FLATHEAD LAKE BIO STATION
UNIVERSITY OF MONTANA

Summer Session 2019

BIOB 491 section 1
Special Topics:

Field Studies in the Evolution of Behavior

6 credits

Lectures / Formal Discussions (30%),
Field Work / On the Spot Discussions (70%)
Course dates: June 24–August 1, 2019
Class formally meets all day 4-days per week; informally 24/7.

Instructor: Dr. Paul J. Watson
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Prerequisites: One semester of college-level biology and an ecology course (can be met via BIOE342 Field Ecology at FLBS) or equivalents; *OR consent of instructor* (e.g., some of my best students have been advanced, deeply curious humanities undergrads.)

Achtung!

Everyone in the course should be prepared to document that they are up-to-date on their tetnus immunizations. Get a booster shot now if you're not sure.

Course Description:

Principles and methods of animal behavior or evolutionary behavioral ecology, applied mainly to the field study of terrestrial species. Emphasis will be on concepts of behavioral evolution and sober (but awesomely fun!) evolutionary adaptationist hypothesis formulation and testing. This course focuses on the development and real world "field testing" of each student's, and the professor's (!), package of intellectual, emotional, and technical skills, which together are necessary to gather publication quality data on the adaptive function of animal behavior using field and complimentary lab observation and experimentation.

The course is designed for mature undergrad upperclassmen / women and beginning graduate students. Graduate credit is associated with some extra expectations (see below). This course is meant to prepare students for high level independent graduate research in animal behavior. More broadly, it also provides essential "principled contact" with complex organisms in their natural environment for all those interested in the role of adaptation and natural selection in the evolution of mind, and the rich philosophical implications of that role. Students in this course will learn to apply modern Darwinian thought to the analysis of the behaviors of virtually any organism, and will move toward becoming knowledge creators rather than just knowledge consumers.

The instructor has studied and taught animal behavior at and around FLBS since 1980. Years ago, this instructor inherited the decades long teaching of this course from the man, Dr. Allen Stokes, who introduced him to the animal (the sierra dome spider; *Neriene litigiosa*: Linyphiidae) that, quite surprisingly at the time, turned out to be the focus of his own successful Ph.D. and post-doctoral research, and beyond. As did Dr. Stokes, the instructor considers it a privilege and a personal mission to introduce dedicated students to first hand study of the amazing lives of wild creatures, and the challenge of understanding how their often puzzling complex contingent behaviors of various species always make profound sense in relation to their species-

typical ecological niche and the reproductive problems and opportunities that niche has presented to individuals during the species evolutionary history.

In this course, every attempt will be made to collect publishable data addressing cutting edge questions in evolutionary behavioral ecology. The instructor can provide projects as necessary, or, as happens every summer, students can discover their own. We will flexibly employ individual, team, and whole class efforts to accomplish our hypothesis testing goals. The instructor will be available 24/7 during the 6-week session to help students develop and troubleshoot chosen projects. The instructor also will continue working with students, *after* the course is completed, in all cases where publication potential exists, to bring projects to their fullest possible fruition and scientific value.

There are seven primary facets to the course that occur in a somewhat phased sequence during our six weeks of intensively and supportively working together: (1) learning to *see* and properly, meaningfully *observe* wild organisms; (2) documenting specific well-defined behaviors and the environmental contexts in which they occur; (3) collaboratively, in whole class discussions, developing alternative hypotheses about the function(s) of focal behaviors and schemes to effectively and efficiently gather data to test them, trying to implement "strong inference" strategies; (4) tapping the textbook and primary literature for additional relevant insights; (5) gathering data via team and individual efforts, with consistent instructor intellectual and moral support; (6) compiling data and performing at least preliminary statistical analyses; (7) writing up and orally presenting a brief summary of project results employing suitable graphics.

Throughout the course, but especially in the first two weeks, the instructor will also lecture and take questions on the evolution of behavior, especially sexual and social behavior, and the modern Darwinian approach to understanding mind and behavior in general.

For University of Montana students, this course is designed to strongly compliment Dr. Doug Emlen's campus-based courses in animal behavior.

