

Biol 233/333 – Animal Locomotion

Course Syllabus

Spring 2015

Instructor

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Office hours: Thursday 10:15-11:15, or by Appointment

Meeting Times

Monday 2:50 – 5:50 pm Lasry, room 124

Textbook (required):

None. All readings will be supplied on Moodle.

Prerequisites

- Biol 101 or 103, or Phys 110 or 120
- Or Permission

Learning Objectives

How do vertebrate animals move? How is their movement affected by different aspects of their environment? What techniques can we use to study locomotion? These are the questions that students will grapple with as they learn about animal locomotion in an inquiry-based research course that will combine short lectures, demonstrations, reading and discussion of primary literature, and hands-on analysis of locomotion data in the form of high-speed videos. Students will learn about the biophysics of locomotion and motion analysis, and apply this knowledge to a research project, where they will collect data from high-speed videos, learn to formulate and test hypotheses about their data and write a report on their findings. Students will learn about various aspects of research, including scientific ethics, data collection and presentation, critical evaluation of the primary literature, and writing in a scientific manner.

Course Website

Students can find the course syllabus and other course materials on Moodle.

Grading, Components and Expectations

Biol 233/333 will be graded based on the following components. I indicates an individual assignment, G indicates a group assignment.

| Course Component | Value | Date |
|--|-------------|-------------|
| Student Profile (I) | 2% | January 12* |
| Responsible Conduct of Research Tutorial (I) | 3% | January 26* |
| Question, Hypothesis, Predictions Presentation (G) | 3% | February 2* |
| Digitized Point Coordinates (I) | 4% | February 9* |
| Bibliography (I) | 10% | February 23 |
| Sample Video Kinematics (I) | 4% | March 9* |
| Locomotion Dataset (G) | 10% | April 6 |
| Academic Spree Day Poster Draft (G) | 0% | April 13 |
| Academic Spree Day Poster (G) | 20% | April 22 |
| Term Paper (I) | 24% | April 27 |
| Class Participation (I) | 20% | Ongoing* |
| Total | 100% | |

* Assignments marked with an asterisk will be done during class time.

General Written Assignment Formatting Guidelines

Unless otherwise stated, format all written assignments as follows. Assignments should have a title page with a title, the name of the assignment, the student name, the course name and number, and the semester and year. Assignments should have 1" margins, be single-spaced, left-justified, and use 12 pt. Times New Roman font. The first line of each paragraph should be indented (unless it starts with a heading), and there should be no extra space between paragraphs.

Student Profiles | 2% of course grade | January 12

Students will be given an index card to do this assignment. On the card, they should place their **name**, the **degree** they are pursuing, the **Year** of their program, their **Major** (and any minors), their **Research Interests** (if they have some) and **Career Goals**. The words that are in bold in this description should serve as headings that are left justified on the index card. This assignment should be hand-written, so ignore the general formatting guidelines.

Responsible Conduct of Research | 3% | January 26

Society relies on and invests in the scientific enterprise so that humanity can learn about and understand the natural world, and is better equipped to face challenges and improve quality of life. The trust that society places in science necessitates that science be conducted responsibly, objectively, and ethically as possible. Ways to accomplish this is by following best practices in research fields, ensuring the quality of data collected and analyses done, establishing strong mentor-student relationships, and treating animal and human subjects with their welfare in mind. One of the goals of this course is to teach students about the responsible conduct of research. We will start this process with some online tutorials, offered by the Collaborative Institutional

Training Initiative (CITI). To Access these tutorials, go to <https://www.citiprogram.org/>. Then register to create an account. Then follow the instructions that appear. Clark has a subscription with the initiative, so make sure that you enter “Clark University” as your organizational affiliation. Also select the “RCR Basic Curriculum + Animal Subjects” for your curriculum. Then run through the series of tutorials. All of the tutorials take several hours to complete, so don’t leave this until right before the due date! There will be some in-class time to work on this, but should be finished on your own, if necessary. There are short quizzes for each section that you must complete. When you are finished, please e-mail a copy of the **Completion Report** to Dr. Bergmann. To do this, save the PDF of the report to your computer, and then e-mail it. This is due at the beginning of class on January 26, so you have two weeks to complete it after our first class.

Question, Hypothesis, Predictions Presentation | 3% | February 2

We will be discussing scientific questions, hypotheses and predictions in class. After discussion of what these are and how you go about formulating them, there will be an in-class group activity to come up with some and then present them to the class. This assignment will be graded on the quality of the question, hypothesis and predictions that each group comes up with. Further instructions will be provided in class.

