

BIOLOGY 4563F/9561A:

genome evolution

FALL 2026

WED (9:30-11:30)

FRI (9:30-10:30)

ROOM: NCB-293

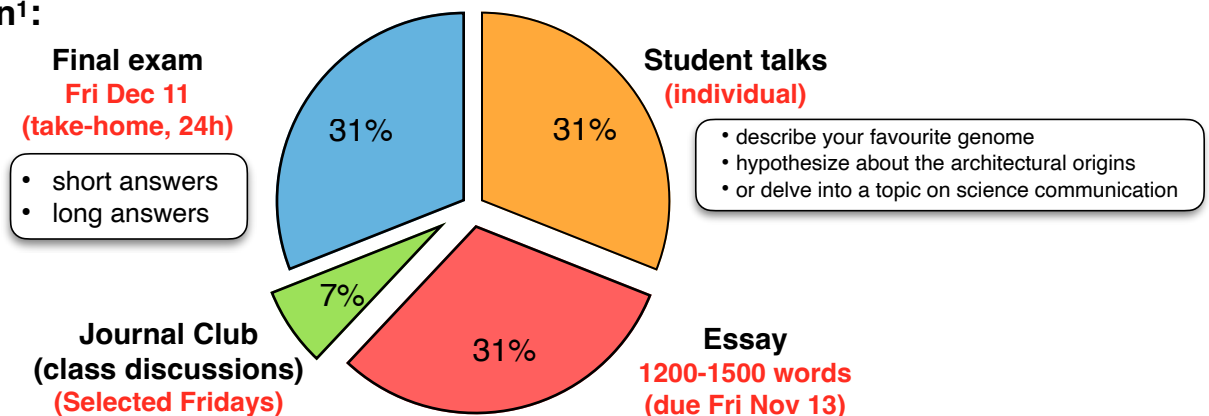
instructor: **David Smith** | office: BGS3028 | office hours: FRI 11:00-12:00 | dsmit242@uwo.ca

About the class: Ever wonder why some genomes are gigantic and others are so tiny? Why some are simple, circular molecules while others are fragmented into hundreds of linear chromosomes? This course will try to answer these & other questions about genome evolution. It will explore the diversity in genomic architecture across the Tree of Life. Through lectures, student presentations, and group discussions, we will examine strange and bizarre genomes – genomes that break all the rules. We will discuss controversial hypotheses about genome evolution and the scientists who developed them. The course also has a strong “communications” component, with lectures on scientific writing and speaking – all with a bend on genomics, of course.

Prerequisites: **4563F:** 1.5 Bio courses at 3000 level or above & registration in Year 4 of an Honours specialization module. **9561A:** Graduate student in Biology.

Text: All materials will be provided in class or online (via Brightspace).

Course website: Brightspace will be the location for materials relating to 4563F.

Evaluation¹:¹FULL DETAILS BELOW

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ESSENTIAL LEARNING OUTCOMES

- Practicing and acquiring effective science communication skills, including impactful public speaking techniques through individual class presentations and class discussions. All students must complete the oral presentation component.
- Developing an engaging scientific writing style and approach through class assignments. All students must complete the essay assignment.
- Understanding the academic landscape of being a genome scientist, including navigating the publication and grant-writing landscape.
- Engaging with scientific peers through thoughtful conversations about genomics and genome evolution (i.e., class discussions during genome talks and journal club).
- Linking diverse topics on genomics into thoughtful scientific syntheses (e.g., answers on final exam). All students must complete the final exam.

