

BENG 100  
HW #9  
due Thursday, April 10, 2008

*Biomechanics*

1. Recall our discussion in class of the ability of a bacterium, a fish, and a human swimmer to “coast” when they suddenly cease the movement that is propelling them at a constant speed.

Assume the following characteristics of each:

	Speed of swimming (cm/s)	Size (cm)
Bacterium	0.001	0.0001
Fish	100	10
Human	1700	170

And that the viscosity of the fluid through which they are swimming is 0.01 g/cm-s.

- a) What is the drag force acting on each swimmer? What is the propulsive force that is produced by each swimmer in order to swim at the stated speed?
  - b) Assume that the swimmer suddenly stops exerting energy in order to swim. At the very instant that it stops, before it has had time to slow down appreciably, what is the drag force on each swimmer? What is the propulsive force?
  - c) How long will each swimmer “coast”: i.e. how long will it keep moving forward before stopping?
  - d) How far did it travel during the “coast”ing phase?
2. An elephant and a mouse fall from a 15 foot height. Explain (using as quantitative terms as possible) why the elephant will likely be injured, but the mouse will not.
  3. The elastic modulus for three different materials is given below:
    - a) Bone 15,000 MPa
    - b) Brain tissue 0.005 MPa
    - c) Artery 3 MPaDraw stress versus strain diagrams for each of these materials.