

BMME 570
From Genes to Tissues
Course Syllabus

1. *Department:* Joint Dept. of Biom. Engr. *Number:* BMME 570 *Credit Hours:* 4
Title: From Genes to Tissues *Required*

2. *Course Description:*

Students will have a solid understanding of biochemistry, genetics, and molecular biology. Biochemistry will cover general chemistry (covalent and non-covalent bonds, pH, pKa) intermediary metabolism, Michaelis-Menton kinetics, and metabolomics. Genetics and molecular biology will cover DNA replication, recombination, transcription and transcriptional control, structure of genes and chromosomes, genomics, mechanisms of translation of mRNA to proteins in the ribosome, structure of RNA, microarray technology, proteomics, cloning, vector constructs, protein trafficking. The last two weeks of the course are spent on bioinformatics and there is a bioinformatics workshop. This course will prepare the students for the graduate tutorial format of the subsequent cell biology course, BMME 251. The student will be introduced to as many ‘-omics’ related technologies as possible by touring the core research facilities mainly at UNC but also NCSU.

3. *Prerequisite(s):* None

4. *Textbook(s) and/or other required material:*

Molecular Biology of the Cell by Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts and James Watson. 4th edition, Garland Sciences, NY. 2002. ISBN # 0-8153-3218-1

5. *Course objectives. By the end of this course, the student should be able to:*

1. Demonstrate a general knowledge of biochemistry, genetics, molecular biology, and the “-omics” sciences
2. Develop basic wet laboratory skills required in biomedical engineering focused on the “-omics” sciences or tissue engineering.

6. *Topics covered (number of lectures per topic, based on 38 50-minute lectures per semester):*

1. Biochemistry (6)

- Cells and the genomes
- Chemicals found in cells
- Bioenergetics
- Protein chemistry

2. Genetics (14)

- Nucleic acid chemistry
- DNA replication, repair, recombination and sequencing
- genetic switches
- chromatin structure
- regulation of DNA replication
- Transcription and control of gene expression in prokaryotes and eukaryote

3. Molecular biology (8)

- cloning technologies;
- nucleo-cytoplasmic transport
- ribosomal structure
- translation to proteins
- posttranslational processing of proteins
- golgi modifications
- trafficking of proteins

4. “-omics labs (10)

- Metabolomics
- Vector engineering and production
- DNA sequencers
- Microarray technology
- Proteomics
- Robotics for high through-put bioassays
- Bioinformatics basic skills workshop
- Bioinformatics computer modeling workshop
- Chromosome painting
- Mutant Mice

7. Class/laboratory schedule (sessions per week and duration of each session):
One 120-minutes lecture/discussion per week. Ten laboratory sessions per semester.

Date of preparation and person(s) who prepared this description:
J.M. Macdonald, October 1, 2005