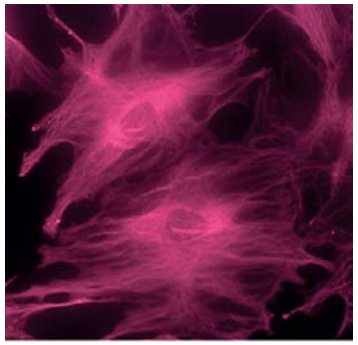
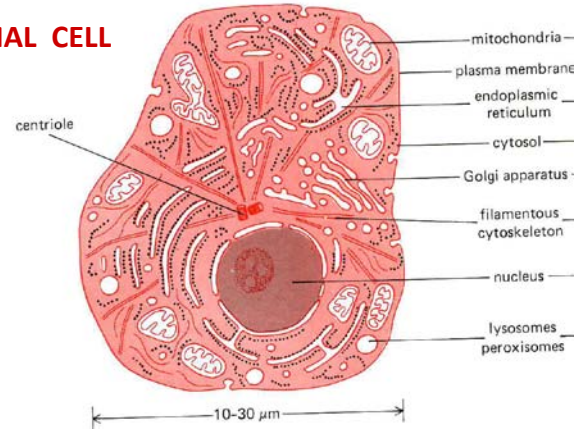
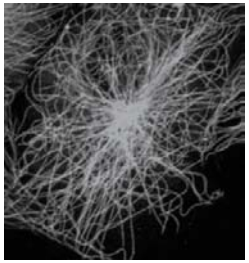
MECH450F/580: Mechanics and Energy Conversion for Living Cells

Instructor: R. Bhiladvala Units: 1.5 Hours: 3-0-1 Summer 2011



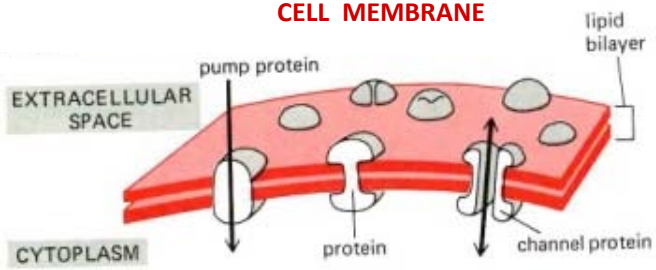
ANIMAL CELL



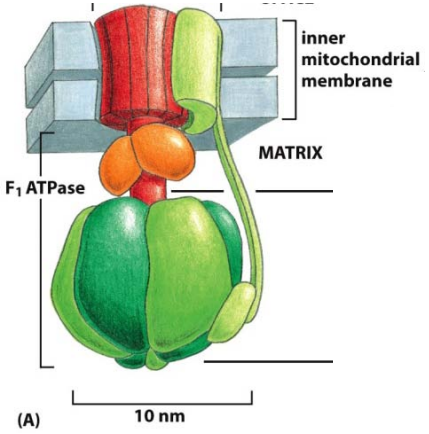


CYTOSKELETON

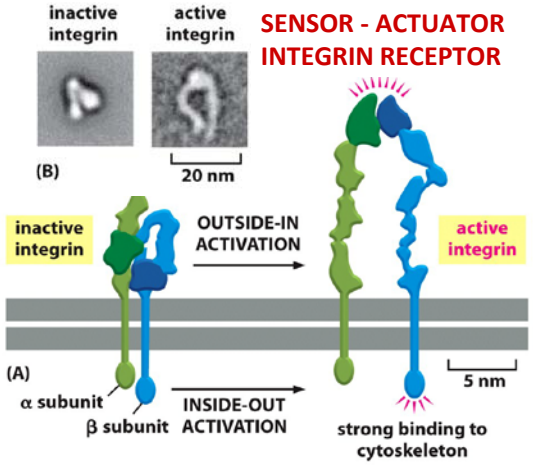
CELL MEMBRANE



PROTON PUMP – TURBINE



SENSOR - ACTUATOR INTEGRIN RECEPTOR



Course Objectives:

[1] To understand how macromolecular machines in living cells contribute to health & disease.

[2] To explore design of engineering systems inspired by mechanics and energy conversion processes in cells, refined by natural selection for over 3 billion years.

[3] To enable engg. career choices in developing instruments for healthcare, biological research.

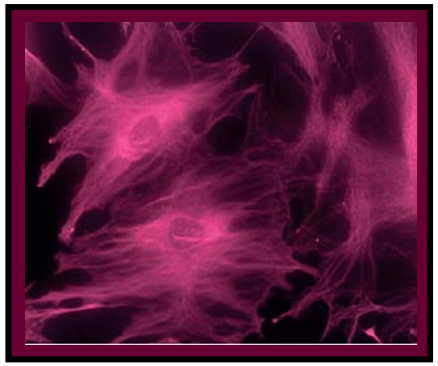
[4] Project Areas: instruments for cellular or molecular level of diagnosis or treatment; tissue engineering; bio-inspired engineering.

Topics:

- Cell components and their functions.
- Families of molecules used by cells.
- Energy conversion and ordering processes.
- Cell signaling and transport.
- Mech analyses of cytoskeleton, cell membrane.
- Cell movement and forces.
- Cell mechanotransduction.
- Tissue regeneration, stem cells for healing.
- Cancer
- Diagnostics/treatment at cell& molecule level.
- Bio-inspired engineering systems.

TENSEGRITY STRUCTURES

MECH450F/MECH580 **MECHANICS AND ENERGY CONVERSION IN LIVING CELLS** **Summer 2011**



Web Info:	http://moodle.uvic.ca is the course info site for announcements, assignments, and course materials.
Instructor:	Rustom Bhiladvala rustomb@uvic.ca EOW 521 *Phone:* 721-8616
Office Hours:	Hour TBA + email for time
Lecture :	TWF 9:30-10:20 ECS125
Tutorial Time:	Thurs 2:30-3:20pm ECS108
Text:	Essential Cell Biology, 3rd Edition (From Campus Bookstore)
Materials:	Class slides, papers, movies, on Moodle course site.

Course Description:

For engineers wishing to contribute to healthcare or emerging biological engineering research, this course is an opportunity to view cell biology through the lens of mechanics, transport or thermodynamics. A basic introduction is provided to: cell components and their functions; four families of molecules; energy conversion and the creation of order; gene expression and protein function; cell signaling; cell proliferation and cell death. Mechanical analyses and characterization of the cytoskeleton and cell membrane, cell movement and cell mechanotransduction, will be emphasized. Undergraduate students will have a project opportunity to be guided in the study and presentation of one emerging nanoscale technique for cellular or molecular level diagnosis or treatment –e.g. early detection of cancer, targeted treatments for cancer cells with reduced side-effects, tissue regeneration for wound healing. Bio-inspired engineering project choices e.g. new directions for direct solar conversion, are also encouraged. Graduate student projects will be individually planned with the instructor, as meaningful for the student's program.

Evaluation:	**MECH450F**	**MECH580**
Assignments & Short Quizzes:	*35 %*	*25 %*
Project:	*25 %*	*45%*
Midterm Quiz:	*25%*	*15%*
End Term Quiz:	*15%*	*15%*