



# BIO 4200

## EVOLUTIONARY BIOLOGY

### SYLLABUS, WINTER 2021

#### Course Reference Numbers: 20925, 21960

**Credits:** 3

**Time:** M/W 10:00AM - 11:15AM

**Place:** Lectures will be given in synchronous zoom meetings which will be recorded. Meeting ID and password will be communicated via school email and Canvas.

**Instructor:** Dr. Markus Friedrich  
Biological Sciences Building, room 3117  
Email: [friedrichwsu@gmail.com](mailto:friedrichwsu@gmail.com)

**Goal:** Introduction to essential concepts, methods, and insights of evolutionary biology

**Contact and communication:** During and after lecture or per email

**Office hours:** After lecture or per email appointment

**Credit requirement policy:** Note that prerequisite requirements as outlined here will be strictly enforced by the department: C- or better in BIO 3070 and one of the following successfully completed: BIO 3100, 3200 or 3500.

## **COURSE DESCRIPTION**

This course is an in-depth introduction to major concepts, mechanisms, and case studies in evolutionary biology.

## **TOPICS COVERED**

1. Microevolution versus macroevolution
2. The mechanism and consequences of natural selection
3. The relationship between genetic and phenotypic variation
4. Understanding organismal diversification as descent with modification
5. Using tree visualization to study and describe evolutionary relationships and ancestries
6. Reconstructing phylogenetic trees using molecular and morphological information
7. Defining homology at the phenotypic and molecular level
8. The impact of selection, genetic drift, migration, inbreeding, and mutation on genetic change at the population level
9. The neutral theory of molecular evolution and the molecular clock
10. The importance of genetic recombination for adaptive evolutionary change
11. The evolution of linkage disequilibrium
12. The diagnostic power of linkage disequilibrium to study genes under selection
13. Molecular approaches to detect selection
14. Quantitative genetic approaches to analyze the adaptive evolution of complex traits including the mapping of quantitative trait loci
15. Recent human population history and its impact on genome evolution
16. Recent adaptive changes affecting human populations at the genetic level
17. Evolutionary forces affecting genome evolution
18. Species concepts
19. Speciation modes
20. The role of developmental genes and mechanisms in body plan evolution, phenotypic plasticity and phenotypic robustness
21. The role of co-option and modularity in the evolution of organismal complexity
22. Sexual selection
23. Kin selection and evolutionary game theory based approaches to study the evolution of social systems
24. Behavioral evolution
25. Primate evolution and ancestral human traits
26. Cultural evolution

## **LEARNING OBJECTIVES/OUTCOMES**

As a result of mastering the material in this course, you will be able to:

1. Understand and study the mechanisms underlying the diversification of viruses, microorganisms, and multicellular systems by means of natural selection

2. Infer phylogenetic relationships using structural and genetic data
3. Apply comparative approaches to analyze and study patterns of genetic, organismal and cultural diversification
4. Study adaptive processes using molecular genetic tests
5. Understand the complementary nature of theoretical, modeling, and experimental studies of evolutionary change
6. Understand the role of kinship and reciprocity in the evolution of cooperative behavior
7. Apply game theoretical thinking
8. Understand the evolutionary origin of gender differences
9. Recognize the multiple levels of evolutionary change that affect the human sphere
10. Apply evolutionary insights to the development of biomedical and public policy

### **METHOD OF INSTRUCTION**

Given the compressed nature of parallel offsite lectures, students will be required to familiarise themselves with the study materials before lecture through lecture materials, textbook, and recommended online resources. The actual online lectures will explore topics guided by interactive poll initiated student responses.

Lectures are accessible online at:

<https://drive.google.com/#folders/0B6RXcc7dd6COUGRqVE5JTld1ak0>

**Canvas:** In this course, we will use Canvas primarily for email announcements, taking quizzes and the final exam, and to post quiz grades. Canvas is located at <http://Canvas.wayne.edu> or <http://academica.wayne.edu>. To login, login to Academica using your Wayne State user id (two letters + four numbers, e.g. bx1234).

For assistance with any of these technology issues, contact C&IT Helpdesk M-F from 7:30 am to 8 pm at 313-577- 4357 or [helpdesk@wayne.edu](mailto:helpdesk@wayne.edu).

