BIOL B216: Genomics

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Professor

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Logistics

Course page: Moodle
Lecture: Tues,Thurs: 9:45-11:15 am (Park 227)
Labs: Wed 1:10-4 pm (Park 246)
Pre-req: One semester B110-111 (Intro Bio I or II). B201 (Genetics) is recommended but not required. No programming experience is required.

Office hours. TBD in consultation with students. For zoom appointments, use this link. I encourage you to attend office hours to discuss class material, studying strategies, learning styles, and final project ideas. I strongly encourage you to meet with me in January outside of class for a quick chat. You may also email me to set up an appointment in-person for specific issues.

Course communications (Moodle). We will use Moodle for general course information, assignment upload, links to readings, and so on. It is your responsibility to check Moodle often to be updated about the course, deadlines, and so on. **I strongly encourage you to use Moodle rather than emailing me for most things because it benefits your classmates and encourages participation. Use the "Logistics" forum for logistics questions, and "Content-related" for content-related questions, discussions, thoughts, etc. You can either initiate a new topic or reply to an existing one.** Please note that I will respond to emails as expeditiously as possible Mon-Fri (9 am-6 pm) but cannot guarantee that I will read or respond to emails over the weekend or evenings. Please do not wait until the last minute to inquire about matters of urgency.

Course Description & Learning Goals

Genomics is a young and fast-evolving field of science that lies at the intersection of genetics, computer science, and biotechnology. We will examine the types of biological questions that can be answered using large biological data sets and complete genome sequences and the techniques and technologies that make such studies possible. Our primary focus will be on animal genomes and, in particular, human genomes, with special attention to evolutionary aspects of genomic data analysis. Topics include:

- Human evolution and our spread around the globe in the last 300,000 years;
- Genetic ancestry analyses: strengths and pitfalls;
- The human genome and those of our most closely related species;
- Genome-editing: how is it possible and what are the challenges (technical and ethical)?

The material will be investigated via lecture, discussions based on pre-assigned readings, problem-solving sessions & case studies ("workshops"), film+discussion, student research and presentations, and guided computer lab activities & problems. By the end of this course, you will have:

- An understanding of how genomic data are being used to provide new insights throughout biology and medicine;

- An intuition about the logic and challenges behind techniques and tools available for genome-scale analysis;
- Hands-on experience in quantitative and computational techniques required for the analysis of large-scale biological data, including the use of public databases and search tools;
- An improved ability to read and interpret the primary literature in genomics, including the relationship between primary findings and public understanding of that research;
- A hands-on exposure to the field of computational biology/genomics (or a deepening of prior understanding);
- A critical understanding of how structural racism permeated the origins of human genetics and its expression today;
- A deeper understanding of how genetics operates in the real world beyond the (few) examples related to one-gene one-trait.

Textbook, Readings & Lecture Slides

The (strongly) recommended textbook for the class is ***Introduction to Genomics,*** by Arthur M. Lesk, 3rd edition, 2017. (about $60 new, or $27 for rent). One textbook copy will be available on reserve in Collier Library. Since this is a fast-changing field, there will be additional readings from the primary scientific literature and other materials you will be required to engage with. **Every class will have assigned readings or other preparations.** Reading guides (for your use and study) with prompts and questions will be provided, and students are expected to have engaged with the material before the lecture following the guide. They will help you prepare for quizzes and in-class discussions. **PDFs of non-textbook readings will be posted on Moodle. I will post some of the textbook readings as well, but copyright laws prevent me from posting more than 15% of the book, so I encourage you to obtain a copy of the textbook.** Lecture slides will be shared on Moodle (usually after class).

Be aware that lecture material may not be covered in the text. Therefore, your readings cannot replace the actual in-person classes. Below are a few optional suggested readings to give you different perspectives and depth on the topics covered in class and inspire your final project. You are not required to have copies of the books below. They are all available via TRIPOD (physical and/or ebook format). Other suggestions will be posted on Moodle.

- *"Genomics: A Very Short Introduction"* (John Archibald, 2018);
- *"A Brief History of Everyone Who Ever Lived"* (Adam Rutherford, 2017);
- "*Life's Edge"* (Carl Zimmer, 2021);
- *"Neanderthal man: In search of lost genomes"* (Svante Päabo, 2013).

