

Evolution of Animal Behavior

NRSC 2140/Biology 2140/Psychology 2220

A. Course Description and Level:

This is a 2000-level biology course with a focus on the evolution of behavior. Lectures will highlight behavioral principles by drawing from a wide range of animal species, both vertebrate and invertebrate. We will explore examples of behavior such as foraging to illustrate the surprising ability that animals have to perform complex economic decisions and explore the extraordinary migratory journeys birds can perform using only earth's geomagnetic field to guide them to their breeding grounds. One of the more fascinating aspects of animal behavior is the decision individuals make to live, or not live, in groups. Much of the course's focus will therefore be on the evolution of social behavior with special emphasis on group formation, cooperation among kin, mating systems, territoriality and communication. Many aspects of the course will be grounded on basic genetic and evolutionary principles. While prior background in biology will be beneficial, lectures will provide the necessary background for all students.

Lecture: Tuesday and Thursday, 1:45-3:15

Room: Tedori Auditorium in the Stephen A. Levin Building

B. Instructors and TAs:

Marc Schmidt (MS; instructor) email: marcschm@sas.upenn.edu
Office Hour: Thursday 6-7pm (Leidy 217)

Yun Ding (YD; instructor) email: yding19@sas.upenn.edu
Office Hour: Friday 10:30-11:30am (Leidy 221)

Ana Alonso (AA ; Teaching assistant) email: aalonso@ldc.upenn.edu
Office Hour: TBD

Marcelina Martynek (MM ; Teaching assistant) email: martynek@sas.upenn.edu
Office Hour: Wednesdays 4:30-5:30pm, Levin 350

C. Quizzes and Recitations:

Students will be assigned weekly research papers from the primary literature on topics related to what is being covered in the course. Students are expected to read each of these papers in

detail and these will be discussed during the recitation section. Each paper will be associated with a short quiz.

Recitation schedule and evaluation

Tuesday 7 pm – 8 pm in [Tedor Auditorium \(Levin Building\)](#) (8/30 to 12/12)

Friday 10:15am-11:15am in [LLAB 109](#) (8/30 to 12/12)

Your TAs will take turns discussing each of the papers in a way designed to help students engage with the paper content. The TAs will then release a CANVAS-based quiz on Friday asking questions about the paper. The quiz will be due the following Tuesday. Each quiz will be worth 4% of the final grade. Students will be able to drop the lowest score with recitation quizzes counting for a total of 32% percent of the total grade.

D. Outline of assignments and assessments:

(1) Quizzes and midterms (60 %)

We will be giving out a total of 4 written examinations throughout the semester. Two of these will be in the form of online Canvas quizzes. Each quiz will be worth 10% of the final grade and will be relatively short covering only a half dozen lectures. The remaining two examinations will each be worth 20% of the final grade and will be in-person midterms that are more comprehensive in scope.

Canvas quiz #1 (10%) To be taken any time on **FRIDAY 9/16/21** (12am to 11:59pm)
Content: Lectures 1 – 5

Midterm #1 (20%) In class midterm on **THURSDAY 10/13/21** from 1:45 to 3:15.
Content: cumulative material that includes lectures 1 – 12.

Canvas quiz #2 (10%) To be taken any time on **FRIDAY 11/04/21** (12am to 11:59pm)
Content: Lectures 13 – 17

Midterm #2 (20%) In class midterm on **THURSDAY 12/08/21** from 1:45 to 3:15.
Content: cumulative material that includes lectures 13 – 25.

(2) Recitation paper quizzes (32%)

There will be 8 quizzes on the papers covered in recitation (4% per recitation paper).

(3) In-class quizzes (8 %) There will be a total of 6 short in-class quizzes that will be given during randomly chosen lectures throughout the semester. Each will be worth 2% of the grade and you can drop two except for the last one which will count for everyone.