ASSIGNMENTS & GRADING

Class presentation: “a genomic show and tell”

Pick a genome, any genome, and describe its architectural features and endearing qualities to the class in a ~25-30 min presentation. Explain what makes this genome interesting and unique (or just plain weird) from an evolutionary and biological perspective. For example, is the genome massive or minuscule? Does it have thousands or only a few genes, and what do these genes encode? Is the genome linear or circular, intact, or fragmented? Is it AT- or GC-rich, or maybe a bit of both? Is the nucleotide sequence cluttered with repetitive elements and bloated with introns or is it a paragon of compactness? Are the coding regions contained in a single unit or are they scrambled throughout the chromosome? Does the DNA sequence of the genome correspond to the RNA sequence or is there post-transcriptional editing? Overall, choose a genome that intrigues you and explain to the class what it teaches us about genome evolution. **(Note: see “Sample genome papers” in Brightspace for potential ideas and topics).**

The presentation should also include some aspects of the following: **I)** A brief overview of the organism and cellular compartment in which the genome is found. If you’re presenting the mitochondrial genome of a box jellyfish, tell us a bit about mitochondria, their DNA, and jellyfish. **II)** A quick summary of who sequenced and analyzed the genome and their motivations for doing so. Did the United States Department of Energy sequence the genome or a PhD student from Iceland, and were they trying to cure malaria or understand the origins of life? **III)** Where, when, and how the genome was sequenced—was it sequenced yesterday or twenty years ago, did the scientists use next-generation sequencing technologies or Sanger sequencing, and was it published in *Nature* or the *Canadian Journal of Botany*? **IV)** Background information and evolutionary hypotheses. For instance, if the talk is about a giant genome from lungfish, touch upon what is known about the variation in genome size among animals and the various hypotheses for explaining it. And **V) (this is mandatory)** A **one-page handout** summarizing the main message and key points of your talk. The information on these

handouts, which can contain bullet points, figures, and/or tables, will be used to develop questions for the take-home exam. You do not need to print the handout; please email me (dsmit242@uwo.ca) an MS word or PDF version of it ~24 hours before your talk.

Note: I'm open to students presenting on topics/subjects/themes that deviate from those described above (genomics). If you have an idea that would you think would work for the course (e.g., communicating genomics to the public, the future of bioinformatics, designer babies, artificial intelligence, etc.) please run it by me. I'll probably say Yes.

Presentation group size, length, and format: All presentations are done individually (i.e., groups of 1). Only one presentation is required per person. Talks should be ~25-30 min, which will leave ~10 min for class discussion. Format: PowerPoint, Canva, Keynote, chalk and blackboard, short videos, skits ... it is all fair game. Just make sure that you get your point across effectively, and that you have fun doing so.

Grading: Each presentation will be given a mark out of 31 based on:

- Effective communication (5)
- Quality of presentation materials (5)
- Scientific content (12)
- The one-page handout (5) (*email to David before the talk and I'll post on Brightspace*)
- Topic selection (4). *For the topic selection please submit a one-paragraph statement including: a) The name of the presenter. b) The key topic of the presentation (i.e., the tomato genome or cancer genomics ...). And c) The title/citation of the key paper(s) that will be summarized. **Deadline for topic selection is Fri Sep 18 (11:59 pm).** Please submit via the Assignment section in Brightspace.*

The presentation represents 31% of the final grade.

Time and place: All presentations will take place during class hours (Wednesdays 9:30am-11:30am and Fridays 9:30-10:30am). **Presentation time slots open on WED Sep 16 at 10:30 am.** Sign-up is on a first-come, first-serve basis and is done through the "Presentation Sign-up" tab on Brightspace. On the day of your assigned talk, make sure you have everything you need, such as laptop cables, plugins, laser pointer, handouts, etc.

Essay Assignment: "portrait of a genome"

Write a 1,000- to 1,500-word essay on one of the following topics: **I)** Select a genome that you find intriguing, perhaps one of the genomes presented or discussed in class. Similar to the Presentation assignment, describe any aspects that make this genome interesting from an evolutionary perspective. **II)** Pick a contemporary or controversial hypothesis on genome evolution, such as Michael Lynch's mutational burden hypothesis, explain it and argue, using examples from the literature, why you agree or disagree with it. **III)** Highlight a scientist or personality that has had a major impact on the field of genomics or genome evolution, such as Richard Dawkins, Craig Venter,

Barbara McClintock, or the double noble laureate Richard Sanger. Summarize the person's work or discovery, place it in context to the current research landscape, and the impact it has had on genome science. **IV)** Investigate a political or cultural theme or technological innovation that has influenced the trajectory and/or our understanding and appreciation of genome evolution, such as next-generation sequencing technologies or personalized genomics. **V)** Discuss a theme in science communication, such as the use of social media by geneticists or communicating genomics to the general public.