Student Learning Objectives:

At the end of the course, you will be able to:

- Learn to observe organisms and develop scientifically principled hypotheses about why they do what they do.
- See well defined behaviors in their larger life history and ecological contexts.
- Deeply understand the process of natural selection in all its forms (e.g., sexual selection, kin selection) and how Darwin's original formulations have evolved, especially over the last several decades.
- Understand the concept of "levels of analysis," which enables smooth and productive interdisciplinary collaboration in the analysis of any behavior.
- Learn approaches to assessing the fitness effects of behaviors and associated morphological structures.
- In a key practice that's complimentary to measuring fitness effects (above), become familiar with "reverse engineering" a putative adaptation as a way of determining its probable adaptive function(s).
- Develop and troubleshoot data collection procedures and forms to enable data collection and descriptions of behaviors in a standard yet project-specific field notebook format.
- Participate in collaborative professional scientific relationships founded on "critical camaraderie" aimed at maximizing the success of all projects.
- Understand the function of expensive courtship rituals and associated structures, such as the showy often ostentatious courtship plumage of birds and other animals.
- Understand special evolutionary puzzles like the evolution of sex differences and the evolution of senescence (i.e., sex-specific and species-typical rates of ageing).
- Recognize the ecological correlates of broad patterns of species-typical behavior, individual variation in behavior, as well as the environmental factors that modulate or trigger execution of behavioral alternatives (e.g., to fight or not to fight, and how hard or riskily to fight). Appreciate the complex

contingent responsiveness to environmental circumstances enabled by even relatively "simple" animal nervous systems.
- Apply modern Darwinian principles to the analysis of the behavior and physical attributes of any organism, including humans.
- Interpret field observations and scientific literature. Plan data collection with an awareness of practicality, efficiency, and *a priori* understanding of how that data will be statistically analyzed.
- Understand the concept of instinct, evolved Darwinian algorithms, and the constant interplay of "nature and nurture" in the lives of organisms on both developmental and immediate time scales.
- Feel the impact of intentionally pursued systematic "views of the real world."
- Other stuff too!

Text: We will read much of Professor John Alcock's classic textbook, now in its brand new 11th edition, "Animal Behavior: An Evolutionary Approach." Sinauer Associates, June 1, 2018. New coauthor this edition, Dustin R. Rubenstein. ISBN-10: 1605355488

Reference Texts: The instructor will bring a handful of additional reference texts and primary literature to the classroom. FLBS will provide electronic access to all relevant primary scientific literature. Students are encouraged to bring personal copies of field guides for mammals, amphibians, fishes, arthropods, flowers, trees, and other biota in the northern Rocky Mountains region of the USA.

Course and Field Supplies/Equipment: (*available for purchase at the FLBS Bookstore)

- Plenty of pencils, regular or mechanical*
- **permanent-ink**, weather-resistant pens are acceptable
- Form holder style metal clipboards for data collection using standardized forms
- Digital wristwatch with stopwatch mode and countdown mode
- Hot/cold mug*
- Rite in the Rain field notebooks*
- Sunscreen, sun hat, and sunglasses
- Lunch pack-up container(s) (resealable)*
- Mess kit and utensils
- Serious raingear
- your favorite insect net(s) (optional)
- Hand lens (10-14x) and 2x magnifying glass, if possible.
- Packable water bottles (total capacity at least 2 liters)*
- Daypack (not a full-size backpack)
- Digital camera with zoom (optional)
- Hip boots or waders (optional)
- Bear spray*
- Binoculars (optional but strongly encouraged)
- Laptop (required); loaded with MS Word, Excel, and, *if you have one*, your favorite statistical/graphics package
- Quality headlamp and small flashlight, extra batteries
- a small, light-weight seat for more comfortable field observations (highly recommended)

- Overnight Field Gear

At the time of this writing, we do not know if we will be taking overnight field trips. The instructor would like to do at least a couple. Moreover, you will officially have three-day weekends, and you may want to use several of them (probably not all) to explore the "Crown of the Continent" on your own. Food and cooking equipment will be provided for any class trips, but you will need your own eating utensils, plate or bowl, cup and water bottle. You may need to be quite self-sufficient during your own overnight excursions. You may want to bring a personal water purification system – many types are available at retailers like REI.

