

Speciation and Adaptation
BIOL 550 (once and future BIOL 589) (3 credits)
New Mexico State University, Spring 2018

Instructor: Dr. Timothy Wright
Office: Foster 310
Phone: 646-1136
E-mail: wright@nmsu.edu (but prefer class e-mail through Canvas)

Class Meetings: Tues and Thurs, 10:20-11:35, Foster Hall 146

Office Hours: Tues 2:00-3:30 in Foster Hall 310 or by appointment

Course Overview: Speciation and adaptation are the two main themes of evolutionary biology. Speciation is the process by which new species are formed. Adaptation is the process by which species change to better fit their environment. The study of speciation and adaptation has a long history, dating to before Charles Darwin's seminal work, and remains a rapidly advancing field today. We will start the course by reading chapters from Darwin's "On the Origin of Species" and other classic foundational texts. Each chapter will be paired for discussion with a more recent treatment of the topic that either updates these ideas or brings new data to bear on them. In second half of the course we will explore topics related to speciation and adaptation that are of particular interest to the class. Students will each select their own topic and work with the instructor to identify readings for the class period in which they will lead discussion. This topic will then form the basis of a more comprehensive review paper due at the end of the semester.

Course Webpage: The course web page is available in Canvas. General course information, lecture handouts, PDF files of discussion papers and grades will be posted on this site. It is also the preferred route for e-mailing me.

Texts: The required text is *On the Origin of Species* by Charles Darwin. For ease of following class discussion, I recommend all student purchase the paperback 150th anniversary Signet Classics edition published in 2003 and available at Amazon for under \$10.
https://www.amazon.com/Origin-Species-150th-Anniversary/dp/0451529065/ref=sr_1_1?ie=UTF8&qid=1515964649&sr=8-1&keywords=darwin+origin+of+species.

Prerequisite courses: This is a graduate level course. Upper division undergraduates may take the course with permission of the instructor. While there are no prerequisites, prior coursework in genetics and evolution is helpful.

Class Format: We will have combined lecture and discussion sessions on Tuesdays and Thursdays each week. Each class will begin with a short introductory lecture by me or by the student leading that day's topics. We will then spend the remaining time discussing the assigned reading for that day. Topics and readings will be added to the syllabus through the course based on student interest and our initial readings.

Class Discussions: Discussions will be led by the instructor early in the semester by students later in the semester. Most discussion sections in the first half of the course will focus on a chapter of Darwin's *On the Origin of Species* or a similarly foundational reading from the field of

evolutionary biology, paired with a more recent paper that examines the same issues. The goals of these discussions are two-fold: first, to improve your ability to think critically, and second, to give you a sense of the history of scientific thought in evolutionary biology. In order to meet these goals, everyone must carefully read the assigned readings. Be sure to leave enough time in your weekly schedule to carefully read the material for each class meeting; I would expect the readings to *require 2-3 hours per class at minimum*. As you read you should consider the links between the foundational and recent papers, and between the current readings and previous assignments. You will need to be prepared to share these thoughts with others in class in order to engender a lively discussion. To promote your readiness for discussion, I expect that all students bring to class 2-3 written thoughts, comments or questions for each reading. **Your participation in discussions throughout the semester is worth 30% of your final grade.**

I will lead class discussions for the first three weeks or so. After that time, the assigned student(s) will be responsible for leading discussion. When it is your turn to lead, you will be responsible for giving a short introductory lecture that sets the stage for the readings, and then facilitating a discussion of main points of the readings. Here your job is not only to understand the research, but also to pick out its strengths and weakness and highlight the links and contrasts between the different readings for that day. The liveliest discussion result when the presenter is prepared with a list of questions for the class that either help it work through the readings systematically and help it to identify main themes and conclusions. I will be available during office hours or by appointment to help presenters prepare when it is their turn to lead; I urge you to make use of this opportunity and visit me during Tuesday office hours in the week before it is your turn to present so you can make sure you understand the readings and are preparing appropriately. Note that I have selected readings for most of these classes but am happy to consider alternatives if you convince me that you have found a worthier one. **Your discussion leading is worth 15% of your final grade.**

Student Research Reviews: All students will be responsible for reviewing a topic of current interest in within evolutionary biology that broadly incorporates the process of speciation or adaptation. Ideally your topic would fall within an emerging or rapidly progressing field. Alternatively, it can be an area with less activity but in which no recent reviews have been published. Most importantly, the topic should be of interest to you! It may be conceptually linked to your thesis research but should NOT be exactly the same as your thesis research. Early in the semester I will present a list of potential topic areas to spur your thinking, but you are not required to pick one of these topics. Term paper topics will be decided in consultation with me as discussed below and will require my final approval. Your review will take the form of three assignments: a topic proposal, a class presentation, and a comprehensive review paper.