I have no strict guidelines for the style of the essay. It can be similar to that of a review article for an academic journal or it can be more light-hearted, like a piece for a popular-science magazine or national newspaper. Please be creative—if you are an aspiring journalist, author, or blogger do take advantage of this assignment to test your inventive abilities at combining creative writing with genome evolution. I will also consider first-person accounts or interviews about genome science—for example, the essay could be a news piece focusing on research being done in a lab at Western. Just make sure your message is accessible and poignant and related to genome evolution. If you are thinking of writing something more unconventional, do run your idea by me first. All essays must include a figure, image, cartoon, comic, or table (created by the student, not taken off of the internet) that helps convey the main theme of the article.

I'm open to the use of AI tools to help guide you and for editing processes. In fact, I'm curious to see how many students use AI (and in what ways) for this assignment. If you incorporate AI tools, please provide a summary for how you used them. At this stage, I'm trying to understand how to adapt my teaching to the changing AI landscape, and to understand how it is helping and hindering student learning.

Grading: Each essay will be given a mark out of 31 based on:

- style and grammar (5)
- scientific content (12)
- persuasiveness (5)
- figure/graphic component (5)
- & topic selection (4) **Deadline for topic selection is FRI Oct 9 (11:59 pm).** *Please submit a one-paragraph outline summarizing the main topic and key paper(s) via the Assignment section in Brightspace.*

The essay represents 31% of the final grade. Based on university policy for “F” courses, failure or non-completion of the written component is an automatic failure of the course.

Due dates: Please upload completed essays to Brightspace (via the Assignment section) by **FRI Nov 13 (11:59 pm).**

4. Take-home exam: “genome trivia”

This exam will include content taken from class lectures, student presentations, particularly the “handout” portion of the presentations, and journal club. The exam will

contain six or seven short-essay questions (350-500-word answers). Students will be asked to answer FIVE of the questions.

The use of generative AI tools is prohibited for the final.

Grading: The exam will be given a mark out of 31 based on short-essay questions (5 questions x 6 marks each; + a one-point bonus). **The exam represents 31% of the final grade.**

Due dates: The take-home exam will be made available on Brightspace (via the assignment section) on **FRI Dec 5 (9:30 am)**. Completed exams must be uploaded to Brightspace (again via the assignment section) by **SAT Dec 6 (11:59 pm)**.

5. Journal club & class discussions

All **4563F students** will be expected to have read the journal club paper before class and to contribute to class discussions on the paper. **Journal club discussions (and discussions following student presentations) represent 7% of the final grade.**

Time and place: Selected Fridays throughout term.

Biology 9561A (graduate students): Each graduate student will be assigned one academic paper on genome evolution, and will then present the main themes and findings of that paper and its broader significance to the class in a “journal club” format. Presenters should give a brief (15-20min) overview of the assigned paper and have a series of questions, perspectives, and/or activities prepared to initiate class discussions and debates, which will last ~30 min. Graduate students will be assigned papers in the first two weeks of class. All presenters will be given a mark out of 7 on their ability to describe and discuss their assigned papers and stimulate classroom involvement. **The journal club** assignment represents 7% of the final grade. Note, this assignment is not part of 4563F, i.e., the undergraduate section of the class. However, undergraduates in 4563G will participate in the journal club discussions, which will contribute to their “class discussion” grade (7%).

