/D2L; check there for the latest course updates and information.
- Biology 3330 is an asynchronous web course and does not have any "live" content. This means that you can proceed through the material at your own pace, keeping in mind that there is an assignment due and a quiz to write every week.
- Two of the deliverables are videos that you will post of yourself discussing course content These recordings will be on the course D2L site and viewable to the instructor and all students registered in the course.
    - These videos
        - are strictly confidential;
        - may be used only by the instructor and students registered in the course only for purposes related to the course, and
        - may not be otherwise shared or distributed.
    - Students who are concerned about posting videos of themselves must

recognize that these recordings are an intrinsic part of the course; as such, you may choose not to participate in them but this means your mark will be zero for these deliverables. These recordings are made under the authority of sections 3 and 14 of the Lakehead University Act, 1965. Questions about the collection of images and sounds in these recordings may be directed to the chair of biology, Dr. Azim Mallik (amallik@lakeheadu.ca).

Calendar description

Biology 3330 | Molecular biology of development

Description	DNA replication and repair; cell cycle regulation. The role of differential gene expression in the regulation of development of model organisms: *Drosophila*, *Caenorhabditis*, yeasts, amphibians and mice.
Credit weight	0.5 FCE
Prerequisite(s)	Biology 2230 and 2910, or permission of the Chair of the Department of Biology
Offering	3-0; 0-0
Course classification(s)	Type C: Engineering, Mathematical and Natural Sciences

Important dates

Take note of the following important dates, as per the academic schedule of dates:

- Final date to add a course for 2024A: Thurs. July 4
- Final date to withdraw from a course without academic penalty (a/k/a drop date): Thurs. July 25
    - I aim to provide you with at least 25% of your final mark by this date so that you can make an informed decision about your progress and projected future performance in the course.

LEARNING OUTCOMES

During this course, you will develop both your "hard" science-based skills and "soft" social and literary skills.

Science-based skills

- Develop new knowledge in developmental biology, molecular biology and comparative biochemistry that logically follows from your previous courses in lab biology, cell biology and biochemistry
- Understand common terms used in developmental biology
- Discuss experimental model organisms amenable to the study of developmental biology
- Discuss common cross-species themes in
    - The regulation of gene expression
    - Biochemical changes during development
    - Adaptive responses to abiotic and biotic stresses
- Discuss several experimental laboratory methods used in developmental biology research, such as
    - Cell culture
    - Epigenetics
    - Protein:protein interactions
    - DNA and protein detection techniques

Social and literary skills

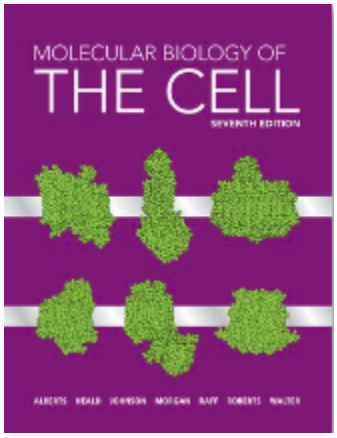
- Conduct a respectful, informed discussion about the past, present and future of developmental biology with your peers
- Read, interpret and extract useful information from primary and secondary scientific journal articles and your textbook
- Developing job-searching techniques and learning what you can do with an undergraduate degree in biology

LEARNING MATERIALS

I'll post videos and other readings by week under **Content** in D2L. Course material is derived mainly from the books below.

Textbook

Alberts B et al. (2022) Molecular Biology of the Cell, 7th edition, W.W. Norton, New York, USA, ISBN 978-0-393-42708-0.



This textbook is optional, but is useful for background on many of the topics we'll cover. However, I will provide readings and videos to explain the concepts in the course.

We'll concentrate on Chapter 21: "Development of multicellular organisms".

If interested, you can rent the e-book from a few places:

- VitalSource (12-mo rental) for CAD 116,
- W. W. Norton, the publisher (12-mo rental), for USD 89 ~ CAD 122
- Redshelf (6-mo rental) for USD 111 or ~ CAD 152.

If you have access to an older version, that is fine, but chapter and page numbers will likely be different. The 6th edition is available at both Paterson Library in Thunder Bay and Harvie (500 University Ave.) in Orillia; both are on 1-day (overnight) loan and available at the Reserves desk.

I will also use material from two other sources:

- **Barresi MJF, Gilbert SF** (2020) *Developmental biology*, 12th edition, Sinauer, New York, USA, 978-1-6053-5822-2.
- **Wolpert L, Tickle C** (2011) Principles of development, 4th edition, Oxford University Press, Oxford, UK, ISBN 978-0-19-954907-8.

Older versions of these textbooks are on reserve in the Paterson (Thunder Bay) and Harvie (500 University Ave., Orillia) libraries, as detailed below.

