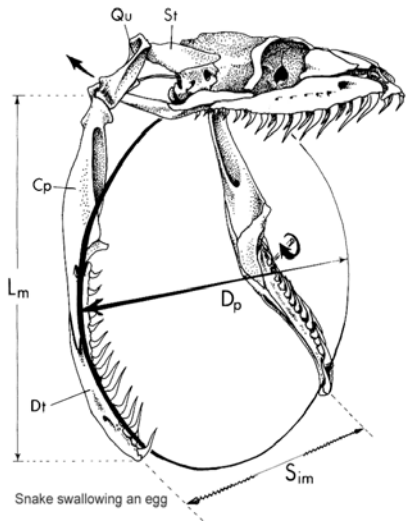


# Evolution of Animal Form & Function

## ECOL 330 | Fall 2009

**Meeting times:**
Lectures:
Tue 9:30-10:45 AM
Thu 9:30-10:45 AM
BioSciences West 237(BSW)

**Instructor:**
Dr Alex Badyaev
Office: BSW 424
Office hours: Tue 11-12
Tel: 626-8830
abadyaev@email.arizona.edu

## Course goals:

This course integrates comparative aspects of ontogeny, physiology and anatomy of animals with the current concepts of evolutionary biology, life history, and behavioral ecology. The overall goal of the course is to facilitate critical thinking and discussion of evolutionary concepts in animal form and function based on a solid understanding of the basic aspects of development, physiology and morphology. The course focuses on the diversity of natural histories of animals – primarily of vertebrates – and takes a historical approach in the discussion of scientific progress that resulted in our current understanding of diversity in animal form and function.

## Credit hours: 4. Note: This is a Writing Emphasis Course

**Prerequisites:** Satisfaction of the Mid-Career Writing Assessment (MCWA) or the former upper-division writing proficiency requirement (UDWPE).

## Course website: www.u.arizona.edu/~abadyaev/ECOL330.html

## Academic, grading, and ethical policies:

### *Course work*

| | | | |
|---|---|---|---|
| **Lecture exams:** | | **Grade:** | |
| First Exam | 200 | | |
| Midterm | 200 | 90-100% | **A** |
| Final | 200 | 80-89% | **B** |
| **Project paper:** | | 70-79% | **C** |
| Proposal and References | 50 | 60-69% | **D** |
| Oral presentation | 100 | < 60 % | **E** |
| Paper | 200 | | |
| **Class discussions:** | 50 | | |
| **Total:** | **1000** | | |

### *Lecture exams*

There will be **three** exams (first, midterm, and a final). Each exam will cover the material from the prior exam onward (i.e., non cumulative). Format will be mixed: definitions, multiple choice, short answers, and essays. Be prepared to synthesize ideas rather than memorize facts and repeat information. All exam

questions will be from the list presented during each lecture. All exams will be closed-book. University of Arizona policy regarding ethical conduct, plagiarism, and cheating during exams, in proposals or final project papers will be *strictly* and *swiftly* enforced. There will be no make-up exams. If you are unable to be present for an exam for legitimate reasons, you must contact me well in advance. Absences due to illnesses must follow the University policies. No early final exam will be given – so don't make travel arrangements before the date of the final is known. Consult Student Code of Academic Integrity early and often: http://studpubs.web.arizona.edu/policies/cacaint.htm

### *Grade appeals*

If you think that an error was made in the grading of your exam, you must appeal in writing (*no emails please*) to the instructor within 2 days of posting explaining, in details, where the mistake was made. Please note that if your grade appeal is determined to be frivolous by the instructor you will lose one additional full grade. No grade appeals will be accepted for the final exam.

### *Attendance*

You are expected to attend each lecture. Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored, as well as holidays or special events observed by organized religions for students affiliated with that religion.

### *Special accommodation or services*

Students who are registered with the Disability Resource Center and need special accommodations or services should contact the instructor no later than by the second week of class to discuss proper documentation. All related discussions will, of course, remain strictly confidential.

