

Biomedical Engineering Department

BMD_ENG 348 Applications of Regenerative Engineering

Instructor Shu Q. Liu
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Time Spring quarter
11:00 – 12:20 Tuesdays and Thursdays

Prerequisites BIOL_SCI 215 Genetics and Molecular Biology or BIOL_SCI 219 Cell Biology

Course Description

Mechanisms of human disease; application of molecular, cellular, and tissue-level regenerative engineering strategies to selected human disorders, including neurodegenerative disorders, stroke, coronary heart disease, cystic fibrosis, cirrhosis, diabetes, muscular dystrophy.

Course Objectives

Understand the pathogenic mechanisms and pathophysiology of selected human disorders.

Apply regenerative engineering strategies to human disorders.

Formulate hypotheses, design research projects, and solve problems in regenerative medicine and engineering.

Course Outcomes

Enable students to: (1) understand the pathogenic mechanisms of selected human disorders; (2) integrate regenerative engineering concepts and technologies to regenerative medicine to treat human disorders; and (3) solve regenerative engineering research problems.

References Shu Q. Liu, *Bioregenerative Engineering: Principles and Applications*. Wiley, New York, 2007.

Shu Q. Liu. *Cardiovascular Engineering: A Protective Approach*. McGraw Hill, New York, 2020.

Grading Homework: 30%
Research project: 20%
Weekly quizzes: 10%
Midterm: 20%
Final: 20%

Lecture topics

Part I Introduction to regenerative engineering

Part II Fundamentals of human disease and regenerative engineering

Concepts of pathogenesis, pathology, and pathophysiology

Mechanisms of disease

Environmental insults as pathogenic factors

Microorganisms

Chemical factors

Physical factors

Psychosocial stress

Overnutrition

Genetic mutations as pathogenic factors

Chromosomal defects

Autosomal dominant gene mutations

Autosomal recessive gene mutations

X-linked gene mutations

Multiple gene dysfunctions

Senescence

Overview of regenerative engineering technologies

Molecular regenerative engineering

Cellular regenerative engineering

Tissue-level regenerative engineering

Part III Application of regenerative engineering to human disease

Traumatic brain injury

Spinal cord injury

Ischemic stroke

Alzheimer's disease

Parkinson's disease

Coronary heart disease

Cystic fibrosis

Hepatitis and cirrhosis

Diabetes

Muscular dystrophy

Part IV Research design