Key dates

- Sep 16 (Wed) Presentation time-slots open on Brightspace.
- Sep 18 (Fri) Submit 1-paragraph outline of presentation topic via assignment section (Brightspace).
- Oct 9 (Fri) Submit 1-paragraph outline of essay topic via assignment section (Brightspace).
- Nov 13 (Fri) Submit essays via assignment section (Brightspace).
- Dec 11 (Fri) Take-home exam released via assignment section (Brightspace).
- Dec 12 (Sat) Submit take-home exam via assignment section (Brightspace).

TENTATIVE COURSE SCHEDULE (SUBJECT TO CHANGE)

Lecture	Date	Day & Time	Length	Speakers	Topic	Reminder
1	Sep-09	Wed, 9:30-11:30	2h	David	Course Outline	
2	Sep-11	Fri, 9:30-10:30	1h	David	Effective Communication Part 1	
3	Sep-16	Wed, 9:30-11:30	2h	David	Effective Communication Part 2	Presentation time-slots open (10:30 am; Brightspace)
4	Sep-18	Fri, 9:30-10:30	1h	David	Introduction to Journal Club	Presentation topic due (11:59pm; Brightspace)
5	Sep-23	Wed, 9:30-11:30	2h	David	Mock Genome Lecture	
6	Sep-25	Fri, 9:30-10:30	1h	David	Journal Club 1	
NO CLASS Sep-30 TRUTH AND RECONCILIATION						
7	Oct-02	Fri, 9:30-10:30	1h	TBD	Guest Lecture	
8	Oct-07	Wed, 9:30-11:30	2h	TBD	Student Talks (x2)	
9	Oct-09	Fri, 9:30-10:30	1h	TBD	Student Talks (x1)	Essay topic due (11:59pm; Brightspace)
FALL READING WEEK Oct 12-16						
10	Oct-21	Wed, 9:30-11:30	2h	TBD	Student Talks (x3)	
11	Oct-23	Fri, 9:30-10:30	1h	TBD	Journal Club 2	
12	Oct-28	Wed, 9:30-11:30	2h	TBD	Student Talks (x3)	
13	Oct-30	Fri, 9:30-10:30	1h	TBD	Student Talks (x1)	
14	Nov-04	Wed, 9:30-11:30	2h	TBD	Student Talks (x3)	
15	Nov-06	Fri, 9:30-10:30	1h	TBD	Journal Club 3	
16	Nov-11	Wed, 9:30-11:30	2h	TBD	Student Talks (x3)	
17	Nov-13	Fri, 9:30-10:30	1h	TBD	Student Talks (x1)	Essay due (11:59pm; Brightspace)
18	Nov-18	Wed, 9:30-11:30	2h	TBD	Student Talks (x2)	
19	Nov-20	Fri, 9:30-10:30	1h	TBD	Student Talks (x1)	
20	Nov-25	Wed, 9:30-11:30	2h	TBD	Student Talks (x2)	
21	Nov-27	Fri, 9:30-10:30	1h	TBD	Journal Club 4	
22	Dec-02	Wed, 9:30-11:30	2h	TBD	Student Talks (x2)	
23	Dec-04	Fri, 9:30-10:30	1h	TBD	Student Talks (x1)	
24	Dec-09	Wed, 9:30-11:30	2h	TBD	Student Talks (x2)	
TAKE-HOME EXAM Dec 11-12						
						Final exam (Fri 10:30am - Sat 11:59pm; Brightspace)

(Note: the most up-to-date version is posted on Brightspace under the “Course Schedule” tab.)

RESOURCES

Where do you find information on genomes and genomic evolution and architecture? There are many academic journals that regularly publish interesting articles on genomics and genome evolution. By skimming through these journals, going through back issues, looking at the advance access articles, you will likely find a wide range of genome papers, from bizarre mitochondrial DNAs to massive nuclear chromosomes to the genomes of ancient creatures found in polar ice. Please see the “Sample Genome Papers” tab in Brightspace for examples of journals that regularly publish genome papers.

1. Student absences/missed coursework:

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs*, posted on the Academic Calendar: https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf.

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person. The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult [Accessible Education](#).