Digitized Point Coordinates | 4% | February 9

In class, we will learn how to use DLTdv5, a program written for MatLab, that can be used to digitize points in a video to obtain 2-dimensional coordinates for the points. During the class, you will be given time to try this out on your own. The file with the 2D coordinates that you obtain for the point is the assignment. Precision counts in this exercise, so part of the grade is for how close the coordinates are to those of Dr. Bergmann.

Bibliography | 10% | February 23

Later in the semester, students will write a term paper reporting their findings from their locomotion datasets. They will need to cite references from the primary literature in their term papers. The purpose of this assignment is to get students to identify and read literature on the topic of lizard locomotion so that they are ready to write their term papers later in the semester.

Students should follow the general formatting instructions and come up with a title that describes the research topic they are working on. They should also follow the reference formatting instructions below. The bibliography should include only primary literature that each student locates – this is an individual assignment – don’t do it in partners or groups. The bibliography should be as extensive as possible, but at a minimum students enrolled in Biol 233 should include **at least 20 references**, and graduate students (Biol 333) should include **at least 30 references**. The references in the bibliography should be **listed alphabetically by first author’s last name and formatted exactly as follows**:

For a journal article:

Bergmann, P.J., Meyers, J.J., & Irschick, D.J. 2009. Directional evolution of stockiness coevolves with ecology and locomotion in lizards. *Evolution* 63: 215-227.

For a book chapter:

Larson, A., & Losos, J.B. 1996. Phylogenetic systematic of adaptation. *In* Adaptation by M.R. Rose & G.V. Lauder, eds. Pp. 187-220. Academic Press: San Diego, USA.

For a book:

Sherbrooke, W.C. 2003. Introduction to Horned Lizards of North America. University of California Press: Berkeley, USA.

Notes on citations:

- Format your citations exactly as they are formatted in the examples above.
- List all of the authors, date, article/chapter title, journal/book title, volume, pages. For book chapters, include names of all editors.
- Do not abbreviate journal titles or publisher names. Do not include issue numbers.
- Do not include other extraneous material; only what you see above.
- Use a format consistent with the examples above for other sources you may want to cite.
- Single-space the assignment, but put a blank line between each citation.
- This assignment should be submitted by e-mail in Microsoft Word or RTF format.

Sample Video Kinematics | 4% | March 9

In class, we will learn how to use ImageJ to obtain kinematic data from animals moving. During the class, student will be given time to try this out on their own. The assignment will be a spreadsheet that includes a series of kinematic data for a sample video. Precision counts in this exercise, just like the digitized point coordinate assignment, so part of the grade is for how close the kinematic data are to those of Dr. Bergmann.

Locomotion Dataset | 10% | April 6

Over the course of the semester, student will work in groups to assemble large datasets of locomotion in lizards. The advantage to this approach, as opposed to individual work, is that students will have larger datasets to work with, and so will have more meaningful results. Only as a group, are these projects feasible. Class time will be given to do data collection, but out-of-class time will also be necessary to complete the projects. Each group will hand in their dataset. These group datasets will have data from all of their members assembled into a single spreadsheet. Grades will be determined by proper formatting of the spreadsheet (to be discussed in class), and completion of the dataset. Individual grades will also be influenced by each group member's contribution to the dataset.

Academic Spree Day Poster Draft | 0% | April 13

Each group will present their work at Academic Spree Day in the form of a poster. A full draft of the poster will be due on April 13, a little more than a week before Academic Spree Day.

Although this draft is not worth a grade, having it ready for this class is mandatory. We will view each of the posters, discuss them, and provide suggestions for improvement, leaving enough time for a revision before they are printed for Academic Spree Day.

Academic Spree Day Poster | 20% | April 22

Groups will present their posters during Academic Spree Day. Note that this is a Wednesday, not a class day, and so leave the afternoon free for this event. All group members should show up and stand by their poster for at least a portion of the time to answer questions and talk to members of the Clark community. The grade for the poster will be determined based on information content, that the project is understandable, results are clearly conveyed, and discussed appropriately, and based on poster design and aesthetics.