Textbook & Reading

Textbook reading: There will be assigned chapter reading from the book by *N.B. Davies, J.R. Krebs, S.A. West (DKW): An Introduction to Behavioural Ecology, 4th edition*. A pdf version of the book will be available on canvas. For students who wish to purchase the book, it will also be available at the Penn bookstore. In some cases, chapters will be assigned from the textbook by *D. R. Rubenstein and J. Alcock (R&A): Animal Behavior, 11th edition*. These will be provided as .pdf documents in canvas.

Primary literature reading: You will be assigned to read 8 papers from the primary literature. These will be discussed during recitation sections and will form the basis of quizzes associated with recitation. These papers will be available on canvas.

(optional) "Book club" reading: We will be discussing the book "*Genius of birds*" by Jennifer Ackerman (Penguin books, 2017). It can be purchased through amazon (the cost is between \$8 and \$15). Several chapters from this book will be assigned for this (optional) "book club" where the instructors will lead a discussion of the chapters' content and integrate it with course material. These "book club" meetings are optional. The primary purpose of these meetings is to discuss topics of animal behavior in a more informal setting. A practical benefit of these meetings will be that some of our exam questions will likely be inspired by readings in the book. To encourage conversation, we will ask those attending to answer a list of talking points that we will hand out to those interested.

Book Club Schedule

Meeting #1:

When: MONDAY, OCTOBER 3 6:30 pm – 7:30 pm.

Where: TBD

READING: Chapter 7 ("A mapping mind – spatial and temporal ingenuity")
Chapter 8 ("Sparrowville – adaptive genius")

Meeting #2:

When: (*tentative*) MONDAY, NOVEMBER 22 – time TBD

Where: TBD

READING: TBD

E. SCHEDULE:

<i>lecture</i>	<i>date</i>	<i>topic</i>	<i>lecturer</i>	<i>readings</i>
WEEK 1				
1	Tue	Aug 30	Introduction	MFS DKW Ch 1
2	Th	Sept 1	Behavior in an evolutionary context	MFS DKW Ch 1 Bateson & Laland (2013)
WEEK 2				
3	Tue	Sept 6	How to study behavior; proximate/ultimate causes	MFS DKW, Ch 2
4	Th	Sept 8	Economic Decisions – Part 1	MFS DKW, Ch 3
<p>RECITATION PAPER #1: ECONOMIC DECISIONS – Quiz due Tuesday 9/13 <i>Darnell et al. (Animal Behavior, 2020) Balancing risk and reward: mating opportunity influences thermal refuge use in fiddler crabs</i> TA: Marcelina Martynek</p>				
WEEK 3				
5	Tue	Sept 13	Economic Decisions – Part 2	MFS DKW, Ch 4
6	Th	Sept 15	Orientation & Navigation – Part 1	MFS TBD
<p>Canvas QUIZ #1: lectures 1 - 5 (to be taken on Friday 9/17)</p>				
WEEK 4				
7	Tue	Sept 20	Orientation & Navigation – Part 2	MFS TBD
8	Th	Sept 22	Conflict and Cooperation	MFS DKW, Ch 5
<p>RECITATION PAPER #2: NAVIGATION – Quiz due Tuesday 9/27 <i>Wittlinger et al. (Science, 2006) The ant odometer: Stepping on stilts and stumps</i> TA: Ana Alonso</p>				
WEEK 5				
9	Tue	Sept 27	Living in groups; territoriality	MFS DKW, Ch 6
10	Th	Sept 29	Communication – Part 1	MFS TBD
<p>RECITATION PAPER #3: CONFLICT and COOPERATION – Quiz due Tuesday 10/04 <i>Sinervo and Lively (Nature, 1996) The Rock-paper-Scissors game and the evolution of alternative male strategies</i> TA: Ana Alonso</p>				