We probably will spend time wading in cold streams and clean but leech-infested muddy wetlands. You will need a good headlamp, good footwear for hiking over rough terrain, including snowfields, good footwear

or waders for working in cold water, extra dry socks and warm clothes. The instructor now uses walking sticks to help his knees and reduce his rate of falling; think about investing in a pair. If we (or you) camp out, you will want a warm sleeping bag, a sleeping pad, and small backpacking tent (though students ideally will share tents to avoid crowding limited campsite space). We are in grizzly country, and bear spray is strongly recommended, as is your preferred insect repellent. **Do not leave food or cosmetic products in tents.**
Grading (percent of final grade):

- Lecture / Discussion Verbal Participation: 20%
- Participation in Field and Supporting Lab Research: 50%
- Written Final Project Report & Class Presentation: 15%
- Final Exam (Two or three hours; Short essay; Partial open book - text only): 15%

*The degree to which you participate in the "24/7" format of this class will be factored in as **extra credit**. Negative extra credit will be awarded to whiners.*

The instructor does not participate in the grade-inflation movement. He does not grade on a curve. 100-90% = A, 89-80 = B, 79-70 = C. We won't even talk about other grades. Everyone can get an "A," because substantive extra credit WORK will yield pretty generous extra credit POINTS.

Graduate Credit: In addition to normal expectations, graduate students will present two recent inspiring substantive papers form the primary literature chosen collaboratively with the instructor. The instructor also expects a higher degree of project leadership, professionalism, and logistical support from graduate students. He will grade graduate students about 20% harder on their field notebooks. He expects graduate students to be around more (e.g., evenings in the classroom) than the average student to help answer undergrad student questions concerning lecture material, etc., in the field and classroom, especially in instances when he is not immediately available.

Course Policies:

The goal in this class is for students to learn and understand basic principles of modern Darwinism and the practices of systematic professional collaboration and data collection in the context of evolutionary behavioral ecology. We will work to find and develop viable projects both on and off the Biological Station. Through field visits, lectures, and select visits with guest scientists, we will view how successful professionals conduct their field research.

Logistical notes: The majority of this course is taught outside, *regardless of weather*, with class plus transport occasionally taking 10 hours or more per day, sometimes at locations far from your housing at the Biological Station. We will hike on some days, usually with breaks for "behavioral prospecting" (discovering behaviors begging for discussion and possible study), and on some days we will hike or be exposed to outside conditions all or most of the day. *Students must be prepared.* If you are certain that you can hike 5–10 miles in a day, you will really enjoy this course. Just as important, you also must nurture the ability to sit patiently and *OBSERVE*.

If you are not sure of your hiking skills in the rough terrain of mountain landscapes, but you like to exercise and are really committed to learning about field study of animal behavior in this marvelous field setting, the instructor will help teach you how to enjoy hiking as a part of the ecological experience. Please pay very close attention to the requirements you pack wet weather and cold weather gear, including a change of clothes for overnight campouts, and appropriate footwear for hiking in rough terrain and wading in smaller

streams and wetlands. And remember to keep a clean camp and carry bear-grade pepper spray on your person and at the ready whenever hiking in open country or forest.

Synthesis, writing and reporting assignments

Field Notebooks: A good 45% of your grade will be based upon "Participation in Field and Supporting Lab Research (see above)." To maximize the objectivity and accuracy of this large part of your grade, field notebooks will be assessed by the instructor. More specifically, the data you collect individually and as part of research teams, will be examined, and their quality will affect your grade. You will be graded on the comprehensiveness, content, and professional quality of all notes you keep in a field notebook (not on lecture notes). You'll be provided with guidelines on how to keep a scientific notebook. As a general rule, if you find yourself going for more than 45 minutes in the field without making any notes, even if we are attacked by a Griz, you should check yourself and make sure you're allocating time appropriately. That said, the content of your notebook can and should span the full scope of field and lab research, from formal observations to immediate, tentative questions and speculations, hypotheses, testing schemes, methods and methodological troubleshooting, to retrospective thoughts you may have well after a lecture, discussion, or after project completion, or additional information (including answers to your questions) you might glean from follow-up discussions with other FLBS instructors, guests, peers, or from research in journals. Besides general information, your field notebook should contain the initial seeds of your written and oral reports. Philosophical musings can also be valuable.

Discussion: A safe but critical discussion environment will be created and enforced at all times. The course is decidedly anti-clique. We are a Team. A privileged band of brothers and sisters. *All thoughtful questions, observations and objections / counterpoints help to enrich the course!* Yes, go ahead, attack me. The instructor loves it; he is leading this course to learn and hone his skills as much as his students are.

