ME 500: Molecular Transport in Connective Tissues

Spring 2022
T/Th: 6:30-8:15pm

Course Description
Due to their avascular make-up and dense extracellular matrices, the transport of fluid, nutrients, and macromolecules in connective tissues are critical for their growth, functionality, and survival. The course focuses on topics of Fick's laws of diffusion, chemical reaction kinetics, Darcy permeability, Donnan osmotic pressure, biphasic tissue modeling, and cell membrane transport. Lecture material will introduce students to fundamental topics as well as explore computational modeling approaches to predict tissue transport phenomena. The course will incorporate laboratory modules where student groups will perform experimental characterizations of transport phenomena in connective tissue specimens.

Prerequisites: Experience with basic Matlab programming

Instructor
Prof. Michael Albro
Office: ENG 108
Telephone: (617) 353-9953
Email: albro@bu.edu

Office Hours
By appointment

Textbooks
There is **no required text** for this course. All covered course material will be provided via lecture slides and journal articles. Transport fundamental material is adopted from:
T.F. Weiss, Cellular Biophysics: Transport (Vol 1): 1996; The MIT Press.

Grading
Your grade in this course will be assess by lab reports, paper presentations, attendance, and class participation.

Four lab reports (15% each)	60%
Two paper presentations (15% each)	30%
Class participation	10%

Attendance and class participation
You are required to actively contribute to lectures and class discussions. A portion of your grade will be determined by this class participation. Attendance of all lectures is mandatory.

Lab Projects
The course incorporates four lab modules—one for each course topic. Experimental lab work will be performed in the College of Engineering BioInterface Technology Facility (ERB B06) or in the Albro Lab (PHO 627) on designated class sessions (see course schedule). Each lab module will require submission of a comprehensive lab report that includes literature review, data analysis, and presentation/discussion of results.

As most biological transport processes occur over large time scales, lab experiments will need to take place during sessions that extend beyond designated class time. Please ensure that you will be available between the hours of 5pm-9pm on days that lab activities are scheduled.

You must complete all requisite online lab safety trainings in order to participate in lab modules.

Paper Presentations
All students will be required to develop and present two paper reviews on transport-related literature during the semester.

Topics to be covered in the course:
Molecular diffusion
Cell osmotic loading
Biphasic tissue properties
Reaction-diffusion transport modeling

ME 500 Spring 2022 Semester Tues/Thurs Schedule

Class #	Date	Agenda
1	20-Jan	**Lecture: Diffusion**
2	25-Jan	**Lecture: Diffusion**
3	27-Jan	**Lecture: Diffusion**
4	1-Feb	**Lecture: Diffusion**
5	3-Feb	**Lab Activity: Diffusion**
6	8-Feb	**NO CLASS**
7	10-Feb	**Lab Activity: Diffusion**
8	15-Feb	**Lab Activity: Diffusion**
9	17-Feb	**Paper Review: Diffusion**
10	24-Feb	**Lecture: Osmosis/Cell Transport**
11	1-Mar	**Lecture: Osmosis/Cell Transport**
12	3-Mar	**Lecture: Osmosis/Cell Transport**
13	15-Mar	**Lab Activity : Osmosis/Cell Transport**
14	17-Mar	**Lab Activity : Osmosis/Cell Transport**
15	22-Mar	**Paper Review: Osmosis/Cell Transport**
16	24-Mar	**Lecture: Biphasic Mechanical Testing**
17	29-Mar	**Lecture: Biphasic Mechanical Testing**
18	31-Mar	**Lab: Biphasic Mechanical Testing**
19	5-Apr	**Lab: Biphasic Mechanical Testing**
20	7-Apr	**Paper Review: Biphasic Mechanical Testing**
21	12-Apr	**Lecture: Reaction Diffusion**
22	14-Apr	**Lecture: Reaction Diffusion**
23	19-Apr	**Lecture: Finite Element Modeling**
24	21-Apr	**Lecture: Finite Element Modeling**
25	26-Apr	**Lab Activity: Reaction Diffusion**
26	28-Apr	**Lab Activity: Reaction Diffusion**
27	3-May	**Paper Review: Reaction Diffusion**