WEEK 6

11	Tue	Oct 4	Communication – Part 2	MFS	TBD
	Th	Oct 6	FALL BREAK		
		Oct 10	DROP PERIOD ENDS		

WEEK 7

12	Tue	Oct 11	Communication – Part 3	MFS	TBD
	Th	Oct 13	MIDTERM EXAM #1 – in class exam (Lectures 1 – 12)		

WEEK 8

13	Tue	Oct 18	Sexual selection – Part 1	YD	DKW, Ch 7 (pp. 179-212)
14	Th	Oct 20	Sexual selection – Part 2	YD	DKW, Ch 7 (pp. 179-212)

RECITATION PAPER #4: COMMUNICATION – Quiz due Tuesday 10/25

Barker, Alison J., et al. (Science, 2021) Cultural transmission of vocal dialect in the naked mole-rat
TA: Marcelina Martynec

WEEK 9

15	Tue	Oct 25	Parental Investment	YD	DKW, Ch 8
16	Th	Oct 27	Mating Systems – part 1	YD	DKW, Ch 9

RECITATION PAPER #5: SEXUAL SELECTION – Quiz due Tuesday 11/01

Chen et al. (Science, 2019) Problem-solving males become more attractive to female budgerigars
TA: Ana Alonso

WEEK 10

17	Tue	Nov 1	Mating Systems – part 2	YD	DKW, Ch 9
18	Th	Nov 3	Kin Selection and recognition – Part 1	YD	DKW, Ch 11
		Nov 7	LAST DAY TO WITHDRAW		

Canvas QUIZ #2: lectures 13 - 17 (to be taken on Friday 11/05)

WEEK 11

18	Tue	Nov 8	Kin Selection and recognition – Part 2	YD	DKW, Ch 11
19	Th	Nov 10	Brood parasitism	AA	TBD

RECITATION PAPER #6 – MATING SYSTEM – Quiz due Tuesday 11/15

Ventura, Francesco, et al. (Proceedings of the Royal Society B 2021) "Environmental variability directly affects the prevalence of divorce in monogamous albatrosses."
TA: Marcelina Martynec

WEEK 12

20	Tue	Nov 15	Social Insects	YD	DKW, Ch 13
21	Th	Nov 17	Cooperation and reciprocal altruism – part 1	YD	DKW, Ch 13

RECITATION PAPER #7: SOCIAL INSECTS – Quiz due Tuesday 11/22

Wilgenburg et al. (Animal Behavior 2002) Spatiotemporal patterns of intraspecific aggression in the invasive Argentine ant.

TA: Ana Alonso

WEEK 13

22	Tue	Nov 22	Cooperation and reciprocal altruism - part 2	YD	DKW, Ch 12
	Th	Nov 24	Thanksgiving		

WEEK 14

23	Tue	Nov 29	Cooperative Breeding	YD	DKW, Ch 12
24	Th	Dec 1	Social behavior in primates	MM	TBD

RECITATION PAPER #8: COOPERATIVE BREEDING – Quiz due Tuesday 12/06

Emlen et al. (American Naturalist 1995) Making Decisions in the Family: An Evolutionary Perspective

TA: Marcelina Martynek

WEEK 15

25	Tue	Dec 6	Short Research Presentations by Marc & Yun	MFS & YD	
	Th	Dec 8	MIDTERM EXAM #2 – in class exam		

MIDTERM EXAM #2: lectures 13 – 25 (to be taken on Friday 12/10)

WEEK 16

Reading Days – 12/11 through 12/14

Note: There is NO FINAL exam for this course

F. GENERAL INFORMATION and HELP:

ATTENDANCE: It is expected that you will attend class sessions. Should you miss one session for some reason, there is no need to contact the instructor about this or to report this through the Course Absence Reporting system (CAR). Lectures will be recorded using Zoom and posted on Canvas. Remember to not rely on lectures being recorded given the real possibility that lectures might be defective or mistakenly forgotten to be recorded. If a family emergency or serious personal illness causes you to miss three or more lectures in a row, please be sure to contact Drs. Schmidt or Ding and the College Office directly. **Note:** To encourage class attendance, we will be giving a total of 6 short in-class quizzes during randomly selected lectures.

