Engineering Inspired by Nature
Freshman Seminar
Fall 2005

Brainstorming session (October 17)

- hierarchical structures with different length scales
  - fractals?
  - wood, bone
- capillary action/trees; transport of water
  - surface tension
- gradient structures
  - palm, bamboo
- growth in response to loading
  - bone, wood
- finite element analysis of remodeling (shape optimization)
  - bone
- compare performance of natural and engineering materials
  - e.g. wood vs. steel – beams of same weight, measure stiffness
  - elephant grass stem vs. steel column of same weight
- sandwich beams
  - in nature and engineering
- hollow tube with compliant core
  - in nature and engineering
- bird bones
  - lightweight, different density in different locations
- model materials
  - abalone shell?
- fish excrete mucus to prevent freezing?
- shark skins – roughness reduces drag – swimsuits?
- bullet train nose like a kingfisher beak?

- fish swimming
  - mechanisms to reduce drag?
  - fish swim faster than theoretically should – vortex shedding and fish motion?

- plane wing tip – like a hawk wing – trailing or tip vortices

- dynamically change wing shape – NASA, birds

- egg shell – can't break in hand – compressive "arch"?