On reserve at the libraries

All available on one-day (overnight) loan - ask at the circulation desk of the library.

In Orillia at Harvie/500 University Ave.:

- Molecular biology of the cell
  Alberts, Bruce; Wilson, John ; Hunt, Tim; *et al.*
  2015; 6th edition
  QH 581.2 M64 2015
- Developmental biology
  Gilbert, Scott F., 1949- author.; Barresi, Michael J. F., 1974- author.
  2016; 11th edition
  QL 955 G48 2016

In Thunder Bay at Paterson:

- Molecular biology of the cell
  Alberts, Bruce; Wilson, John ; Hunt, Tim; *et al.*
  2015; 6th edition
  QH 581.2 M64 2015
- Developmental biology
  Gilbert, Scott F., 1949-
  2020; 12th edition
  QL 955 G48 2020
- Principles of development
  Wolpert, Lewis
  2007; 3rd edition
  QH 491 P74 2007

SCHEDULE AND MARKING SCHEME

- One assignment and one quiz are due every week, Monday evenings at 11:59 PM EDT.
- The next week's work will go live no later than midnight of that week. This means that you have at least 7 days to review and complete each week's work.
- Assignments are worth 60% of your final mark and quizzes 40%. This emphasizes the importance of showing me your personal views in the assignments and practicing your writing and oral presentation skills.
- This class is half the length of a F or W term 0.5-FCE course: 6 weeks instead of 12. This means that you will have to devote at least twice as much time per week to reading and thinking about the material than for a F or W course.

Week	Dates; *All deliverables due Monday at 11:59 PM*	Topics and deliverables	Weight *% of final mark*
1	July 2 - 8	• Introduction to developmental biology • Embryology becomes experimental dev bio • Know your sources: primary, secondary, other	
	July 8	Video #1	10
		Quiz #1	6.67
2	July 9 - 15	• Topics TBD	
	July 15	Written discussion forum post #1	10
		Quiz #2	6.67
3	July 16 - 22	• Topics TBD	
	July 22	Written assignment #1	10
		Quiz #3	6.67
4	July 23 - 29	• Topics TBD	
	July 29	Video #2: video discussion forum	10
		Quiz #4	6.67
5	July 30 - August 5	• Topics TBD	
	August 5	Written discussion forum post #2	10
		Quiz #5	6.67
6	August 6 - 12	• Topics TBD	
	August 12	Written assignment #2	10
		Quiz #6	6.67
Total marks			**100**

DELIVERABLES

General advice

All work is due on the seventh day of each week in the course: **Mondays at 11:59 PM EDT.** You won't be able to write that week's quiz or contribute to its discussion forum after this day/time. **Please don't leave completing work until the last minute.**

Each week, you have a quiz and an assignment to complete. I suggest you tackle each week's work in this order:

- Review the readings and take notes.
- Watch the videos and take notes.
- Do the quiz, which will be based on all of the week's material, while it's fresh in your mind.
- When possible, choose your assignment based on the course material you found most interesting. For example, for video or written discussion forum posts, choose your favourite topic.
- Complete your assignment, following its instructions closely to maximize your mark; for example, find, read and incorporate information from peer-reviewed articles in your discussion post.
- **After viewing or reading your assignments, I may have follow-up questions that require us to have a brief discussion on Zoom before I give you a mark. If this happens, I'll email you to set up a meeting time.**

Video assignments

There are 2 video assignments. These will let you practice

- showcasing your knowledge of the course material in a different way, and
- giving oral presentations in a friendly forum.

Access the assignments and their details/instructions in D2L at **Content > Week x > Video assignment #y**.

- Task #1: Video assignment #1 (due at the end of week 1).
- Task #4: Video assignment #2 (due at the end of week 4).

Discussion forums

Discussion forums are an important part of online classes because there is no face-to-face time with your fellow students or prof like there is in a classroom-based course. Posting in forums helps you understand the course content, deepens your learning experience and sharpens your critical thinking skills.

For you to receive discussion participation marks, you must participate regularly with thoughtful posts. For each of the 2 written discussion forums during the course, I will post specific instructions, such as "post one reply to other posts to obtain your participation marks for this forum."

For all discussion forums, I will post at least 3 discussion topics. One student may reply directly to each of my original questions; there is thus an advantage to posting early. **Further posts must be formatted as replies to those student posts and not directly as replies to my original post.** This means that there is **only one thread allowed for each discussion topic**. Replying to others' posts will encourage your

- deep thought about the subject,
- consideration of other students' points of view, and
- formatting of discussion topics like a conversation, often one that does not have one right answer, rather than an information download.