### **Recommended textbooks:**

*Evolutionary Analysis, 5th edition*

Authors: Scott Freeman, Jon C. Herron

Publisher: Pearson

*Evolution: Making Sense of Life*

Authors: Carl Zimmer and Douglas Emlen

Publisher: Roberts and Company Publishers

ISBN: 9781936221172

### Recommended complementary resources:

- <http://en.wikipedia.org/wiki/Evolution>
- Concepts of Genetics 9<sup>th</sup> edition
- Peter R. Grant, B. Rosemary Grant: *How and Why Species Multiply: The Radiation of Darwin's Finches*

### GRADING

There will be **3 options** to determine your final percentage course score:

#### Option 1:

100% will be calculated from the average percentage performance of a total of 12 weekly exams. Note that there will be a total of 14 weekly exams and that the two lowest scores will be dropped in the calculation of the weekly average (see further below regarding the format of the weekly exams). Obviously, **participation at the weekly exams is obligatory to pass this class.**

#### Options 2 and 3:

Your final grade will be determined from a composite of your weekly exam results and a final exam in one of two possible ways:

- 80% will derive from the average percentage performance of a total of 12 weekly exams and 20% will derive from a cumulative final exam
- 60% will derive from the average percentage performance of a total of 12 weekly exams and 40% will derive from a cumulative final exam

**Important:** The first (ungraded) question in the final exam will ask you whether you want your final exam to count 20% or 40% of your final grade. 20% is the recommended 1 letter grade improvement ambition move. 40% is the recommended 2 letter grades improvement ambition move. This way you can customize the risk and potential of how much the final exam will impact your grade.

**Note: The final exam is not obligatory.** If you are satisfied with the grade resulting from your average exam scores, you do not have to take the final exam. **BUT:** If you decide to take the final exam in order to improve your final grade, the final exam score will count regardless of whether it improves or lowers your final grade.

The final letter grade will be determined by a straight scale as follows:

<u>Total Percentage</u>	<u>Final Grade</u>
90.00%- 100%	A
86.00%- <90%	A-

84.00%- <86%	B+
78.00%- <84%	B
76.00%- <78%	B-
74.00%- <76%	C+
68.00%- <74%	C
66.00%- <68%	C-
64.00%- <66%	D+
58.00%- <64%	D
56.00%- <58%	D-
<56%	F

- There is no extra credit under any circumstances.
- Students with scheduling conflicts for the final exam must notify Dr. Friedrich in writing by class time by January 16<sup>th</sup>.
- Reasonable exceptions will be granted in cases of illness, which will require notification prior to the exam and must be followed up with an original signed note from a physician.

## EXAM FORMATS

### *Weekly Exams*

- 10 multiple choice questions on lecture content of the previous week accessible on Canvas
- Each correct answer will count 1 point
- There will a maximum point score of 8 points
- 5 minutes duration **provided** lack of evidence of cheating in the classroom. To control for cheating, the following will be required during any exam: Answers count only of video **AND** microphone are for zoom while you are taking the exam. If there is evidence of cheating in the classroom, exam time will be shortened per discretion of the instructor, for the entire class.
- There will be 3 types of questions:
  - 2 True/False “backup” questions each of which can, if answered correctly, replace one incorrect answer to the remaining 8 questions
  - 6 questions asking about concepts or examples specifically addressed in one of the lectures of the previous week
  - 2 questions that will ask you to connect concepts or facts covered in the previous week in novel ways or with new examples

### *Final Exam*

- Scheduled for 3rd of May from 8.00 am to 10.00 am
- Given through Canvas
- 30 multiple choice, problem or short answer questions
- Each course week will be sampled by two questions

### *Internet connectivity problems*

- If you experience internet connection problems, email me screenshot documentation and we will look for an adequate makeup solution

## EXAM GRADE DISPUTES / CHALLENGE OPTION

- Students are strongly encouraged to check graded exams for potentially overlooked points.
- Students will have one week after the return of an exam to challenge a grade. The grade rebuttal needs to be submitted together with the exam. The rebuttal document needs to provide detailed explanations why additional points should be granted for every answer requested to be reconsidered.
- Failure to challenge the grade within one week after the return of an exam constitutes acceptance of the exam grade as is.

## CHEATING

Academic misbehavior means any activity that tends to compromise the academic integrity of the institution or subvert the education process. All forms of academic misbehavior are prohibited at Wayne State University, as outlined in the Student Code of Conduct (<http://www.doso.wayne.edu/student-conduct-services.html>). Students who commit or assist in committing dishonest acts are subject to downgrading (to a failing grade for the test, paper, or other course-related activity in question, or for the entire course) and/or additional sanctions as described in the Student Code of Conduct.

- **Cheating:** Intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information or assistance in any academic exercise. Examples include: (a) copying from another student's test paper; (b) allowing another student to copy from a test paper; (c) using unauthorized material such as a "cheat sheet" during an exam.
- **Fabrication:** Intentional and unauthorized falsification of any information or citation. Examples include: (a) citation of information not taken from the source indicated; (b) listing sources in a bibliography not used in a research paper.
- **Plagiarism:** To take and use another's words or ideas as one's own. Examples include: (a) failure to use appropriate referencing when using the words or ideas of other persons; (b) altering the language, paraphrasing, omitting, rearranging, or forming new combinations of words in an attempt to make the thoughts of another appear as your own.
- **Other forms of academic misbehavior include, but are not limited to:** (a) unauthorized use of resources, or any attempt to limit another student's access to educational resources, or any attempt to alter equipment so as to lead to an incorrect answer for subsequent users; (b) enlisting the assistance of a substitute in the taking of examinations; (c) violating course rules as defined in the course syllabus or other written information provided to the student; (d) selling, buying or stealing all or part of an unadministered test or answers to the test; (e) changing or altering a grade on a test or other academic grade records.