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage: https://registrar.uwo.ca/academics/academic_considerations/. All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

NOTE: **The class presentation is an essential requirement of this course.** If a student misses it, they will be offered a rescheduled date. The student must request Academic Consideration through SAP to access this opportunity.

All assignments and exams with a stated due date include an automatic 48-hour period after the deadline during which students may still submit without a late penalty. For example, if an assignment is due on November 5, they may submit it until November 7 without penalty. After this 48-hour period, no further submissions will be accepted, and students do not need to request Academic Consideration for a missed deadline; their grade for this component will be calculated as described above.

2. Additional Statements:

Religious Accommodation

When a recognized religious holiday either requires a student to be absent from the University, or requires or prohibits an activity that makes it impossible for them to complete an academic requirement scheduled that day, they are entitled to accommodation. No student will be penalized for an absence for religious reasons, and an alternative means of satisfying the requirement will be arranged. This accommodation is provided in accordance with the University's policy on Accommodation for Religious Holidays: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf.

The student should submit their requests through the Student Absence Portal (SAP), identifying the conflict and the specific course component(s) affected (e.g., test, midterm, exam).

Presentations and Assignments: If a religious observance conflicts with a presentation or assignment, they must submit their request no later than **two weeks** before the due date. Their instructor will arrange an early sitting of the test. As set out above, no makeup test is offered for any other reason; this early sitting is available specifically for this accommodation.

Students are responsible for finding out what was covered in any class they miss due to a religious observance, and for taking the appropriate steps to keep up with the course.

If a suitable arrangement cannot be reached between a student and their instructor, they should consult the Undergraduate Chair of the department offering the course, and if necessary, the Associate Dean (Academic) of the Faculty of Science.

For a list of recognized religious observances, please visit the calendars posted on the Equity, Diversity & Inclusion website - <https://www.edi.uwo.ca> (About Us – Resources – Additional Resources – Calendars).

Academic Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf.

General Academic Policies

The website for Registrar Services is <https://www.registrar.uwo.ca/>.

Use of @uwo.ca email: In accordance with policy, https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual's official university email address. It is the responsibility of the account holder to ensure that emails received from the University at their official university address are attended to in a timely manner.

Requests for Relief (formally known as "appeals")

Policy on Request for Relief from Academic Decision:

https://uwo.ca/univsec/pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Procedures on Request for Relief from Academic Decision (Undergraduate):

https://uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_requests_for_relief_procedure.pdf

Procedures on Request for Relief from Academic Decision (Graduate):

https://uwo.ca/univsec/pdf/academic_policies/appeals/graduate_requests_for_relief_procedure.pdf

Scholastic Offences

Procedures on Scholastic Offences (Undergraduate):

https://uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

Procedures on Scholastic Offences (Graduate):

https://uwo.ca/univsec/pdf/academic_policies/appeals/graduate_scholastic_offence_procedure.pdf

Use of Software for Assessments

All required papers and exams may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Support Services

Academic Advising. Please visit the Science & Basic Medical Sciences Academic Advising webpage for information on adding/dropping courses, academic considerations for absences, requests for relief, exam conflicts, and many other academic-related matters: <https://www.uwo.ca/sci/advising/>.

Mental Health Support. Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Gender-Based and Sexual Violence. Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who has gone through these traumatic events. If a student has experienced GBSV (either recently or in the past), they can find information about support services for survivors, including emergency contacts, at:

https://www.uwo.ca/health/student_support/survivor_support/get-help.html.

To connect with a case manager or set up an appointment, please contact support@uwo.ca.

Accessibility for Coursework. A student may contact the course instructor if they require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to them. If they have any questions regarding accommodations, they may also contact Accessible Education at http://academicsupport.uwo.ca/accessible_education/index.html

Learning Development and Success. Learning-skills counsellors at Learning Development and Success (<https://learning.uwo.ca>) are ready to help students improve their learning skills. The facility offers strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Student Councils.

Student-run support services are offered by the University Students' Council (<https://westernusc.ca>) and the Science Students' Council (<https://www.westernssc.ca>).