

**Bioengineering 555**  
**Molecular and Cellular Biomechanics and Cell Function**  
**Spring Qtr. '07 M, W, F, 9:30-10:20; Benson 115. 3 Credits**  
**Undergrads welcome**

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This course elucidates the basic mechanisms underlying cell function with emphasis on motion. We begin from first principles of physics and chemistry, building progressively to organelle structure and function. Emphasis is given to the gel-like nature of the cell, and the critically important role of cell water. We see how this leads directly to the various types of cellular and molecular motions, from transport, streaming, mitosis, to muscle contraction and cell motility. This unique course has been appreciated for its mildly heretical and provocative approach: students claim to have learned as much about the process of doing science as about the basis of cell function. The principles elucidated in the course are fundamental, and have far-reaching consequences for many areas of science and engineering.

Main text: Pollack (2001): *Cells, Gels and the Engines of Life* (cf. <http://cellsandgels.com/>). This best-selling, user-friendly book has won several awards, and is used as a didactic tool at many universities. It has been labeled by Harvard biologist Don Ingber as “a 305-page preface to the future of cell biology.”

Course material intersects several sub-disciplines:

- molecular function and cell biology: surface-induced ordering of water, gel behavior, and the role these phenomena may play in motion generation and other basic cellular processes;
- biomaterials: materials surfaces, polymer gels, phase transitions – and their unexpected significance in cell function;
- biomechanics: molecular basis of stresses and strains;
- instrumentation: methodologies ranging from nanofabricated transducers to optical traps.

**Prerequisites:** A course in basic biology or physiology is helpful but not essential. The course is appropriate for anyone in a scientific or engineering discipline.

**Note:** This replaces published course descriptions, some of which are obsolete.