

BIOLOGY 4563G/9561B:

genome evolution

WINTER 2022

TUE (10:30-12:30)

THU (10:30-11:30)

ONLINE SYNCHRONOUS*

instructor: **David Smith** | office: BGS3028 | office hours (Zoom): THU 12:00-1:00 | dsmit242@uwo.ca

***Covid-19:** All of the lectures for this course are currently scheduled to be delivered in an online and synchronous format via Zoom on TUE (10:30-12:30) and THU (10:30-11:30), with office hours taking place over Zoom on THU (12:00-1:00). **NOTE:** there is the possibility that we may return to an in-class lecture format, as originally planned.

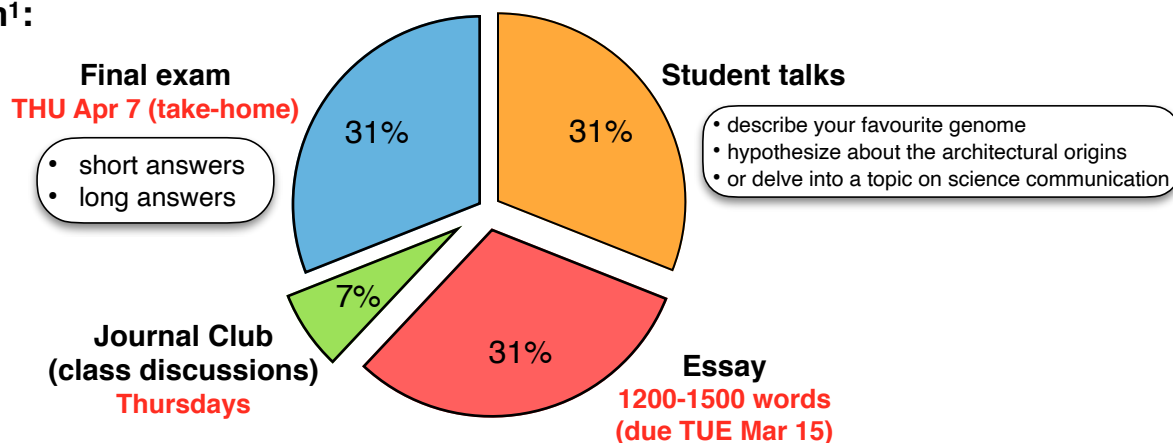
About the class: Ever wonder why some genomes are gigantic and others are so tiny? Why some are simple, circular molecules while others are fragmented into hundreds of linear chromosomes? This course will try to answer these & other questions about genome evolution. It will explore the diversity in genomic 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, speaking, and social media – all with a bend on genomics, of course.

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

Text: All materials will be provided in class or online.

Course website: OWL will be the location for materials relating to 4563G/9561B.

Evaluation¹:



¹FULL DETAILS BELOW

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ASSIGNMENTS & GRADING

1. 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 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 OWL 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. If you are unable 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 ...) please run it by me. I’ll probably say, Yes.

Presentation group size, length, and format: All presentations will be performed individually. Only one presentation is required per person. Talks should be **25 min** in length, which will leave ~10 min for class discussion. Format: PowerPoint, 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 OWL)
- Topic selection (4). *For the topic selection please submit a one-paragraph document 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 THU Jan 20 (11:55 pm).** Please submit via the assignment section in OWL.*

The presentation represents 31% of the final grade.

Time and place: All presentations will take place during class hours (Tuesdays 10:30-12:30; three talks per class. Some Thursdays; two talks per class). Currently, this will be over Zoom, but there's always a chance we could return to in-person talks. **Presentation time slots open on THU Jan 13 at 10:30 am.** Sign-up is on a first-come, first-serve basis and is done through OWL. On the day of your assigned talk, make sure you have everything you need (e.g., a strong internet connection for Zoom).

2. Essay Assignment: “portrait of a genome”

Write a 1,200- 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.

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 THU Feb 10 (11:55 pm).**
Please submit a one-paragraph outline summarizing the main topic and key paper(s) via the assignment section in OWL.

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

Due dates: Please upload completed essays to OWL (via the assignment section) by **TUE Mar 15 (11:55 pm)**. There will be a 10% deduction per day for late essays; no essays will be accepted after Fri Apr 8.

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

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 OWL (via the assignment section) on **THU Apr 7 (10:30 am)**. Completed exams must be uploaded to OWL (again via the assignment section) by **FRI Apr 8 (11:55 pm)**.

4. Journal club & class discussions

Biology 9561B: 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. All students will be expected to have read the paper before class. Presenters should give a brief (15-20 min) 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.

Time and place: Graduate students will be assigned papers in the first two weeks of class. Journal club will take place in class on Thursdays 10:30-11:30 am.

Grading: 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 4563G, 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%)

Again, for students in **Biology 4563G, 7% of the final grade** will be based on course participation, including involvement in roundtable discussions, organized classroom debates, journal club, and the question periods following presentations.

Key dates

Jan 13 (Thu) Presentation time-slots open on OWL.

Jan 20 (Thu) Submit 1-paragraph outline of presentation topic via assignment section (OWL).

Feb 10 (Thu) Submit 1-paragraph outline of essay topic via assignment section (OWL).

Mar 15 (Tue) Submit essays via assignment section (OWL).

Apr 7 (Thu) Take-home exam released via assignment section (OWL).

Apr 8 (Fri) Submit take-home exam via assignment section (OWL).

