Homework Assignment 1:

- Due by **11pm Tuesday 9-07-10** via course website upload link
- Turn in hard copy on **Wednesday 9-08-10** in class

Describe and contrast basilisk lizard and water strider locomotion.

**Purpose of HW1:** This assignment may be a significant challenge to some of you in the class. It requires you to read scientific papers in depth and really understand them. Besides the interesting biomechanics of water locomotion, this reading/writing exercise is an example for the need to develop an ability to deal with unfamiliar material and make sense out of it, something you’ll likely encounter time and time again after you leave college.

In HW1, you have to figure out what were the questions asked, the experiments carried out to address/answer the questions, the results obtained, and what inferences were made or could be made from the results. The challenge is amplified by the fact that there are significant amount of mathematical derivations. However, the first principal is simple – both water strider and basilisk lizard must generate sufficient upward force to support their upright position on water.

Download and read Hu et al 2003 paper, and the two Glasheen & McMahon 1996 papers, and try to understand as much as you can. The lecture slides provide help in understanding the studies and some of the mathematical derivations in the papers.

**HW1 essay:** Write a coherent review paper – describe and contrast the water locomotion of the water strider and basilisk lizard.

**Format and style:**
1. Essay length - at least 3 pages, no more than 4 pages, single line spacing. Bibliography, i.e. a section on References cited, goes on at the end of your essay.
2. Style – scientific review paper.
   - Essay should consist of an Introduction, a main body of several sections (with section subtitles), and a Conclusion.
   - Figures from the three assigned papers and other sources can be incorporated in the 3-4 page essay for purpose of illustration. Figures must be numbered and have a legend.
   - In-text citation is needed when you make reference to statements from published literature or other sources.
   - Bibliography – list all reference sources consulted, in standard scientific journal bibliography format.
   - Consult the paper “AF evolution (Cheng98)” posted on the course website as an example of a scientific review paper. You can follow the format of this example. For the References section, you only need to provide the standard scientific citation, i.e. Authors, year, article title, journal name, volume, pages.

**Your review paper should discuss the water strider and basilisk lizard studies in an integrated manner. The following points are given to help you identify what you should discuss (not necessarily in the order outlined below). Use data and derivations in the papers to support your statements:**
1. To maintain stationary and/or ambulatory stability on water, what are the basic force considerations for the water strider and basilisk lizard.

2. How do water striders maintain stationary stability?
   -- the specific downward and upward forces involved, and the source of these forces
   -- what is surface tension of water, and what property of water gives its strong surface tension, and how does surface tension support the strider?
   -- Hu et al (2003) found striders spanning 3 orders of magnitudes in body weight can all remain stationary on water surface. How did they derive the conclusion from their data (scaling of $F_s$ with $F_g$)?

3. Can the basilisk remain stationary on surface of water?

4. Newton’s 3rd Law applies in both basilisk lizard and water strider in enabling forward motion. What is Newton’s 3rd Law? Describe and contrast how forward motion is achieved in the two cases:
   -- what is momentum transfer?
   -- what are capillary waves?
   -- what is Denny’s Paradox? How was it resolved by the study of Hu et al (200)
   -- how is momentum transferred to water by striders as discovered by Hu et al (2003)
   -- what are the forces involved in the basilisk running across water, and how are they generated? What experiments and approaches did Glasheen and McMahon carry out to characterize the run, speed, and the forces generated?
   -- Why basilisk lizard above 200gm cannot run on water? How does effective radius of foot scaled with body size? What’s the range of possible slap impulse, and the extent of impulse surplus for small lizards versus larger lizards? How does these variations affect the large lizards’ water running ability?

5. Thought questions: What are the biological advantages of being able to stay on/walk on water habitats? How would distribution, resource competition etc for basilisk lizards be affected for the small versus large lizards and their ability or inability to run across water?

Grading Criteria:
- A good grasp of the studies, the results, the inferences, and presenting them coherently.
- Proper layout of the text, figures, bibliography and other items, eg. in-text citations and mathematical derivations, in accepted scientific review paper format.

How to Upload Homework:
- Go to the upload link on IB426 web site, or http://www.life.uiuc.edu/cgi-bin/upload/ib426
- Type in your NetID
- Enter the path to your homework file (or use Browse button to find and select the file in your computer)
- Click Upload
- If upload successful, it will say so in the next screen

Hardy Copy:
- Print out a hard copy.
- Turn in hard copy on Wednesday 9-08-10 in class. No late homework accepted