### *Project paper:*

*Grading*

This is an outstanding opportunity to research a topic of interest to you that is appropriate for the course with the focus on evolution of morphology and behavior. Your grade for the project paper will consist of three components: 1) Presentation of research question (proposal) and a list of primary scientific literature on the topic; 2) Oral presentations of your results to your classmates and submission of handout outlining presentation, 3) Submission of the paper.

You have the option of doing either a project that is centered on a scientific paper or research a specific question (see below for examples). You may conduct the projects in teams of two (*no more*). If you are currently involved in any collaborative research projects, independent study, or otherwise work with some lab or group on campus – this is a great opportunity to write up, summarize, and present this research to your peers in the class. Proposals, handouts and the final paper should be submitted by 9:30AM in the class on the date they are due (see syllabus). Penalty for all late submissions is 50 points per 12 hrs delay.

Article-based project paper should take the format of a review, similar to those published in the journal *Natural History* or *Trends in Ecology and Evolution.* Independent project papers should be in the format of the research article, similar to those published in *Journal of Animal Ecology* or *Journal of Zoology*. Details will follow.

*Miscellaneous*:

1) Project papers must be typed!
2) Project papers must be stapled and pages numbered!
3) Scientific names should be underlined or *italicized*.
4) Take pride in your writing. Although scientific writing is different from other forms of written communication, you are still conveying information using the English language. Good scientific writing is concise, precise, and as simple as needed to convey the information. Use technical terms when they clarify your point; avoid them when they do not. *You will be graded on your English.*

# Schedule of the lectures

| Date | Module | Examples of topics |
|---|---|---|
| 27 Aug | **Reviewing the concepts** | Introduction and Overview<br>Concepts and Questions:<br>-Evolution *vs.* Development<br>-Phenotype *vs*. Genotype |
| 1 Sept | **Reviewing the basics:**<br>**Developmental preliminaries** | -Form *vs*. Function<br>-Epigenesis *vs*. Preformation<br>Sperm competition and adaptations in gametogenesis |
| 3 Sept | | Germ cells<br>Gametogenesis |
| 8 Sept | | Fusion of the genetic material<br>Meiosis variations |
| 10 Sept | *Special lecture* | Form and function of body size in reptiles |
| 15 Sept | **Outline of proposals**<br>**Project paper preparation**<br>**Literature searches** | *-How to find suitable references in the library*<br>*-How to present your research questions* |
| 17 Sept | | **FIRST EXAM** |
| 18 Sept | *Last day to drop class without record* | |
| 22 Sept | | Egg-sperm attraction<br>Ecology and evolution of fertilization and implantation |
| 24 Sept | **Evolutionary embryology** | Evolution and ecology of oogenesis<br>Cycle of life<br>Body plans and early development<br>Constraints in form and function |
| 29 Sept | **Form, function, and evolution:**<br>**Feeding structures** | Feeding in birds |
| 1 Oct | | Feeding in reptiles |
| 6 Oct | **Form, function, and evolution:**<br>**Protection, thermoregulation, and predator avoidance** | Morphogenesis of skin and its derivatives: skin, glands, scales, feathers, hair |
| 8 Oct | | Evolution of camouflage, protective gear & chemical defenses |

| | | |
|---|---|---|
| 13 Oct | **Student presentation of proposals (1)**<br>**Proposals & reference lists due by 9:30AM** | |
| 15 Oct | **Student presentation of proposals (2)** | |
| 20 Oct | **Student presentation of proposals (3)** | |
| 22 Oct | **MID-TERM EXAM** | |
| 27 Oct | | Evolution of color vision in vertebrates |
| 29 Oct | | Animal coloration: Evolution and ontogeny |
| 3 Nov | | Evolution of bird feathers |
| 5 Nov | **Form, function, and evolution: Sex** | Evolution of sex determining systems<br>Evolution of sexual dimorphism |
| 10 Nov | **Form, function, and evolution: Locomotion** | Morphogenesis of the skeleton<br>Constraints on human athletic performance |
| 12 Nov | **Evolutionary transitions in locomotion** | Flight: Evolution and ontogeny |
| 17 Nov | **Form, function, and evolution: Behavior** | Evolution of sexual displays and traits<br>Alternative mating strategies |
| 19 Nov | **Student presentations (1)** | |
| 24 Nov | **Student presentations (2)** | |
| 26 Nov | *No lecture –Thanksgiving* | |
| 1 Dec | **Student presentations (3); Project Papers Due by 9:30AM** | |
| 3 Dec | **Student presentations (4)** | |
| 8 Dec | **FINAL EXAM REVIEW IN CLASS, catch-up time** | |

