

BIOL B317: Evolution and Medicine

Adam Williamson Office: Park 212 Email: awilliams6@brynmawr.edu	Seminar: Mon, Wed. 10:10 am -11:30 am Park Science Room 264 Student Hours: Scheduled via Calbird calbird.com/adam-williamson/student-meetings
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OVERVIEW

An opportunity to apply evolutionary thinking to the prevention and treatment of human disease. Course themes include: pathogen evolution; evolution of defense mechanisms; reproductive medicine; cancer as an evolutionary process; disease-associated allele frequencies in populations; individual health versus population health. A seminar course with an emphasis on the primary research literature. Students will complete a sequence of writing assignments in response to posted prompts, present current research about a topic of personal interest, and actively contribute to class conversations during and between seminar meetings using a variety of forms of participation. We will convene for three hours of course meetings per week.

LEARNING OUTCOMES

After this seminar you will be able to...

- Define the evolutionary mechanisms underlying genetic conflicts including host-pathogen evolution and meiotic drive
- Evaluate both individual patient and population-level approaches to the treatment of human disease
- Write concise narrative prose applying evolutionary principles to a broad array of human diseases
- Envision the frontiers and immediate future of evolutionary medicine, a fast-moving field at the interface of evolutionary biology and immunology

COMMITMENT TO BUILDING AND NURTURING AN INCLUSIVE CLASSROOM

In my role as seminar facilitator, I will strive to build and nurture an inclusive, responsive classroom that supports you as a student and human being. I value the diversity of backgrounds and experiences that together we bring into our space and I will try my best to provide an equitable learning environment that supports all seminar students.

I recognize that the practice of scientific research, both in the past and today, is not unbiased, but rather a reflection of the flawed society in which it occurs. I also acknowledge that harm continues to be done to people who hold historically excluded identities, including but not limited to first-generation, low-income (FGLI), LGBTQ+, neurodiverse, and BIPOC individuals.

I know that students face significant personal, familial, and societal stressors that place considerable demands on your time and energy, both inside and outside our classroom. I ask that if you encounter difficulties in this course, you reach out to me, your dean (or both) as soon as you are able so we can craft a path forward that works for you.

I welcome your feedback and commit to listening to/reading your concerns in full, believing that your experiences in this course are real, and responding to your concerns by implementing necessary changes to the best of my ability. In addition to regular student office hours, I offer the following avenues for you to reach out with any questions or concerns:

- 1) An initial conversation early in the semester to develop shared class norms that promote your full participation in our course
- 2) A mid-semester evaluation and conversation to implement any necessary changes during the term
- 3) A form at the top of the course Moodle to submit questions or concerns at any point during the term

REQUIRED TEXTS

Stearns & Medzhitov (2018). Evolutionary Medicine (1st Ed.). Sinauer Publishers, Sunderland, MA. ISBN-13: 978-1605352602

A primer on Evolutionary Medicine co-authored by an evolutionary biologist (Stearns) and an immunologist (Medzhitov). Assigned readings from Stearns & Medzhitov as indicated on the schedule below will provide you with the foundation necessary to productively contribute to our seminar.

Primary research, review articles, and book chapters posted on Moodle

Required primary research articles, conceptual review papers, and book chapters are on the schedule below and will be made available on the course Moodle.

Accessibility of required texts: All readings will be made available in a form accessible to all members of our seminar. High resolution, accessible PDF files will be available on Moodle for all primary research articles, reviews, and book chapters. High resolution, accessible scans for Stearns & Medzhitov readings will be provided to any student who requires them.

CRITQUED AND EVALUATED WORK

Course assignments and corresponding weights indicated below. Course graded out of 400 points. Weight and number of assignments subject to change if necessary.

ASSIGNMENTS – Course graded out of 400 total points

Response Papers – 5 response papers, 50 points each (250 points total)

You will complete five short response papers this semester (2 pages double-spaced maximum length) in response to a posted prompt.

Writing focus will depend on the content of course. On average you will complete a response paper every other week. You will have ~5 days to complete each response paper, enabling you to bring themes from different class sources and conversations into your writing.

I will provide feedback and a grade each written response using feedback features on Moodle using the following categories: 1) Content (~25%) , 2) Analysis/Creativity (~50%), 3) Writing (~25%)

Response Paper Grading Rubric

10 points: Outstanding work that draws on multiple sources to support an argument. Clear, concise prose that is easy for an instructor to follow. A 10/10 on a response paper is rare in this course.

