

MATSCEN 3611 (Approved): Biological Response to Biomaterials

Course Description

The biological response to biomaterials implanted within the human body.

Prior Course Number: 645, 646

Transcript Abbreviation: Bio Resp Biomat

Grading Plan: Letter Grade

Course Deliveries: Classroom

Course Levels: Undergrad

Student Ranks: Junior

Course Offerings: Spring

Flex Scheduled Course: Never

Course Frequency: Every Year

Course Length: 14 Week

Credits: 3.0

Repeatable: No

Time Distribution: 3.0 hr Lec

Expected out-of-class hours per week: 6.0

Graded Component: Lecture

Credit by Examination: No

Admission Condition: No

Off Campus: Never

Campus Locations: Columbus

Prerequisites and Co-requisites: 2010 or permission of instructor.

Exclusions: Not open to students who have taken MSE 645 and MSE 646.

Cross-Listings: To be cross-listed within BME

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: Yes

The course is a GEC: No

The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.3101

Subsidy Level: Baccalaureate Course

Programs

Abbreviation	Description
MATSCEN	Materials Science and Engineering

General Information

Many medical conditions requiring the introduction of a synthetic material into the body. Novel technologies based upon the application of materials science in medicine are producing a renaissance of innovation directed toward improving human health. Unfortunately, even our best technological efforts are regarded as foreign bodies and can induce responses degrading both the material and surrounding physiological functions. This class will review of the basic concepts of the biological response to the implantation of any foreign body. Engineering principles utilized to improve biocompatibility and reduce inflammation will also be covered.

Course Goals

Students will learn the concepts of biology that govern how the body reacts to the presence of modern biomaterials.
Students will learn concepts relating to how implants are labeled as foreign and the aggressive chemical response that often damages both the implant and surrounding natural tissues.
Students will study materials engineering strategies used to minimize or ignore these biological reactions.

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
The Immune System Self and non-self discrimination; Innate and adaptive immune response; molecular basis of T cell, B cell and antibody responses; inflammatory response, inflammatory mediators; surfaces and protein adsorption	9.0							
Foreign body response Resorption, Integration, Encapsulation	6.0							
Metals Materials selection, effects of mechanical properties, chemistry and corrosion	4.0							
Ceramics Materials selection, effects of chemistry and processing	4.0							
Polymers: Natural and Synthetic Materials selection, effects of chemistry, molecular weight, degradation rate, wetting angle	6.0							
Surface Engineering Surface morphology, surface chemistry, surface energy	3.0							
Tissue Engineered Biomaterials Cell sourcing, tissue typing, use of xenogenic and other naturally derived materials	3.0							
Modifying the foreign body response: Case studies Orthopaedic Implants, surgical staples/sutures, dental implants, biosensors, cosmetic implants, tissue engineered skin	9.0							

Representative Assignments

Mini-case studies in groups

Grades

Aspect	Percent
Midterm 1	25%
Midterm 2	25%
Mini-case study in groups	20%
Final	30%

Representative Textbooks and Other Course Materials

Title	Author
<i>Biological Performance of Materials: Fundamentals of Biocompatibility 3rd Edition</i>	Jonathan Black

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
**	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
***	c	An ability to design a system, component, or process to meet desired needs.
*	d	An ability to function on multi-disciplinary teams.
***	e	An ability to identify, formulate, and solve engineering problems.
**	f	An understanding of professional and ethical responsibility.
*	g	An ability to communicate effectively.
*	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
*	i	A recognition of the need for, and an ability to engage in life-long learning.
*	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

2/1/21 per HP, Biology requirement is helpful but not required, so removing BIO 1113/2100 requirement

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