COURSE TITLE:

Zoological Physics

CALENDAR ENTRY:

BIOL/PHYS 438. (3) *Zoological Physics* — Animal systems viewed from a physicist's perspective. Topics include sensory systems, energy budgets, locomotion, internal flows, physical advantages of grouping. *Prerequisites*: One of PHYS 101, PHYS 107. (BIOL 325 is recommended.) [0–0–0; 3–0–0]

TIME AND PLACE: Lectures: Brock Hall Annex 2365 - Tue & Thu 12:00-2:00 PM.

INSTRUCTOR:	Jess H. Brewer (Physics)	and	Jeremy Goldbogen (Zoology)
E-MAIL:			
OFFICE:	Hennings 320A: 2-6455		Bioscience 3475: 2-2373
LABORATORY:	TRIUMF: 222-1047, ext 6471		Bioscience 3475
OFFICE HOURS:	TBA		

MARKING:

ITEM	MARKS
Assignments	30
Term Paper	30
Poster Presentation	10
Final Exam	30
TOTAL	100

TEXTBOOK: B. Ahlborn, *Zoological Physics* (Springer Verlag 2004).

REFERENCES: P.A. Tipler, *Physics* (Worth) or any similar text.

Skeptic's Guide to Physics: http://musr.physics.ubc.ca/~jess/hr/skept/

First Year Science *HyperTextBook:* http://musr.physics.ubc.ca/~htb/

WikipediA: http://en.wikipwdia.org or *Google:* http://google.com

Note: Websites are great for discovery, but you may *not* use them as References in your papers, because (unlike published papers and books) they may *change* with time, or even disappear completely!

TEAM ASSIGNMENTS: Professionals generally work in collaborations, sharing their previous knowledge to solve problems that would stump them as individuals. To help you practice this way of learning, you will work on your **assignments** in groups of 3 to 5 students. The course material crosses the border between Physics and Zoology, and the audience consists of students from different Departments (such as Biology, Chemistry, Human Kinetics, Mathematics and Physics). Therefore each of you brings different expertise to the team. which they can share when they work together. A single assignment is handed in for each group. There will be roughly 6 assignments.

- Almost every problem should be accompanied by a *diagram*.
- Brief explanatory comments are required for every problem.
- Presentation is important! Leave plenty of room and organize your paper æsthetically.

INDIVIDUAL TERM PAPERS: A scientist must also be able to produce original ideas, pursue them on personal journeys of discovery, and report the results in his/her own voice. This can be a deeply satisfying adventure. In the **term paper** a physical principle of some organ or animal action is investigated and reported on by an individual student. Collaboration with other students studying similar problems is of course allowed, but joint projects (by at most two students) are rare exceptions. Your term paper must contain some numerical calculations that illustrate a biological process, and that could be used as part of an assignment for next year's class. There is no restriction other than that the topic must be approved by one of the instructors. Examples of previous topics are:

- the acoustics of bats;
- how whales find their way in the ocean;
- the mechanical and optical tricks of the archer fish;
- why crocodiles swallow gastrolyths;
- forces generated in the tendons in ski jumping;
- oxygen exchange in mammalian *versus* avian lungs;
- optical tricks for hiding;
- the electric sense of the platypus;
- whether smokers on average have deeper voices than non-smokers;
- tricks to survive in very cold and very hot environments;
- the mechanics of walking or running;
- the resolution of flies' eyes.

POSTERS: After the science is done and the papers are written, a professional scientist must be able to *present* her/his work on a manner that compels the interest of others. Each student must produce a **poster** describing the essence of the term paper, and explain it to the rest of the class in the poster sessions scheduled in the last week of term. This is an excellent simulation of the environment of research conferences, today's maketplace of ideas.

FINAL EXAM: The final exam is open book. It will likely contain one problem which every student must attempt, one problem to be selected from 4 or 5 problems, one problem chosen from poster material, and an essay problem from a list of specified topics.

PREPARATION: It is expected that each student has taken first-year University courses in Biology and Physics, and has access to a University level introductory Physics textbook, such as P.A. Tipler's *Physics* (Worth) or one of the Halliday & Resnick (and ...) textbooks from Wiley.

CHANGE OF PROFESSOR: This will be the first year this course is not taught by the author of its textbook, Boye Ahlborn. It is a safe bet that his replacement will not know the subject as well as Boye does, and you can be sure that he will be struggling to learn it just a little faster than you do. Please be patient and help him out when he falls behind in that struggle.

SUGGESTIONS & FEEDBACK: You have to do all the work of learning, but there may be things we can do to make it more fun, more efficient, more rewarding or more useful. Let me know if you have any suggestions! You will of course have the usual opportunity to evaluate the course after it's essentially over; this will be helpful to next year's students, but not to you! If you would like to give your suggestions some chance of affecting your own experience, there are several *surveys* on our Website to facilitate such feedback. See

`http://musr.physics.ubc.ca/surveys/`