Thus, **other than the first reply to each discussion topic, further direct replies to the original topics will not count as posts towards your mark for that forum.**

I'll also contribute to the forums, often to try to clarify arguments and prod further thought and replies. I encourage you to reply to my posts… I will be respectful of your point of view.

How do you contribute effectively to discussion forums? Follow these discussion guidelines from Debbie Morrison's *Online Learning Insights* for some hints:

- Use a subject line that relates to your post; this will help create interest and focus for the discussion.
- Write clearly and with expression. Communicating online requires careful and concise writing, but also allows your personality to come through. Though humour is effective and at times relevant in discussion, be sure to avoid sarcasm, which does not translate well online.
- Be supportive, considerate and constructive when replying to your classmates. Do not use jargon, slang or inappropriate language. If you disagree with a

classmate, please respond in a respectful and tactful manner. Any posts that I deem inappropriate will be removed from the discussion board.
- Focus on the topic, relating any class readings and materials from the current module in your post (as applicable).
- Proofread and review your response before hitting the submit button.
- Participate regularly. Improve your learning by being an active and engaged student. Follow and participate in the assigned discussion throughout the module, logging on at least every couple of days while reading and participating in forums as assigned in the module.

Access the discussion forums in D2L at **Content > Week x > Discussion forum #y**.

- Task #2: Written discussion forum post #1 (due at the end of week 2).
- Task #5: Written discussion forum post #2 (due at the end of week 5).

Written assignments

Note the page limits in the instructions for each written assignment… generally 2 to 3 double-spaced pages. Provide cited sources for your statements. You don't have to use any particular citing style (e.g., ADA) since all biology journals are different (what a surprise). One possible citation style is

I am looking for a well-researched review that demonstrates that you have sought out multiple sources to support your statements and that you've thought about the material we've covered in previous weeks.

Access the assignments and their details/instructions in D2L at **Content > Week x > Written assignment #y**.

- Task #3: Written assignment #1 (due at the end of week 3).
- Task #6: Written assignment #2 (due at the end of week 6).

Quizzes

You will write a 10-minute 10-question multiple choice quiz in D2L each week. **Write the quiz at any time during the week.** These test your knowledge of all of the week's material. As long as you complete the readings, watch the videos and take notes on these, you will have what you need to do well.

Access the quizzes and their details/instructions in D2L at **Content > Quizzes > Week x**.

COURSE IMPROVEMENT

I value student feedback to help me improve my courses. Below are some data from the Student Feedback on Teaching survey the last time I taught this course in 2023W. The comments are complete and unedited (except for spelling and grammar).

Note that this version was live/F2F in telepresence in both Orillia and Thunder Bay, not asynchronous web. This term, we'll have shorter and more frequent quizzes and no oral presentation.

Based on the comments below from 2023W, I will try to improve in this version of the course:

- **Limit groupwork**… there is no oral presentation, but you will have to comment on others' videos and written posts in the discussion forums.
- **Provide written work expectations**… more information about these are laid out for each assignment by week.
- **Limit including material from other courses**… I will try. Biochem I isn't a prerequisite, but cell and lab biology are, so it's fair for me to reference concepts and techniques from both of these in this course. Also, building on the foundations you've already covered is the point of getting a degree.
- **Give more time in test.** One minute per mark is the standard, and I'll stick with that. Each weekly test is out of 10, so you have 10 minutes to complete each. If you need more time, please ask Student Accessibility Services for an accommodation.

Marks

For the 23 questions where 1 = strongly disagree and 5 = strongly agree,

- Average score = 4.69 / 5
- Standard deviation +/- 0.30
- Number of survey participants = 6 out of 32 total students

Comments

What did you like about this course?

- I really liked the way that this course was taught. It was straightforward, and enough information was always provided to do well on the tests. Even though some of us did not love the breakout questions, I do think they were beneficial and made

us feel more comfortable doing the presentation at the end. Overall I really loved this class, and how much information applied to other courses.

- I liked that there were multiple smaller projects that allowed me to prepare for my future career in the sciences. The CV assignment was incredibly useful, I was able to use it to apply and get summer jobs, as well as offer job-search advice to fellow students who are looking for jobs in a scientific field.
- This course draws on a lot of the knowledge that we've accumulated over the years, so it was nice to see the material synthesized this way. The professor did a really good job at highlighting recurring themes in biology and making connections between different topics.
- -like how its not cumulative
  -like the media references, making it engaging
  -like the variety of assignments
- The course was very interactive and stimulating. I enjoyed the opportunities to discuss the topics. I think it was well paced and assessments were reasonable.
- Engaging and provided lots of resources to help learn the content

What suggestions do you have for improving this course?