Course Assessment & Grading

There will be a total of 450 points allocated. You must submit all work and no make-ups will be provided **(see Policies)**. Work will be weighted as follows:

Percentage of grade	Activities	Points
20%	Three take-home exams	90 pts (30 pts each)
36%	Problem sets (5) and quizzes (6)*	162pts (18 pts each)
20%	Final project	90 pts
14%	Three short reflection papers**	63 pts (21 each)
10%	Participation	45 pts

**For these assignments, the lowest graded item will be dropped from your final grade and only four problem sets and five quizzes of each will be counted.*
***For these assignments, you will be allowed to resubmit after reading my feedback and your final grade will be the average of both.*

Final grades will probably be assigned as follows***:

93-100%	4.0	80-82%	2.7
90-92%	3.7	77-79%	2.3
87-89%	3.3	70-76	2.0
83-86%	3.0		

*** If curving is performed, it could increase but not decrease your grade.

Quizzes & Workshops. Quizzes and workshops have been scheduled on the days indicated on the syllabus. These exercises are meant to help you review material that you may have covered in Intro Bio and reinforce new concepts you learn in B216. ***Quizzes:*** We will have six quizzes and they will cover key points from the previous week and the readings for the current week **(closed book, closed notes, no internet).** You are expected to take and submit the quiz on Moodle before class meets (see Calendar). The lowest graded item will be dropped from your final grade. ***Workshops:*** You will be provided with preparation material and questions which you should review before coming to class. In class, we will break up into small groups to discuss the problems for a few minutes, after which I will ask for volunteers to answer the questions **(this is a GREAT opportunity to earn participation credit and engage in active learning).**

Computer labs & problem sets. Each lab session will have a guided activity and we will have five graded problem sets throughout the semester (and you may drop the lowest grade). We will use desktop computers provided by the College. You may bring your laptop to labs if you wish but you do not need to. It may be possible to loan you a laptop from the Bio department for the semester if you reach out to me early in the semester. Students are encouraged (but not required) to work in pairs. **Attendance is mandatory and absence needs to be appropriately justified before (not after) the session.**

Participation. Engaged participation is crucial for effective learning. Ways to participate/contribute include: asking/answering/commenting in class and on Moodle forums, sharing further exploration of class topics on Moodle, doing all the pre-class preparation that is expected of you, engaging in discussions in-person and on Moodle, taking all surveys posted, handing your assignments on time, handing in all minute-papers (end of class reflections) and keeping honest and timely communications with me when unable to meet deadlines, attending office hours as often as possible. If you need to miss class, I expect you to be proactive and creative about how to make up for it. Sending in your reading guide notes and engaging in discussions on Moodle are ways to show your participation and engagement. **Frequent engagement is required for full participation credit.**

Short papers. You will be asked to submit three short papers (600-800 words) throughout the semester. The main topic can be chosen from a recent scientific publication, popular science article, newspaper report, or blog post. Ideally, you will choose material that supports your final project, but that is not necessarily a requirement. I encourage discussing ideas with classmates but papers should be written individually and submitted on Moodle. These will serve you well in preparation for your final project. You are allowed to resubmit these to me for re-grading within exactly one week of my handing it back to you. Instructions will be posted. If you take the feedback seriously and resubmit it within the deadline, you might improve your grade. Instructions will be posted on Moodle.

Exams. Because this class emphasizes the integration of information from diverse sources, the **three exams will be open-book, open-notes, and open-internet.** In fact, some questions may *require* the use of internet resources. The exam format will be similar to a combination of what you will see in quizzes and problem sets, as well as the ability to articulate ideas required in the short papers. ALL SUBMITTED WORK MUST BE SUBMITTED INDEPENDENTLY. Exams will be distributed on a Thursday (see Calendar) and due back the following Tuesday in class (unless otherwise pre-agreed in advance). You must address any scheduling conflicts well before the exam posting, and no make-up exams will be offered. Exams will be based on both lecture and lab content and you will be expected to be able to articulate your ideas clearly and justify your answers in detail. There will be no final exam; instead, we will have a "Final Project".

Final project. Rather than a final exam, the final evaluation for the course will be a 6–8 page review paper on a recently sequenced genome or other research involving genome-scale data analysis. **Please do not leave this project to the last minute. Instead, use the entire semester to think about, develop, and finalize your project.** You will review the technical approaches that were used to produce the genome, and the biological insights that the genomic data provided, with a focus on discoveries that would not have been made without genome-scale data. The written assignment will be due at the end of the semester but you also will need to present your research to your fellow classmates in the last week of class. You will be graded on: your ability to summarise the relevant literature; synthesize the main "hot topics" in the field; talk about the current limitations/challenges and potential ethical/cultural aspects of the research topic; give a clear presentation. Detailed guidelines will be posted on Moodle. **I have added checkpoints to the calendar where you are encouraged to meet with me and/or hand me your preliminary work for feedback.** While not required doing so will count positively towards your participation in the course and avoid last-minute, rushed work.