MASK POLICY: We assume that all of you are vaccinated and that all of you will follow the University's policies related to the pandemic, including the policy on masks. We will require that masks be worn for the first 2 weeks of class and for the first recitation. We will also require masks be worn for both midterms. After the first two weeks, mask-wearing will be recommended but not be required for regular class. If you have a valid medical reason why you cannot attend in-person activities, wearing a mask, get in touch with Drs. Schmidt or Ding and we will do our best to accommodate you through a combination of Zoom and prerecorded material.

Covid-19 exceptions: Students, teaching assistants, and professors are encouraged to assess themselves for potential symptoms prior to every class period. Please exercise caution to avoid infecting others in the classroom. If you are unable to attend class for an extended period of time, please notify the instructors as soon as possible in order to discuss appropriate accommodations.

Getting Academic Help: Your TAs and instructors will be available during scheduled office hours. You may also see reach out to each instructor by appointment if the scheduled office hour does not work. While some of our time is spent in other activities such as research, you are our priority this semester, and we expect you to find us or the TAs if you run into problems. We are here to help you. Please do not hesitate to let your TA or instructors know if you are experiencing difficulty.

Mental Health Resources: The Biology Department is here to support you! We care about the holistic well-being of our undergraduates. While focusing on academics, it is important to attend to your physical and mental health as well. Anxiety and depression are all too common in high-stress environments. If you are concerned about yourself or a friend, please reach out to either the Biology Undergraduate Office. If you, or anybody you know, is in need of mental health care, please refer to the following campus resources: (1) Counseling and Psychological Services, [CAPS 215-898-7021](tel:215-898-7021) (off hours and weekends [215-349-5490](tel:215-349-5490)); (2) Department of Public Safety [215-898-7333](tel:215-898-7333), or [511](tel:511) if imminent danger to themselves or others; (3) Finding Programs for Student Wellness through the [VPUL](#); and (4) [Student Health Services](#).

Inclusion and Diversity: We value the backgrounds and identities of all students (including but not limited to country of origin, race, class, religion, ethnicity, gender, sexual orientation and identity, and disability status), and are committed to providing an inclusive climate. If there are elements of your experiences, culture, or identity that you would like to share with us as they relate to your success in this class, Yun and I would be happy to meet to discuss. Likewise, if you have any concerns in this area or are facing any special issues or challenges, you are encouraged to discuss the matter with either of us (set up a meeting by email) with an assurance of full confidentiality, or with the Biology Undergraduate Office.

Formal and Informal Accommodations: The Biology Department at Penn is committed to assisting students requiring special accommodations for circumstances that are registered with the Office of Student Disability Services (SDS; <https://www.vpul.upenn.edu/lrc/sds/>). The University of Pennsylvania provides reasonable accommodations to students with disabilities who have self-identified and been approved by the Office of Student Disabilities Services (SDS). In these online courses, this would translate into having extra time to take the exam. If you have not yet contacted SDS and would like to request accommodations or have questions, you can make an appointment by calling SDS at [215-573-9235](tel:215-573-9235). The office is located in the Weingarten Learning Resources Center at Stouffer Commons 3702 Spruce Street, Suite 300. All services are confidential. If you are not formally registered with SDS and experience anxiety, depression, learning disabilities, or other issues that affect your ability to fully participate and learn in this class, you are encouraged to check in with one of us or with the Biology Undergraduate Office so that we can help you to secure the resources to promote your success.

Contacts for Help: For help with any of these issues, please feel free to reach out to the Biology Undergraduate Office [Professor Paul Schmidt, Undergraduate Chair (schmidtp@sas.upenn.edu) or Mr. Roberto Corral, Undergraduate Coordinator (robcorra@sas.upenn.edu)].