8-9 points: Strong work that connects to course material. Argument or prose challenging for Adam to follow. Most strong papers will receive between 8 and 9 points depending on strength of work in each ca

6-7 points: Complete work related to prompt

6 points and below: Brief response that does not connect to course material

Facilitated discussion about an Evolution & Medicine topic of personal interest – 50 points

Each student will lead the class in conversation about a topic of personal interest. These student-facilitated class meetings will occur near the end of the semester. We will establish a set of norms for these discussion prior to the first student-led class.

Final Portfolio

During our mid-semester conversation we will discuss what a meaningful final piece of work would look like to you in the context of this course. Students will have the opportunity to choose from a menu of options we’ll develop as a class. Possible examples of a final portfolio include: a collection of your response papers with a 4-6 page written introduction about your path in this course and meaningful learnings along your journey, a recorded audio podcast about a current topic in Evolution & Medicine, or an online or hard copy poster about a topic you found interesting during the class.

Contributions to the Seminar

Contributions to the seminar will take a variety of forms beyond attendance and speaking in class. For instance, a class Piazza forum will enable you to interact with your classmates and post interesting news articles related to Evolution and Medicine that you find during the term.

Points for Key Pieces of Evaluated Work (400 pts total for class)

5 written responses (50 pts each).....	250 points
Facilitated discussion about a topic of personal interest	40 points
Final Portfolio	60 points
Contributions to seminar.....	25 points
Student office hours visits (5 pts each).....	15 points

Summary of important dates

Jan 19-Apr 6
 Apr 11-Apr 20
 May 8 (seniors), May 13 (all others)

Written response papers ~every other week
 Student-facilitated class meetings
 Final portfolio due

ATTENDANCE

Our seminar is focused on supporting you and your learning. It is my sincere hope that our space is a valuable opportunity to move your work forward each week and provide a space for our community reflect on one another's progress towards our goals. Thus, it is my expectation that each student will attend every seminar meeting. That said, I am fully cognizant that each student is working in the context of variety of stressors. **Please contact me directly via email or through your dean if you anticipate missing a scheduled seminar meeting.**

DUE DATES AND EXTENSIONS

Due Dates: I set the schedule so you are only working on one key piece of evaluated work at a time for this course. Please submit your work on Moodle by the deadline to protect your time and allow me to provide actionable feedback in a timely manner. **Please review the key due dates and let me know by Jan 28th if you have potential conflicts.**

Extensions: I will discuss extensions on a case-by-case basis as necessary. Please note the lowest reflective writing assignment is dropped when calculating your final grade.

GRADES AND PROVISIONAL GRADING SCALE

Grades on Moodle: Any overall course grade visible on Moodle is not a reflection of your current grade for the course. I understand this is confusing for students. So why is it this way? The Moodle gradebook requires the instructor to enter percentages for each assignment prior to the term and is somewhat inflexible if changes are required during the semester. It is important to me that there be some flexibility on assignments if circumstances necessitate a change to coursework or percentage of the final course grade for each piece of work. **I will send each student a mid-term grade after Week 7. If you would like to opt out of this grade report please let me know.**

Grades for this course will likely be assigned as follows:

The grading scale for this course is subject to change. However, please note any change will be in the students' favor (i.e. the 3.3 cutoff would not be higher than 87% but may go lower if necessary)

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

OFFICE HOURS (aka "STUDENT HOURS")

Office hours ("student hours") with your instructors offer you an opportunity to discuss aspects of course material you find interesting and/or challenging, develop your academic professional network, and represent an important piece of academic science's "hidden curriculum." For these reasons I require you to meet with me at least three times during student office hours (Zoom or in person, your choice): once to introduce yourself, once to discuss your first response paper after submitting it for critique and a third time to plan a strategy for your final portfolio. You will receive 5 points for each student hours visit.

Accommodations (*italicized text from BMC Access Services*)

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 Director of Access Services, 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. More information can be obtained at the Access Services website. (<http://www.brynmawr.edu/access-services/>)

Recording class (*italicized text courtesy of BMC Access Services*)

Any student who has a disability-related need to record this class first must speak with the Director of Access Services and to me, the instructor. Class members need to be aware that full class meetings may be recorded.