Extroverts are expected to help the shy to express themselves, as will the instructor. Time will be given for every student to fully articulate any thoughts they have to offer at any time and place. We'll try to schedule limited textbook-inspired or article-based discussions on an *ad hoc* basis when opportunity arises in the classroom or field. The instructor may ask students to lead at least one such discussion. Because of the large amount of time we spend away from desks and computers, hard copies of the articles will be provided.

Independent Written Report: Each student is required to produce one written report, due at 11:59pm on the final Friday of class. The instructor will be available to evaluate and discuss report topics and drafts with each student to improve research and writing skills. The report is to be a review and synthesis of the student's main final project and key bits of previously published research. *Note that selection of final projects are subject to class "advise and consent" and ultimate instructor approval.* Formatting of reports will be discussed. Length of the final report should be in the range of 2000–2500 words (*excluding* any tables, graphs, figure legends, and highly select literature cited).

Oral Report: On the final Friday of class, you will present the content of your final independent written report to the class in the form of a PowerPoint presentation or alternative oral/poster presentation (on approval from the instructor) as you would give at a scientific meeting. You are required to condense the essentials of your presentation to 10 minutes, allocating 5 minutes for questions and class discussion. Each student will also meet with me to discuss possibilities for future work to hone the project and report for publication. The instructor reserves the right to appear as LAST author on any publication, especially ones based on his prior knowledge of the study system.

Final Exam

The final exam will consist of about 6-8 questions. Your answers will be in the form of very short essays: 4-6 complete, succinct, grammatically well-crafted sentences. Questions will either 1) present as scenario and ask you to provide principles of evolutionary ecology / modern Darwinism to resolve a question about the

behavioral scenario, or conversely 2) will identify a concept or principle an ask you describe examples of how that knowledge has been, or could be fruitfully applied to a behavioral study. The final exam will be partially open book; that is, only your already badly worn out textbook will be available to help you. You will not know the questions prior to the exam period. You will need to be prepared to draw on your vast in-class experience and what you recall from prior readings and discussion to do well. Your answers should display an integrated understanding of the course concepts, drawing from field experiences, all discussions, and literature readings, as well as the textbook. Merely reciting relevant sections of the text will not suffice.

Outside of Class

Plan on allocating a good share of your evening hours and your intervening weekend to reading the text, engaging in research, and preparing your data and reports. You cannot do well in this course without reading the text and keeping up with your notebook entries. As mentioned above, hiking on our "off days" is encouraged, because there is so much to see around FLBS. But, conduct your trips with an eye toward the course content, and allocate time accordingly.

Use of Wireless Internet at FLBS:

A reliable secure wireless connection to the Internet is available in selected areas. Bring your laptop!

Students will adhere to University of Montana Student Conduct Code and Discrimination, Harassment, Sexual Misconduct, Stalking, and Retaliation Policy (policy website: http://www.umt.edu/safety/policies/) and to the Biological Station Code of Conduct form signed during student registration. Students must also follow FLBS Rules and Regulations and abide by the Safety Orientation Checklist. Students who have not already completed the University of Montana PETSA training may access the Moodle module at this link: http://www.umt.edu/petsa/.

Students with disabilities may request reasonable modifications by contacting the instructor. The University of Montana assures equal access to instruction for students with disabilities in collaboration with instructors and Disability Services for Students (406.243.2243, http://www.umt.edu/dss/default.php). The University does not permit fundamental alterations of academic standards or retroactive modifications.

Schedule: The precise schedule for this course is not yet established. It really can't be. The format fundamentally is inquiry-based. We have to be opportunistic in what research objectives we pursue. But, for example, Week 1 optimally could include a trip to the National Bison Range; hopefully we will be able to gain access to backcountry areas closed to the public and be accompanied by bighorn sheep mating system expert and conservation biologist Dr. Jack Hogg. To maximize the day, we would eat dinner at the Bison Range camping area, but be back at the Biological Station for the night. Etc.

Data collection should cease by the end of the 5th week of class. Except under special circumstances, the 6th week of class exclusively will be devoted to instructor-assisted data analysis, report writing, and presentations, and the final exam.

Overall, be ready to be flexible and weather-proof for the whole 6-week class session. The instructor will be working from now until the course begins to plan six weeks' worth of excursions and examination of possible study systems, all subject to modification based on conditions and new discoveries. The instructor has been successful working this way in the past. ***Call me if you have questions at my personal cell: 505-681-3391.***

Make sure you pack your brown bag lunch each day at breakfast!

Last updated 21 December 2018