Topic Proposal: This one page proposal will concisely describe the topic you wish to cover in your presentation and term paper. It should provide a brief overview of the history of the topic and summarize current recent progress to justify the extent to which it is a field of current and general interest. It also should include a list of at least 10 relevant references, **This one page proposal is due in class on Tuesday, Feb 22 and is worth 5% of your course grade.** We will discuss your proposal and its suitability for a review topic in one-on-one meetings on Thursday March 1.

Review Presentation: In the last third of the course we will have a series of research review presentations by students on their approved topic. Each student will be responsible for presenting a short overview lecture on the historical context and current state of research in the area, and then leading discussion on one or two recent papers that represent advances in the field. The last part of the discussion should focus on future directions in the field—what are the

next interesting experiments to conduct and why. Students will meet with me in advance of their presentations on either March 15 or 27 to discuss their presentation plans and the papers they are considering assigning for the class. All students are responsible for reading the assigned papers and preparing for class discussion as per above. **Your review presentation is worth 15% of your final grade.**

Review Paper. The final course assignment is a term paper in the form of a review for the journal Trends in Ecology and Evolution. The goal of these papers, as stated at the TREE website is to “offer a balanced account of newly emerging or rapidly progressing fields and provide a guide to the most relevant recent literature and prospects for future research”. Your aim is to synthesize the current literature and find common threads and, conversely, holes in the current research that could be further explored. The paper format should follow the guidelines listed for a “review manuscript” on the TREE website at <http://www.cell.com/trends/ecology-evolution/authors>. You should read these guidelines carefully and follow them for your paper except as noted here. Specifically, you should have a title, abstract and keywords. The length should be 3000-3500 words (roughly 10-12 pages, double spaced) and should include a minimum of 25 relevant references to the primary literature (rather than the 80-100 expected by TREE). Citations should be formatted for TREE. You should include a Glossary box and at minimum one Figure (and legend) of your own creation illustrating a key point in graphic form. You should also include one Table highlighting key relevant papers and summarizing their findings. You do NOT need to include a highlights section nor any text boxes, although you may include either if you wish. **This paper will be worth 35% of your course grade and is due in class during the scheduled exam period for the course at 10:30 am on May 10.**

Attendance: Attendance is required in order to participate in discussions; if you will miss a discussion **on documented university business**, you must provide the written documentation to Dr. Wright **two weeks in advance of the discussion**. If you miss a class because of an extreme illness or emergency you should contact Dr. Wright immediately and provide documentation of the event if requested. If your excuse is accepted, you will be allowed to make up the discussion section by writing a one-page summary of the missed readings that include 5 substantive and relevant questions or comments.

Use of Electronics: Laptops and notepads are permitted for taking notes and viewing course materials as long as they do not present a distraction to you and other members of the class. The instructor reserves the right to disallow their use if this expectation is abused. Cell phones should be turned off during class. Electronic conversations and text messages should be conducted outside of class time.

Academic Honor: Academic honesty is a fundamental expectation of your participation in this course and your academic life at New Mexico State University. **Academic misconduct will not be tolerated in this class and any cases of academic misconduct will be prosecuted fully following NMSU procedures.**

The student code of conduct outlines many of these expectations, and may be found at <http://studenthandbook.nmsu.edu/student-code-of-conduct/academic-misconduct/>. The student code of conduct outlines various forms of academic misconduct in section B. Cheating includes, but is not limited to possession and/or use of unauthorized materials during exams; copying the work of another (e.g. another student, instructor or other reference source); using the words or ideas of another (e.g. another student, instructor or other reference source), especially without proper acknowledgement and citation (but keep in mind that citing a source DOES NOT allow you to use their words and/or organization and/or structure if these are copied directly or

substantially copied); providing another student the opportunity to copy your work on exams or assignment, looking at the work of another student during exams and quizzes and providing another student the opportunity to earn participation points when they are not in class to earn them themselves.

