

**Cellular and Molecular Engineering
BIEN224 for Fall, 2016
Instructor: Associate Professor Jiayu Liao
Tuesday & Thursday
9:40am-11:00am
MSE 011
Office: MS231
☎: 951-827-6240 ☎: jiayu.liao@ucr.edu
Office Hours: Thursday 1:10-2:00pm or by email appointment**

Emphasizes engineering and biochemical/biophysical concepts intrinsic to specific topics at the cellular and molecular level. Includes receptor-ligand dynamics in cell signaling and function; DNA replication and RNA processing; cellular energetics and control of gene expression; membrane structure; transport and traffic; biological process; and mechanics of cell division, and protein and cellular engineering approaches.

Course materials

Handouts and materials will be handout out by Instructor in the class;

Reference Books(optional for background information):

- ☎ **Beckman M: Molecular and Cellular Signaling (Biological and Medical Physics, Biomedical Engineering) Springer, 2005**
- ☎ **Berg J. et al. : Biochemistry W. H. Freeman, 2006**
- ☎ **Jackson M: Molecular and Cellular Biophysics Cambridge University Press, 2006**

Course requirements

**Evaluation and Grading: midterm and final;
Midterm 40% Final 60%**

The exams will have portions in essay and objective format related to the lecture and assigned readings.

Important dates

The midterm will be on Nov.1st

The final will be on Wednesday Dec. 8th 11:30 a.m. - 2:30 p.m.

Class Schedule

Week 1

Sep.27th. Cellular machineries for genetic information process-DNA replication, gene expression; RNA processing;
(Reference: chapter 27, 28, 29 and 31 of BJ; chapter 16 of BM)

Sep.29th. Biosignal control: Introduction to signaling mechanisms initiated by cell surface receptors (Handout)

Week 2

Oct.4th. Molecular forces in biological molecules and Experimental approaches for detecting protein-protein interactions
(Reference: chapter 2 of JM) (Handouts)

Oct.6th. Biomembrane structures-Membrane Lipids; Membrane fluidity; Membrane transporter, channel and Pumps
(Reference: 12, 13 of BJ and handouts)

Week 3

Oct. 11th. Membrane potentials and neural signal transduction
(Reference: 13,14,15 and 16 of JM)

Oct. 13rd. Protein transport and traffic control
(Handout)

Week 4

Oct. 18th. Storing and transducing cellular energy
(Reference: 14, 16, 17, 18, 19, 20, 21 and 22 of BJ)

Oct. 20th. Protein Engineering Principles I: DNA recombination and shuffling technologies
(Handout)

Week 5

Oct. 25th. Protein Engineering Technology Case I: Phage Display-Human growth hormone engineering (Handout)

Oct. 27th. Protein Engineering Principle II: screening and selection technologies
Case II-Fluorescence protein engineering (Handout)

Week 6

Nov. 1st. Midterm

Nov.3rd. Next generation sequencing(NGS) and Personalized medicine

Week 7

Nov. 8th. Methods of quantitation of cellular processes performance (Handouts)

Nov. 10th. Cellular fermentation process and kinetics (Handout)

Week 8

Nov. 15th Cellular engineering for biofuel production(Handout)

Nov. 17th Synthetic biology (Handouts)

Week 9

Nov. 22rd. CRISPR/Cas9 genome editing technology

Nov. 24th. No class (Thanksgiving)

Week 10

Dec. 29th. Engineering cellular machinery for unnatural amino acid incorporation (Handout)

Dec. 1st. Regenerative Medicine and stem cell therapy (Handouts)

Week 11

Dec. 8th. Thursday, Final 8, 11:30 a.m. - 2:30 p.m.