

# BME4632 Biomedical Transport Phenomena

**Class Periods:** MWF, Period 4, 10:50 -11:40 am, Section 23BC

**Location:** CHE0237

**Instructor:** W. Lee Murfee  
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352-294-8813

**Office Hours:** COME SEE ME!

## Course Description

Introduction to and application of the concepts of momentum, mass and thermal energy transport in the context of problems of interest in biomedical sciences and engineering. Macroscopic and microscopic analysis of momentum, mass, and thermal energy transport problems in biomedical systems.

## Course Pre-Requisites / Co-Requisites

BME 3060 with minimum grade of C.

## Course Specific Aims

1. Students will understand the relationship between blood flow and physiological function and dysfunction in the surrounding tissues and organs.
2. Students will be able to solve transport equations using methods from advanced mathematics.
3. Students will develop an intermediate/advanced understanding of transendothelial transport and oxygen delivery to tissues and organs.
4. Students will learn about receptor-ligand kinetics and how to apply the kinetic models to study cell adhesion and intracellular signaling.
5. Students will be able to apply dimensional analysis to the equations for the problems in fluid transport.
6. Students will become comfortable applying fundamental biotransport fundamentals to the design and interpretation of experiments.

## Professional Component (ABET):

This course will prepare students to apply advanced mathematics to solve problems at the interface of engineering and physiology. Specific to the UF BME program educational outcomes, students will gain experience applying a knowledge of biotransport fundamentals to solving open ended biomedical engineering challenges related to therapeutic design and basic science discovery.

## Relation to Program Outcomes (ABET):

Outcome	Coverage*
a. an ability to apply knowledge of mathematics, science, and engineering	High (2)
b. an ability to design and conduct experiments, as well as to analyze and interpret data	High (2)
e. an ability to identify, formulate, and solve engineering problems	High (2)
i. a recognition of the need for, and an ability to engage in life-long learning	High (2)
j. a knowledge of contemporary issues	Low (1)

\*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not part of the course. 1 point = 0.33 credit hours; points reflect an alternative indicator of relative coverage.

## Required Textbooks

G.A. Truskey, F. Yuan, D.F. Katz, *Transport Phenomena in Biological Systems, 2<sup>nd</sup> Edition*. Pearson Prentice Hall, 2009. ISBN: 0-13-156988-8.

## **Course Topics (see course schedule for specific class dates, assignments, presentations and exams)**

Introduction to biotransport problems  
Diffusion and convection  
Blood flow through the cardiovascular system  
Fluid and mass transport: conservation laws and basic equations  
Pathological scenarios associated with altered blood flow  
Rheology of blood  
Parallel-plate and microfluidic flow systems  
Dimensional analysis and scaling  
Steady diffusion  
Cell adhesion  
Osmotic pressure  
Facilitated and active transport across the cell membrane  
Intracellular signal transduction  
Transport in porous media  
Transvascular transport  
Mass transfer in a laminar boundary layer  
Pharmokinetics  
Drug delivery  
Cancer metastasis and anti-cancer therapy

## **Attendance Policy, Class Expectations, and Make-Up Policy**

Attendance is expected, required, and noted by the instructor each class. Excess absences, class disruption, and lack of engagement will influence the class participation grade. All assignments are due at the beginning of class. Late work will not be accepted. Exams may be made up if extenuating circumstances are discussed beforehand or due to medical/family emergency.

## **Evaluation of Grades**

<b>Assignment</b>	<b>Percentage of Final Grade</b>
Homework Assignments	20%
Midterm Exams (2)	30%
Final Exam	25%
Paper Presentation	5%
Class Participation	20%
<b>TOTAL</b>	<b>100%</b>

## **Grading Policy**

Final grades will be influenced by the class average, the guiding grade range below, and the instructor's discretion.

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E
≥92	90-91	87-89	83-86	80-82	77-79	73-76	70-72	67-69	63-66	60-62	< 60

This course is not a *critical tracking course*. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). Note: a C- average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. More information on UF grading policy may be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

## **Course Evaluation**

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

### **Students Requiring Accommodations**

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### **University Honesty Policy**

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### **Software Use**

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### **Student Privacy**

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

### **Campus Resources**

#### Health and Wellness

#### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

#### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling.  
<https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus**: [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints**: <http://www.distance.ufl.edu/student-complaint-process>.