Students must be especially careful to avoid plagiarism, particularly when writing their research paper. Plagiarism is defined as the presentation of others' ideas as your own, whether intentional or not. Any ideas or materials taken from another source must be fully acknowledged. Not only must you credit your source(s) for any ideas that are not your own, but you **MUST** paraphrase in **YOUR OWN WORDS**, or use quotation marks to indicate a direct quotation. The NMSU Library has more information and help on how to avoid plagiarism at <http://lib.nmsu.edu/plagiarism/>. If you submit an assignment in which you have merely changed a few words from a source, or have retained the structure and organization of your source, then you have submitted a plagiarized assignment, even if you have cited that source. Any act of plagiarism will result in a **MINIMUM** of a zero for that assignment, and more severe penalties (including failure of the course) may be imposed at the discretion of the instructor.

Withdrawals: It is the responsibility of the student to administratively withdraw from the class should you decide to do so. **The last day to add the class is Friday 1/26. The deadline to drop with 'W' is Thursday 3/15.**

Attendance: Lecture attendance is expected except for documented university business or extreme emergencies, and regular participation will greatly improve your success in the course. You will be graded on your active participation in discussion sections as detailed above.

Grading Summary: The final grade will be determined by the points accumulated on each part of the course. The different parts are valued as follows:

Discussion Participation	30
Leading Discussion	15
Paper Proposal	5
Review Presentation	15
Paper	35
Total	100

I will assign grades for points earned during the class according to the following scale:

A	90 and above
B	80-89 points,
C	70-79 points
D	60-69 points
F	59 and below

Disabilities & accommodations: Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act Amendments Act (ADAAA) covers issues relating to disability and accommodations. If a student has questions or needs an accommodation in the classroom (all medical information is treated confidentially), contact:

Trudy Luken, Director

Student Accessibility Services (SAS) - Corbett Center, Rm. 208

Phone: (575) 646-6840 E-mail: sas@nmsu.edu

Website: <http://sas.nmsu.edu/>

Discrimination: NMSU policy prohibits discrimination on the basis of age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, retaliation, serious medical condition, sex, sexual orientation, spousal affiliation and protected veterans status. Furthermore, Title IX prohibits sex discrimination to include sexual misconduct: sexual violence (sexual assault, rape), sexual harassment and retaliation.

For more information on discrimination issues, Title IX, Campus SaVE Act, NMSU Policy Chapter 3.25, NMSU's complaint process, or to file a complaint contact:

Lauri Millot, Title IX Coordinator or Agustin Diaz, Title IX Deputy Coordinator

Office of Institutional Equity (OIE) - O'Loughlin House, 1130 University Avenue

Phone: (575) 646-3635 E-mail: equity@nmsu.edu, Website: <http://www.nmsu.edu/~eoo/>

Other NMSU Resources:

NMSU Police Department:	(575) 646-3311	www.nmsupolice.com
NMSU Police Victim Services:	(575) 646-3424	
NMSU Counseling Center:	(575) 646-2731	
NMSU Dean of Students:	(575) 646-1722	
For Any On-campus Emergencies:	911	

Speciation and Adaptation Lecture Schedule

(vers 1/17/18, subject to revision by instructor)

