Biopolymers: Manufacture, Stability and Biocompatibility

EMA4062 Class Number 13529

Class Periods: T period 4 (10:40am-11:30am), Th period 4-5 (10:40am-12:35pm)

Location: Online via Zoom

Academic Term: Spring 2020

Instructor:
Josephine Allen, Ph.D.
jallen@mse.ufl.edu
Office Hours: By appointment

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- N/A

Course Description
3 credit hours - Polymer manufacturing processes and biochemical/biophysical behavior are considered from the perspective of achieving those properties needed for the engineering of polymeric implants and devices. Unique economic, ethical and regulatory issues are also presented.

Course Pre-Requisites / Co-Requisites
EMA3066 – Introduction to Organic Materials

Course Objectives
This course will provide an overview of polymeric biomaterials used in the design of medical devices, and to augment or replace soft and hard tissues. Discussion will include the manufacturing, applications, and in vivo behavior of different classes of natural and synthetic biomaterials. Analysis of the regulatory process as well as failure analysis of implantable polymeric biomaterials/devices. Finally, evaluations of relevant case studies covering biomaterial approaches will be conducted.

Materials and Supply Fees
None

Relation to Program Outcomes (ABET):
This course provides 3 credits towards engineering sciences.

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	Medium
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Low
3. An ability to communicate effectively with a range of audiences	High
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Medium

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

- Zoom for class meetings

Course notes are developed by the instructor

Recommended Materials

- Optional: Biomaterials Science, Third Edition: An Introduction
  - Ratner, Hoffman, Schoen, Lemons
  - ISBN: 978-0-12-374626-9

Course Schedule (Tentative)

Week 1: Welcome, Biomaterials Overview, Project guidance
Week 2-3: Module I: Polymeric Biomaterials for soft tissue applications
Week 4-5: Module II: Polymeric Biomaterials for hard tissue applications
Week 6-7: Module III: Polymeric Biomaterials for drug delivery applications
Week 7: RECHARGE DAY! No class on Thursday 2/25
Week 8-13: Module IV: Student Presentations
Week 14-15: Module V: Clinical Translation of Biomaterials: Sterilization, Commercialization, Regulation

Online Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance, Class Expectations, and Make-Up Policy

Lecture attendance is highly recommended and will be reflected in your participation grade. Experience has shown that those who attend lectures earn higher grades in the course. The class will be synchronous, i.e. the lectures will be delivered during the listed course times. Lectures will be recorded and accessible through Canvas for students who miss class. This course will use Canvas and Zoom exclusively as a communication and archival tool. Students can access all relevant course information (course notes, lectures, concept check assignment, announcements, grades, etc.) via the Canvas entry link: https://elearning.ufl.edu/. Pertinent course information may also be announced via Canvas announcements. It is highly encouraged that each student put their phone away, turn of notifications on their computer and email, and close irrelevant windows during lecture or when participating in the breakout rooms for group exercises for this class.

Attendance for student lectures and discussion is <u>required</u> (tentatively weeks 8-13) to ensure that each student has the benefit of full participation and a robust discussion. If one of these classes must be missed, the students should notify the instructor for prior approval. Student lectures WILL NOT be posted on Canvas, so students will need to attend lecture to receive this content.

Students are expected to arrive to class on time, however, we will make use of a zoom “waiting room”, whereby Dr. Allen will control the entry of late students into the zoom class. If you arrive late, please patiently wait in the “waiting room” until you are granted entry. Proper behavior during class (via zoom) is always important and leads to a

relaxed and productive educational environment. Students who behave disorderly or disrespectfully WILL be asked to leave the zoom class session. Any persistent and disruptive behavior in class sessions will result in the student being removed from the virtual classroom and, depending on the nature of the behavior, reported to the department, college, or university for misconduct.

Generally, at least one week of advance notice is required for assignment or exam make-up opportunities. In accordance with university attendance policy, acceptable reasons for absence from or failure to participate in class, missed assignment or exam include illness, serious family emergencies, special curricular requirements, military obligation, severe weather conditions, religious holidays, and participation in official university activities such as music performances, athletic competition or debate. Absences from class for court-imposed legal obligations (e.g., jury duty or subpoena) will be excused. Students who do not follow the approved procedure and timeliness for an assignment or exam make-up will receive a score of zero. ***Make up exams will be provided only with the approval of the instructor and in accordance with university policies.***

Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Evaluation of Grades

Assignment	Percentage of Final Grade
Exams (x3)	45%
Concept Check exercises (~weekly)	20%
Biomaterials Project Presentation	15%
Biomaterials Project Report	10%
Participation (discussion Board, attendance, peer evaluations)	10%
	100%

Exams:
There will be 3 equally weighted (15%) exams in this course. Exams will be administered during the regular class time, which should avoid exam conflicts. There will be no final exam. Exam dates will be announced.

Concept Check Exercises:
Each week, students will be given a few questions to answer related to the lecture topics of the week. These questions check the students understanding of the current concepts being covered. The concept check exercises will be timed and administered and submitted via Canvas.

Biomaterial Project:
Students will provide an oral lecture (via zoom) to the class and a written report on a biomaterial topic, selected from a list of topics. Details of this assignment will be provided separately.

Grading Policy

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:
- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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: https://registrar.ufl.edu/ferpa.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 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 Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

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/.

Academic Resources

E-learning technical suppor*t*, 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://care.dso.ufl.edu.

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