## **POSTING OF EXAM GRADES**

Exam grades will be posted in the Canvas environment. The distribution of scores will be provided and discussed in class.

## **SPECIAL CONSIDERATIONS FOR INDIVIDUALS WITH DISABILITIES**

If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TTY: telecommunication device for the deaf; phone for hearing impaired students only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services' mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

## **RELIGIOUS HOLIDAY CONFLICTS**

- If you have a conflict with any of the scheduled class or exam times due to religious reasons, you must notify Dr. Friedrich in writing by class time on January 16<sup>th</sup>.
- No makeup exams will be given unless he is notified in writing by this date.

## **UNEXPECTED UNIVERSITY CLOSURES**

If the University is officially closed on an exam day, the exam will be held on the next regularly scheduled class day. Closure of the University is announced by the following mechanisms:

1. the University Newline (313) 577-5345 \*
2. WSU Homepage ([www.wayne.edu](http://www.wayne.edu)) \*
3. WSU Pipeline ([www.pipeline.wayne.edu](http://www.pipeline.wayne.edu)) \*
4. WDET-FM (Public Radio 101.9)
5. by other local radio and television stations

\* Note: The information on closures and class cancellations is likely to be found at these locations before it is broadcast by local radio and television stations

## **OTHER**

- I will write letters of recommendation for students who earn a grade of B+ or better.
- Any specific issue not covered by this syllabus will be resolved using University policies.
- Disputes that cannot be resolved following the guidelines present in this syllabus will be resolved by following the guidelines of the University "Student Due Process".

## ADD/DROP POLICY

- Add forms will not be signed after the second week of class.
- Drop forms must be signed before the end of “study day”, which is the day after the last day of classes.

Wayne State has changed the grading policy. There are no more "X" grades. If you sign up for a class, stop attending, and fail to withdraw, you will receive an F for the course. In addition, if you drop the course after 5 weeks, you will be assigned one of the following three marks: WP (withdrew but was passing at the time), WF (withdrew but was failing at the time), WN (withdrew and never attended class or no graded work). Also, any "I" given to a student will automatically revert to "F" if the work is not completed within one calendar year. There are no exceptions. The failure notation has been changed from an "E" to an "F". Further information on the grading policy can be found at <http://sdcl.wayne.edu/RegistrarWeb/Registrar/policies.htm>.

## AMENDMENTS

**First:** Everyone makes mistakes. So there may still be glitches in the syllabus that need to be amended...

**Second:** Life is a continuously “*evolving*” situation. This has been especially true for the past 10 months and counting. We therefore reserve ourselves the option of making amendments to the syllabus throughout the course to improve the experience and success of the course.

Tentative lecture schedule:

Week	Quiz	Day	Agenda/Topic	Broader concept	EA chapter
1		1/11	HELP!	How to survive this class	?
		1/13	Evolution in real time right now: Covid-19	<b>Tree thinking</b>	1, 3
2	1	1/20	Evolution in real time last century: Darwin's finches		3
3	2	1/25	Evolution in Darwin's time: Homology and fossils		2, 18
		1/27	Genomic evidence of our evolutionary origins		15
4	3	2/1	Reconstructing evolutionary "descent with modification"		4
		2/3	What actually is a species?	<b>Population thinking</b>	16
5	4	2/8	And how do we make them: Speciation?		16
		2/10	Variation in populations		5,6
6	5	2/15	Genetic drift	<b>Population genetics:</b> 2 alleles of a gene in a population	7
		2/17	Effect of mutation		6
7	6	2/22	Neutral theory of molecular evolution		7
		2/25	Effect of migration		7
8	7	3/1	When traits are forced to change: Selection		6
		3/3	Allelic expressivity: A matter of extinction vs fixation		6
9	8	3/8	How most real traits evolve: Quantitative genetics and complex traits	<b>Quantitative genetics of evolutionary adaptation:</b> Many alleles of a gene affecting the variation of a trait in a population	9
		3/10	Linkage disequilibrium: Genomic fingerprints of selection		8
10	9	3/22	Recombination or the genetics of why we have sex	<b>Sexual selection</b>	8
		3/24	Sexual dimorphism: Why girls look different from boys		11
11	10	3/29	INTRA vs INTERsexual selection		11
		3/31	When things don't work out: Sexual conflict & parental conflict	11	
12	11	4/5	After things worked out: Kin selection	<b>Cognitive, behavioral, and social evolution</b>	12
		4/7	Direct reciprocity		12
13	12	4/12	Indirect reciprocity		12
		4/14	Group or multilevel selection		12
14	13	4/19	WEIRD or the power of cultural group selection		12
		4/21	Extinctions	Ultimate evolutionary outcomes	7.4, 13
15	14	4/26	Coevolution		?
		5/3	<b>FINAL EXAM: 8.00 - 10.00 am</b>		