<u>Date</u>	<u>Day</u>	<u>Topic and Reading</u>	<u>Class Leader</u>
1/18	R	What are adaptation and speciation?	TW
1/23	T	--Darwin, <i>Origin of Species</i> , Chap 1: Variation under Domestication --Iriando, J.M., et al. (2018) Reproductive traits and evolutionary divergence between Mediterranean crops and their wild relatives. <i>Plant Biology</i> 20 , 78-88.	TW
1/25	R	Darwin Chap 2: Variation Under Nature - Grant, P.R., et al. (1976) Darwin's finches – population variation and natural selection. <i>Proceedings of the National Academy of Sciences of the United States of America</i> 73 (1), 257-261.	TW
1/30	T	-Darwin Chap 3: Struggle For Existence -Levis, N.A., et al. (2017) Intraspecific adaptive radiation: Competition, ecological opportunity, and phenotypic diversification within species. <i>Evolution</i> 71 (10), 2496-2509.	TW
2/1	R	-Darwin Chap 4: Natural Selection -Wallace 1858 On the Tendency of Varieties to Depart Indefinitely from the Original Type.	TW
2/6	T	-Darwin Chap 5: Laws of Variation -Krishnan, J., and Rohner, N. (2017) Cavefish and the basis for eye loss. <i>Philosophical Transactions of the Royal Society B-Biological Sciences</i> 372 (1713), 10.	
2/8	R	-Williams <i>Adapation and Natural Selection</i> , Chaps 1 and 2 -Santos, M.E., et al. (2017) Taxon-restricted genes at the origin of a novel trait allowing access to a new environment. <i>Science</i> 358 (6361), 386-389.	TW
2/13	T	-Darwin Chap 6: Difficulties with the Theory -Gabbott, S.E., et al. (2016) Pigmented anatomy in Carboniferous cyclostomes and the evolution of the vertebrate eye. <i>Proceedings of the Royal Society B-Biological Sciences</i> 283 (1836), 8.	TBD
2/15	R	-Darwin Chap 7: Miscellaneous Objections -Lawson, L.P., and Petren, K. (2017) The adaptive genomic landscape of beak morphology in Darwin's finches. <i>Molecular Ecology</i> 26 (19), 4978-4989.	TBD
2/20	T	-Darwin, Chap 10: On Imperfections of the Geological Record -Gould <i>The Structure of Evolutionary History</i> , P765-78: Punctuated Equilibrium - Good, B.H., et al. (2017) The dynamics of molecular evolution over 60,000 generations. <i>Nature</i> 551 (7678), 45-+.	TBD
2/22	R	-Darwin Chap 8: Instinct -Audet, N. et al. in review. Divergence in problem-solving skills is	TBD

		associated with differential expression of glutamate receptors in wild finches. *Topic Proposals due in class*	
2/27	T	-Williams <i>Adapation and Natural Selection</i> , Chaps 4 and 7 -Fisher, D.N., and McAdam, A.G. (2017) Social traits, social networks and evolutionary biology. <i>Journal of Evolutionary Biology</i> 30 (12), 2088-2103.	TBD
3/1	R	Meeting Day: All students meet with TW to discuss their topic proposal	TBD
3/6	T	-Coyne & Orr <i>Speciation</i> : Chap 1: Species Realities and Concepts - Lackey, A.C.R., & Boughman, J.W. (2017) Evolution of reproductive isolation in stickleback fish. <i>Evolution</i> 71 (2), 357-372.	
3/8	R	-Darwin Chap 9: Hybridism -Barrera-Guzmán, et al. (2018) Hybrid speciation leads to novel male secondary sexual ornamentation of an Amazonian bird. <i>Proceedings of the National Academy of Sciences</i> 115 (2), E218-E225.	TBD
3/13	T	-Coyne & Orr <i>Speciation</i> , Chap 10: Reinforcement -Bay, R.A., et al. (2017) Genetic Coupling of Female Mate Choice with Polygenic Ecological Divergence Facilitates Stickleback Speciation. <i>Current Biology</i> 27 (21), 3344-3349.e4.	TBD
3/15	R	Research/Meeting Day: Presenters 1-4 meet with TW to discuss presentations, meetings optional for others <i>Last day to drop with a W</i>	
3/18-25		NMSU Spring Break	
3/27	T	Research/Meeting Day: Presenters 5-9 meet with TW to discuss presentations, meetings optional for others	
3/29	R	Student Research Review Presenter 1	TBD
4/3	T	Student Research Review Presenter 2	TBD
4/5	R	Student Research Review Presenter 3	TBD
4/10	T	Student Research Review Presenter 4	TBD
4/12	R	Student Research Review Presenter 5	TBD
4/17	T	Student Research Review Presenter 6	TBD
4/19	R	Student Research Review Presenter 7	TBD
4/24	T	Student Research Review Presenter 8	TBD
4/26	R	Student Research Review Presenter 9	TBD
5/1	T	Interesting Topic Not Yet Covered: I	TW
5/3	R	Interesting Topic Not Yet Covered: II	TW
5/10	R	Final Meeting, 10:30 am: Term Papers due	