Policies & Expectations

- Please refrain from engaging in non-B216 related activities during class. You may use a personal laptop to support your learning for all in-person meetings.
- I tend to be accommodating whenever possible if students are **proactive** and **honest** and communicate with me before assignments are due/posted.
- I tend to be fueled by students' enthusiasm and I welcome contributions of any kind.
- I do not expect you to memorize facts. I expect you to understand them and their implications (and show me you did).
- **I encourage open and frequent communication!** You can only benefit from reaching out to me and your dean if anything is preventing you from doing your best work.
- I will **not** be recording lectures and labs and video recording by students is not allowed. Audio recordings (without video) by individual students are permitted and encouraged and may be shared with other members of B216 this semester but not outside the B216 Spring '22 community.
- **Attendance should be a priority.** Every meeting will have activities that count towards your final grade directly or indirectly.
- Proper communication of absence ahead of time and creative and proactive make-ups for in-person participation are encouraged.
- All exams and assignments are required to pass the course. There will be no make-up exams or assignments. You must submit all your work on time or communicate with me **at least 24h before the deadline if you wish to request an extension**, which will be evaluated on a case-by-case basis. Leaving a phone message or sending an email without confirmation of receipt is not acceptable.
- In the absence of any prior notice, late assignments will incur a 10% penalty per day. Any assignment handed in ten days late or more without prior communication will not receive credit.
- **No retroactive accommodations and extensions will be given**, so please read the schedule carefully and plan accordingly.
- Discussion with other students on technical and content-related topics is allowed and encouraged. All submitted work should be your own, with any assistance from other students clearly acknowledged.
- **Academic Integrity.** The Bryn Mawr College Honor Code binds all students attending Bryn Mawr College classes. If you witness cheating by another student, you are expected to confront that person promptly but politely.
- **Plagiarism from other students or other sources will not be accepted as gradable work.** Instructions on how to properly cite scientific literature will be given.
- When an exam or quiz is returned to you, please examine it for mathematical accuracy. If you detect a mathematical error, you have one week from the time the exam is returned to request adjustments. After that week, the score is considered final. More importantly, please read the comments provided and come to office hours to go over any lingering questions.
- Some of you may face circumstances that prevent you from attending. I request that you communicate with your dean or me as soon as possible if/when you know that you may miss more than one class meeting in succession. This will allow us to find a path forward in class in such extenuating circumstances. See calendar for deadlines.

Resources

Academic support. An overview of effective strategies can be crucial to your success in College. There is a large body of studies on how we learn. Here are a few good resources to get you started (if you find others, please share them on Moodle): Bryn Mawr academic support services, general learning resources,

study smarter not harder, how students learn. My best advice: be consistent in your studies; keep up with assigned readings; take notes during lectures and review your notes within a couple of days to make sure you understood the material; use all the material provided to you (readings, videos, etc.); if anything is less than clear, come to office hours immediately (instead of waiting until right before the exam); always review the keys posted and tackle additional problems in your textbook (or other Genomics textbooks available in the library or online). The more you practice and apply the material you learn, the better! Though some of you may succeed without proper preparation, *the reality is that classes are more interesting when we are prepared*. Think about that!

Students with physical or learning differences. Bryn Mawr College is committed to providing equal access to students with a documented disability. Students needing academic accommodations for a disability must first register with Access Services. Students can call 610-526-7516 to make an appointment with the Access Services Director, Deb Alder, or email her at dalder@brynmawr.edu to begin this confidential process. Once registered, students should schedule an appointment with the professor as early in the semester as possible to share the verification form and make appropriate arrangements. Please note that **accommodations are not retroactive** and require advance notice to implement. You can find more information at the Access Services website.

Health & General well-being. College is a marathon, not a sprint. Take care of your physical and mental health. You will reap more benefits if you are consistent than cramming an unreasonable amount of work into a short period of time. If you are struggling, do not wait: keep your professors and your academic dean on the same page so that we can help you achieve your best. Also, do not hesitate to seek out the services available to you such as the Bryn Mawr College counseling services.

Diversity & Inclusion. In an ideal world, it would be possible for the scientific practice to be done in a perfectly objective way, free of biases and preconceptions. However, it is not so. Scientists are flawed and human. The history of science is also a history of who got the credit and is dominated by white, male, colonialist, and racist ideas. I will try to acknowledge that by highlighting less known historical figures and providing a critical perspective on such matters whenever possible. I see the diversity of backgrounds and identities our students bring as a strength: age, culture, disability, ethnicity, gender, nationality, religion, sexuality, socioeconomic status. I intend for this course to serve students from diverse backgrounds and perspectives. **Your suggestions are encouraged and appreciated.** Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. Check the schedule and if you foresee conflicts in the schedule due to religious observance, reach out to me as soon as possible so we can negotiate extensions. If you have concerns about being able to afford course materials, please reach out to me.

Title IX. The College strongly encourages all students to report any incidents of sexual misconduct. Please be aware that all Bryn Mawr/Haverford employees (other than those designated as confidential resources such as counselors, clergy, and healthcare providers) are required to report information about such discrimination and harassment to the Bi-College Title IX Coordinator. See here.

While I will try my best to adhere to the schedule, changes to the syllabus/course format may be necessary due to unforeseen circumstances. If so, I will announce changes by email and will update the Moodle page accordingly.