TENTATIVE COURSE SCHEDULE (SUBJECT TO CHANGE)

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

Lecture	Date	Day & Time	Length	Speakers	Topic	Reminder
1	Jan-11	Tue, 10:30 am	2h		Course Outline	
2	Jan-13	Thu, 10:30 pm	1h	David Smith	Introduction to journal club	Presentation time-slots open
3	Jan-18	Tue, 10:30 am	2h		Effective communication	
4	Jan-20	Thu, 10:30 pm	1h	David Smith	Mock genome lecture	Presentation topic deadline (11:55 pm)
5	Jan-25	Tue, 10:30 am	2h	TBD	Student talks x 3	
6	Jan-27	Thu, 10:30 pm	1h	David Smith	Journall club 1	
7	Feb-01	Tue, 10:30 am	2h	TBD	Student talks x 3	
8	Feb-03	Thu, 10:30 pm	1h	TBD	Journall club 2	
9	Feb-08	Tue, 10:30 am	2h	TBD	Student talks x 3	
10	Feb-10	Thu, 10:30 pm	1h	TBD	Journall club 3	Essay topic deadline (11:55 pm)
11	Feb-15	Tue, 10:30 am	2h	TBD	Student talks x 3	
12	Feb-17	Thu, 10:30 pm	1h		OPEN	
READING WEEK Feb 21-25						
13	Mar-01	Tue, 10:30 am	2h	TBD	Student talks x 3	
14	Mar-03	Thu, 10:30 pm	1h	David Smith	Journall club 4	
15	Mar-08	Tue, 10:30 am	2h	TBD	Student talks x 3	
16	Mar-10	Thu, 10:30 pm	1h	TBD	Journall club 5	
17	Mar-15	Tue, 10:30 am	2h	TBD	Student talks x 3	Essay deadline (11:55 pm)
18	Mar-17	Thu, 10:30 pm	1h	TBD	Journall club 6	
19	Mar-22	Tue, 10:30 am	2h	TBD	Student talks x 3	
20	Mar-24	Thu, 10:30 pm	1h	TBD	Student talks x 2	
21	Mar-29	Tue, 10:30 am	2h	TBD	Student talks x 3	
22	Mar-31	Thu, 10:30 pm	1h		OPEN	
23	Apr-05	Tue, 10:30 am	2h	TBD	Student talks x 3	
24	Apr-07	Thu, 10:30 pm	1h		Final exam (take-home)	
	Apr-08	Fri			Final exam deadline (11:55 pm)	

RESOURCES

Where do you find information on genomes and genomic evolution and architecture? For a start, 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. Among my favourite journals for reading genome papers are:

Genome Biology and Evolution (<http://gbe.oxfordjournals.org>)

Molecular Biology and Evolution (<http://mbe.oxfordjournals.org>)

BMC Genomics (<http://www.biomedcentral.com/bmcgenomics>)

DNA Research (<http://dnaresearch.oxfordjournals.org>)

Genome Research (<http://genome.cshlp.org>)

Genomics (<http://www.journals.elsevier.com/genomics>)

Current Genetics (<http://link.springer.com/journal/volumesAndIssues/294>)

Molecular Genetics and Genomics (<http://link.springer.com/journal/438>)

And many of the “big” journals also regularly publish genome papers, including:

Science (<http://www.sciencemag.org/magazine>)

Nature (www.nature.com)

PNAS (www.pnas.org)

Cell (www.cell.com)

Plant Cell (www.plantcell.org)

Current Biology (<http://www.cell.com/current-biology/>)

Genome Biology (genomebiology.com)

I have also posted a folder on OWL containing PDFs of some my favourite genome papers (see “Sample genome papers” section).

ADDITIONAL STATEMENTS

Student absences

Students who experience an extenuating circumstance sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
 - an absence must be no more than 48 hours
 - the assessments must be worth no more than 30% of the student's final grade
 - no more than two SRAs may be submitted during the Fall/Winter term
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

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

and for the Student Medical Certificate (SMC), see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar: <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

EDI statement

The pronouns used by instructor are he/him.

Land acknowledgment

We acknowledge that Western University is located on the traditional lands of the Anishinaabek, Haudenosaunee, Lūnaapéewak and Attawandaron peoples, on lands connected with the London Township and Sombra Treaties of 1796 and the Dish with One Spoon Covenant Wampum. This land continues to be home to diverse Indigenous peoples (e.g., First Nations, Métis and Inuit) whom we recognize as contemporary stewards of the land and vital contributors of our society.

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The Academic Accommodation for Students with Disabilities policy can be found at: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf

Academic Policies

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy, <http://www.uwo.ca/its/identity/activatenonstudent.html>, the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

Some of the remote learning sessions for this course (if moved online during the semester) might be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals participating in the course for their private or group study purposes. Please contact the instructor if you have any concerns related to session recordings.

Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf. Graduate students please see:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf.

Turnitin **aids** in identifying plagiarism. 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.

Completion of this course will require you to have a reliable internet connection and a device that meets the system requirements for Zoom (in case the course gets moved online during the semester). Information about the system requirements are available at the following link: <https://support.zoom.us/hc/en-us>

Professionalism & Privacy

Western students are expected to follow the Student Code of Conduct. Additionally, the following expectations and professional conduct apply to this course:

Students are expected to follow online etiquette expectations provided on OWL. All course materials created by the instructor(s) are copyrighted and cannot be sold/shared. Recordings are not permitted (audio or video) without explicit permission. Permitted recordings are not to be distributed. Students will be expected to take an academic integrity pledge before some assessments. All recorded sessions will remain within the course site or unlisted if streamed.

Note that disruptive behaviour of any type during in-person or online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offences may be subject to disciplinary measures under the Code of Student Conduct.

Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on add/drop courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Student Accessibility Services (SAS) at 661-2147 if you have any questions regarding accommodations.

The policy on Accommodation for Students with Disabilities can be found here: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_disabilities.pdf

The policy on Accommodation for Religious Holidays can be found here: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on 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.

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