Title IX concerns (*italicized text from Bryn Mawr College Provost*): *Bryn Mawr/Haverford College is committed to fostering a safe and inclusive living and learning environment where all can feel secure and free from harassment. All forms of sexual misconduct, including sexual assault, sexual harassment, stalking, domestic violence, and dating violence are violations of Bryn Mawr/Haverford's policies, whether they occur on or off campus. Bryn Mawr/Haverford faculty are committed to helping to create a safe learning environment for all students and for the College community as a whole. If you have experienced any form of gender or sex-based discrimination, harassment, or violence, know that help and support are available. Staff members are trained to support students in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, and more.*

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](#).

SEMINAR SCHEDULE AND REQUIRED READINGS (Subject to Change if Necessary)

Week	Dates	Topic, Theme, or Question	Required Readings
Week 1	W Jan 19	Evolutionary thinking	The Dawn of Darwinian Medicine Williams & Nesse (1991). The Quarterly Review of Biology. Stearns & Medzhitov, pp 1-23
Week 2	M Jan 24 W Jan 26	What is a patient?	A Reasonable Organism Defends Itself. Cohen, E. <i>A Body Worth Defending</i> (Ch. 1). Duke Press (2009) Stearns & Medzhitov, pp 25-85
Week 3	M Jan 31 W Feb 2 (groundhog day!)	What is a disease?	Conclusion. Cohen, E. <i>A Body Worth Defending</i> (Ch. 6). Duke Press (2009) Stearns & Medzhitov, pp 87-100
Week 4	M Feb 7 W Feb 9	Evolution of defenses	The Evolution of Adaptive Immune Systems. Cooper and Alder (2006). Cell. Stearns & Medzhitov, pp 101-138
Week 5	M Feb 14 W Feb 16	Evolution of pathogens	Immunological Characteristics Govern the Transition of COVID- 19 to Endemicity. Lavine et al. (2021). Science. Stearns & Medzhitov, pp 139-167
Week 6	M Feb 21 W Feb 23	Genetic Conflicts I: Host- Pathogen Conflicts	Evolutionary Insights into Host- Pathogen Interactions from Mammalian Sequence Data. Sironi et al. (2015). Nature Reviews Genetics. A New Evolutionary Law Van Valen, L. (1973).
Week 7	M Feb 28 W Mar 2	Genetic Conflicts II: Intragenomic Conflicts	Centromeres Drive a Hard Bargain. Rosin & Mellone (2018). Trends in Genetics. The Red Queen in Mitochondria: Cyto-Nuclear Co-evolution and Human Disease Chou & Leu (2015). Frontiers in Genetics.

Week 8	Mar 4 - Mar 13	No Class Meetings, Spring Break (Take a Break!)	
Week 9	M Mar 14 W Mar 16	Reproductive Medicine	Placental Invasion and Adaptive Molecular Evolution. Crosley et al. (2013). Placenta. Stearns & Medzhitov pp. 191-218
Week 10	M Mar 21 W Mar 23	Cancer as an Evolutionary Disease	The Clonal Evolution of Tumor Cell Populations. Nowell, P.C. (1976). Science Stearns & Medzhitov pp. 167-189
Week 11	M Mar 28 W Mar 30	Disease-Associated Alleles in Human Populations	The Population Genetics of Human Disease: Recessive, Lethal Mutations. Amorim et al. (2017). PLOS Genetics.
Week 12	M Apr 4 W Apr 6	Individual Health Versus Population Health	On the Relationship Between Individual Health and Population Health. Arah, O.A. (2009). Medicine, Health Care, and Philosophy Stearns & Medzhitov pp. 253-266
Week 13	M Apr 11 W Apr 13	Student-led facilitated discussions	Student-Assigned Background Readings
Week 14	M Apr 18 W Apr 20	Student-led facilitated discussions	Student-Assigned Background Readings
Week 15	M Apr 25 W Apr 27	Evolution and Medicine: Frontiers and Emerging Research	Bats as Reservoirs for Emerging Zoonotic Pathogens. Brook, C.E. (2015) Trends in Microbiology Frontiers in Evolutionary Medicine. Stearns, S.C. (2019). Journal of Molecular Evolution
Finals period	May 8 (seniors), May 13 (all other students)	Final portfolio due	