***Project write-up***

Project papers should be 5-6 typed double-spaced pages long and contain the following:
*Title.* Title should be short but descriptive. To be maximally useful, the title should contain the name of organism (or problem or ecosystem) that was studied or reviewed and the particular aspect or feature of the system that was studied or reviewed. Example: "*Common problems in organizing research projects by the students in ECOL 330*"

*Abstract.* The abstract is a one or two paragraph summary of the entire project. Someone should be able to understand the abstract without referring to the rest of the paper. It should contain: 1) the purpose of the study, 2) a brief statement of what was done, 3) a brief statement of what was found, and 4) brief conclusions and general significance.

*Introduction, Methods, and Discussion.* The exact format of your project paper will depend on whether it will take a form of a review or an original research project.

*References.* In the text of your paper, you can refer to other research by including the authors name and date of publication in parentheses. For example: "Because other birds use crossed mandibles to extract seeds from cones (Crossbill 1994), I expected to find…". If you cite more than one study, list them in chronological order in the text (e.g., Jay 1991, Crossbill 1994). References for the final write-up and the reference list for the proposal presentation should be listed in alphabetical order using the format below.

*Co-authorship statement.* On the title page of your project paper please write the following: "We agree that the following members have contributed equally to the preparation of this report". Both members of the group should sign their names under this statement.

### *Break-up of points for project write-up (200 total)*

*Abstract* (60 pts)

*Introduction, Methods, and Discussion* (100 pts), of those:

1) *What is your question?* - Identify the question that you investigated (20)
2) *Why it is interesting? Why do we care?* - Elaborate why you think that this question was interesting and worth pursuing, cite appropriate references (20)
3) *What did you/the authors do to answer the question and why?* - Explain in details the hypotheses and predictions that you examined/tested, cite appropriate references (20)
4) *What did you/the authors find?* - Describe what you found. What data you accumulated, what conclusions you have drawn from these data. Do the conclusions agree with the predictions? Did you find support for your hypotheses? Explain. (20)
5) *What has been done in this area?* - Describe how your results and conclusions are related to previous research that has been done in this area – cite relevant references. What are the prevalent hypotheses and explanations for the question that you have investigated? Why? (20)

***Note**: In sections above 1/3 of the grade can be for English grammar and style.*

*References:*

In the text of your paper (15)

References for the final write-up should be listed in alphabetical order using the format in the syllabus.

Reference list (only scientific papers can be cited): (25)

### *Research proposal*

You and your collaborators need to present your research proposal and list of references to the class on the date indicated in the syllabus. The research proposal will be no more than **one page long** and should contain the following:

1) Briefly identify your project and the question to be investigated
2) Tell us why you think this question is interesting and worth pursuing
3) Explicitly state the hypotheses and predictions that you plan to examine
4) Tell us how you plan to evaluate these hypotheses and what kind of data or information you plan to gather
5) Tell us briefly about what is being done in this area – this is to be based on the literature survey summarized in the reference list.

*Reference lists (separate page 20 points total)*: Reference lists should be at least 10 (ten) original scientific articles on the topic, listed in the alphabetical order of the authors and in format similar to the in the list of topics in your syllabus. References can ***only*** be to the published scientific work (e.g., no references to the on-line publications, web pages, CDs, etc will be allowed unless justified).

In parentheses state what the paper is about (10 points): e.g.,: Simmons, R. E., and L. Scheepers. 1996. Winning by a neck: sexual selection in the evolution of giraffe. American Naturalist 148 :771-786. (*the authors present an alternative hypothesis that male-male competition and female choice favored evolution of long necks in giraffes*)