Term Paper | 24% | April 27

Each student will also present their work in the form of a term paper. This will have similar content to the group poster, but is an individual assignment, which means that all text, figures, and tables should be made individually by each student. Only the dataset is shared among members of the group. The term paper should follow the form of a scientific article, like those that we discussed in class. Specifically, it should have a title page, Introduction, Methods, Results, Discussion, Acknowledgements, and Literature Cited sections. The general formatting guidelines (above) should be followed. The acknowledgements section should at least include the names of the other members of the group. The Literature Cited section should be formatted follow the guidelines for the references of the bibliography. Figures and tables can (and should) be used. These can either be embedded in the text, or placed at the end, after the literature cited section. Table headings should go above the table, figure captions should go below the figure. Headings and captions should be on the same page at the table or figure. Tables and Figures should be numbered and cited in the text in the order of numbering. The grade will be determined based on information content, whether each section contains information that should appear in that section, clarity of writing, and whether the formatting instructions were followed.

Class Participation | 20% | Ongoing

During this course, the class will discuss scientific articles, various topics, work in groups, and provide input on classmates' work. A considerable part of the course is based on participation in the class beyond simply showing up and doing all the assignments. Students will be evaluated on their participation in all of these activities.

Course Rules & Time Commitment

- All components of the course are mandatory to receive a passing grade. Because much of the work is oral, it is imperative that readings and assignments are completed on time.
- Attendance of all class sessions is mandatory. Students that must miss a class must discuss this beforehand with Dr. Bergmann.
- Late assignments are not accepted without discussing the matter with Dr. Bergmann **prior** to the assignment being due. Accepting late assignments at that point is at the discretion of Dr. Bergmann.
- The time commitment expected of students in this course each week is as follows:
 - 3 hours of class meetings, plus 5 hours of preparation and review
 - 1 hour for working on class assignments
 - 4 hours for working on the term project, including data collection
- Over a 14 week semester, this amounts to approximately 182 hours

Academic Integrity, Honesty, and Plagiarism

Academic dishonesty includes any effort to circumvent the evaluation procedures of the course to improve a grade for yourself or other students (“cheating”). Academic dishonesty includes but is not limited to unauthorized copying of another person’s work, and not citing sources whose information you use in your assignments. Due to the nature of this course, most “typical” forms of academic dishonesty would be of no benefit, but students should give credit for ideas in written work through the use of citations, and give credit for graphics used in written or visual work (e.g. Powerpoint presentations). As a research course, the falsification or fabrication of data will not be tolerated and will result in disciplinary action. All students are expected to adhere to Clark University’s rules of Academic Integrity, available at: <http://www.clarku.edu/offices/aac/integrity.cfm>.

Course Schedule

| Dates | Topics |
|---------------------|---|
| January 12 | Introduction, Signing out laptops, Responsible Conduct of Research Assignment Due: Student Information Cards (I) |
| January 19 | No Classes – Martin Luther King Day |
| January 26 | Discussion of RCR, Introduction to Locomotion (lecture), Introduction to the Dataset (Philippines Slide Show), Formation of Groups Assignment Due: RCR Tutorial (I) – Due by beginning of class |
| February 2 | Lecture: The Musculoskeletal System, QHP Discussion & Activity Tutorial: Using library resources QHP Presentations (G) |
| February 9 | Lecture: Measuring Locomotion: Performance & Kinematics, Video digitizing tutorial, Assigning groups to projects, Digitizing time Assignment Due: Digitized Point Coordinates (I) |
| February 16 | Discussion: Performance article Digitizing time, start group projects |
| February 23 | Demo: Running and video recording animals Tutorial: Spline fitting & calculation of performance Assignment Due: Bibliography (I) |
| March 2-6 | No Classes – Spring Break |
| March 9 | Discussion: Kinematics article Tutorial: ImageJ for calculating angles and footfalls Assignment Due: Sample Video Kinematics (I) |
| March 16 | Demo: Using a force plate Time for collecting data |
| March 23 | Discussion: Making a poster Time for collecting data |
| March 30 | Discussion: Writing in Science Tutorial: Organizing data in a spreadsheet Time for collecting data |
| April 6 | Discussion: Article topic TBA Tutorial: Data presentation, using figures and tables Assignment Due: Locomotion Datasets (G) |
| April 13 | Assignment Due: Academic Spree Day Poster Draft (G) Discussion: Tips for improving posters Demo: High-speed X-ray video for studying locomotion |
| April 20 | Discussion: Article topic TBA Time to work on outstanding assignments |
| April 22 (W) | Academic Spree Day |
| April 27 | Conclusions Assignment Due: Term Paper (I) |

Note: The course schedule can be modified. Check the course website regularly.