- I do not have any suggestions, I really think this course was super organized and well-taught.
- For the presentation specifically, I was not the biggest fan of working with individuals across campuses, although this is a personal preference. I found it difficult to organize and collaborate with a group online, as I know that I can collaborate better in person without the division of a screen. Furthermore, 10 minutes was a short amount of time for three people to present in, especially taking into account the lag of video conferences. I would suggest letting the presentations be a total of 20 minutes, with 15 minutes of presentation material (to account for the lag and transition time) and 5 minutes for questions. This would make for a more relaxed presentation environment as discussing all of the content in under three minutes lead to everyone rushing to get their points across.

  I also found that I was losing a large amount of marks for formatting, the exact format should be laid out if that component is going to be worth that many marks (specifically assignment 2 of the course).

- There were a lot of references to Plant Biology in the course, which I understand is part of the professor's enthusiasm for plants, but since it is not a prerequisite for this course, I never took that class. So sometimes it was hard to follow the plant

references. I understand though that many other students have to take plant biology, so this may have not been an issue for them.

- -40 min tests were too short, for the amount of material need like 1 hr. I felt with more time I could have shown I known more versus rushing and not able to even read and understand question

  -it was lots of information at once, need to go slower sometimes

- Assignments didn't really align with the course content. It would have been nice if they were more related so we could gauge our understanding of the material before tests.
- I would suggest providing a more detailed description of what is expected from the oral presentation. I personally do better with more direction than just a simple prompt. Maybe just add some examples to know what you are looking for in the presentations

Additional Comments

- I enjoyed the enthusiastic energy that Dr Law brought to every class. I liked the layout of the slides and the opportunities for extra study sessions prior to the midterms.

USING ARTIFICIAL INTELLIGENCE

Wondering whether you can use AI like ChatGPT to complete coursework? You're not alone. First, read Lakehead's checklist for its appropriate use. Using AI may violate the Lakehead Academic Integrity Code (Section III) and be subject to disciplinary action. It's best to check with me prior to using it if you are unsure. There is no shame in doing so since I'm very aware of these tools. As this technology evolves, it's up to your instructors to ensure that student marks reflect their own work.

To get an idea about how chatbots can be used in higher ed, watch this Vox video. It summarizes my thoughts about acceptable and unacceptable use of AI to complete coursework.

A list of the possible ways to use AI for your coursework as listed in the Vox video is below. I'm OK if you use AI for most of their examples; exceptions are listed below:

Research

- Answers to a homework question (sometimes)
    - It's very tempting to let AI do all the work and once you have it for you to say "I have the answer; I'll go back and understand it later". But will you?
    - As long as you're not handing in the answer for marks… where is the ethical line?
- Background information on a topic
- Definitions or explanations of a concept
- Sources to find more information
    - To me, these 3 uses are no different than a Google search or looking up a topic on Wikipedia, but keep in mind how flawed these sources can be
    - Your sources must be
        - Genuine and relevant
        - Specifically, mostly reviews and primary literature articles from peer-reviewed journals
- Summaries of readings and lectures
- Study guides for an exam
    - OK, but read and/or watch these first to make sure you understand and can summarize them without AI help

Ideas

- Ideas for how to respond to an assignment
    - But not using AI to actually write your assignment…again, where is the line?

- Instructions for solving a problem
    - But don't rely on it to do your work for you since you'll have to do it yourself on a test
- Outline for a paper or presentation
    - AI can suggest how to best organize your thoughts
- Examples, analogies and counterarguments
    - Use at your own risk

Writing

- Script for a presentation
    - As long as it's based on your own original work and not AI-generated text… AI summarizing AI is bad
- Feedback on your work
    - This one is for your profs. I haven't used AI yet for this purpose, but I can see how it might be useful
- Revision of a text to improve it
    - While being aware that AI doesn't always "improve" written work
- Revision of a text to change word count
    - Sometimes a necessary editing step
    - Summarizing and collating ideas is a key part of work life, and AI doesn't always do a great job

There's only one use of AI from the Vox list that I consider plagiarism:

- Writing a draft of a paper or discussion post
    - It's too tempting to let it do all the work, including writing the final version

ACADEMIC DISHONESTY

Lakehead has a Student Code of Conduct – Academic Integrity. All students in this course should read the Code and become familiar with it.

To summarize the relevant parts of the Code, the penalty for plagiarism or cheating on any part of this or any other course is zero for the work where the student is caught. Serious or repeated plagiarism, including cheating on an examination or test, will result in a mark of zero for the course and may result in expulsion from Lakehead.

There are two particular places in this course where cheating might occur:

1. submitting written work that you did not research and write;
2. participating in a discussion forum under any name other than your own.

Academic dishonesty for any of these areas will result in a mark of **zero** for the work concerned. If this happens, I'll also submit

To ensure academic fairness for students who work hard, rest assured that I will take **every precaution** to ensure that potential cheaters are caught and subjected to the appropriate penalty.