

SYSTEMS, SYNTHETIC, AND PHYSICAL BIOLOGY (SSPB)

SSPB 501 - PHYSICAL BIOLOGY

Short Title: PHYSICAL BIOLOGY

Department: Systems/Synthetic/Phys Biology

Grade Mode: Standard Letter

Course Type: Lecture

Credit Hours: 3

Restrictions: Enrollment is limited to Graduate level students.

Course Level: Graduate

Description: Basic introduction to a biophysical view of living systems, from the subcellular to the multicellular scales. Topics include: biomolecular dynamics, cellular biomechanics, cell motility and cell division, calcium signaling, action potential propagation, and tissue organization. Cross-list: BIOE 502, BIOS 505.

SSPB 502 - INTRO COMPUTATIONAL SYSTEMS BIOLOGY: MODELING & DESIGN PRINCIPLES OF BIOCHEM NETWORKS

Short Title: INTRO SYSTEMS BIOLOGY MODELING

Department: Systems/Synthetic/Phys Biology

Grade Mode: Standard Letter

Course Type: Lecture

Credit Hours: 3

Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Doctor of Philosophy degree. Enrollment limited to students in the Systems/Synthetic/Phys Biology department.

Course Level: Graduate

Description: The course summarizes techniques for quantitative analysis and simulations of basic circuits in genetic regulation, signal transduction, and metabolism. The class is based on MATLAB, with a brief refresher provided at the beginning. We discuss engineering approaches adapted to computational systems biology and aim to formulate evolutionary design principles explaining the organization of networks in terms of their physiological demands. Topics include end-product inhibition in biosynthesis, optimality and robustness of the signaling networks, and kinetic proofreading. The topics covered include modeling of enzyme kinetics, biochemical reaction networks, gene regulation, stochasticity of gene expression, and evolutionary and epidemiological population dynamics. The final project focuses on modeling synthetic biology circuits. Cross-list: BIOE 552. Recommended Prerequisite(s): Basic knowledge of biochemistry, cell biology, linear algebra, and ordinary differential equations is expected. Experience with MATLAB or Python programming is highly recommended.

SSPB 503 - SYNTHETIC BIOLOGY

Short Title: SYNTHETIC BIOLOGY

Department: Systems/Synthetic/Phys Biology

Grade Mode: Standard Letter

Course Type: Lecture

Credit Hours: 3

Restrictions: Enrollment is limited to Graduate level students.

Course Level: Graduate

Description: Design of biology at scales from molecules to multicellular organisms will be covered by lecture, primary literature, and student presentations. Students will write a research proposal at the end of the course. Cross-list: BIOE 508.

SSPB 550 - GRADUATE SEMINAR

Short Title: GRADUATE SEMINAR

Department: Systems/Synthetic/Phys Biology

Grade Mode: Satisfactory/Unsatisfactory

Course Type: Seminar

Credit Hour: 1

Restrictions: Enrollment is limited to students with a major in Systems/Synthetic/Phys Biology. Enrollment is limited to Graduate level students.

Course Level: Graduate

Description: Seminar course to introduce SSPB students to current research topics and activities in the systems, synthetic, and physical biology fields. Repeatable for Credit.

SSPB 575 - INTRODUCTION TO RESEARCH

Short Title: INTRODUCTION TO RESEARCH

Department: Systems/Synthetic/Phys Biology

Grade Mode: Satisfactory/Unsatisfactory

Course Type: Research

Credit Hours: 3

Restrictions: Enrollment is limited to students with a major in Systems/Synthetic/Phys Biology. Enrollment is limited to Graduate level students.

Course Level: Graduate

Description: Introduction of first-year graduate students to the research programs and laboratories of individual faculty members. Repeatable for Credit.

SSPB 599 - GRADUATE TEACHING IN SSPB

Short Title: GRADUATE TEACHING IN SSPB

Department: Systems/Synthetic/Phys Biology

Grade Mode: Satisfactory/Unsatisfactory

Course Type: Internship/Practicum

Credit Hour: 1

Restrictions: Enrollment is limited to Graduate level students.

Course Level: Graduate

Description: Supervised instruction in teaching systems, synthetic, and physical biology. Repeatable for Credit.

SSPB 601 - NAVIGATING INTERDISCIPLINARY TEAMS IN SCIENCE AND ENGINEERING

Short Title: INTERDISCIPLINARITY I

Department: Systems/Synthetic/Phys Biology

Grade Mode: Standard Letter

Course Type: Seminar

Credit Hour: 1

Restrictions: Enrollment is limited to Graduate level students.

Course Level: Graduate

Description: Covers team science literature on the assumptions that guide scientific practice, communication, and group integration. Instructor Permission Required.

SSPB 602 - INNOVATIONS AND CHALLENGES IN BIOELECTRONICS RESEARCH

Short Title: INTERDISCIPLINARITY II

Department: Systems/Synthetic/Phys Biology

Grade Mode: Standard Letter

Course Type: Seminar

Credit Hour: 1

Restrictions: Enrollment is limited to Graduate level students.

Course Level: Graduate

Prerequisite(s): SSPB 601

Description: Covers literature on past biotechnological innovations that required interdisciplinary collaboration for success. Instructor Permission Required.

SSPB 610 - INTERDISCIPLINARY BIOELECTRONICS RESEARCH COLLOQUIUM

Short Title: BIOELECTRONICS COLLOQUIUM

Department: Systems/Synthetic/Phys Biology

Grade Mode: Satisfactory/Unsatisfactory

Course Type: Seminar

Credit Hour: 1

Restrictions: Enrollment is limited to Graduate level students.

Course Level: Graduate

Description: Covers effective oral communication in the interdisciplinary field of bioelectronics. Repeatable for Credit.

SSPB 620 - INTERDISCIPLINARY BIOELECTRONICS PEER WRITING GROUPS

Short Title: BIOELECTRONICS WRITING

Department: Systems/Synthetic/Phys Biology

Grade Mode: Satisfactory/Unsatisfactory

Course Type: Seminar

Credit Hour: 1

Restrictions: Enrollment is limited to Graduate level students.

Course Level: Graduate

Description: Covers effective written communication in the interdisciplinary field of bioelectronics. Repeatable for Credit.

SSPB 677 - SPECIAL TOPICS

Short Title: SPECIAL TOPICS

Department: Systems/Synthetic/Phys Biology

Grade Mode: Standard Letter

Course Type: Lecture/Laboratory, Independent Study, Internship/Practicum, Laboratory, Lecture, Seminar

Credit Hours: 1-4

Restrictions: Enrollment is limited to Graduate or Visiting Graduate level students.

Course Level: Graduate

Description: Topics and credit hours vary each semester. Contact department for current semester's topic(s). Repeatable for Credit.

SSPB 700 - INTERDISCIPLINARY BIOELECTRONICS RESEARCH

Short Title: BIOELECTRONICS RESEARCH

Department: Systems/Synthetic/Phys Biology

Grade Mode: Satisfactory/Unsatisfactory

Course Type: Research

Credit Hours: 1-3

Restrictions: Enrollment is limited to Graduate level students.

Course Level: Graduate

Description: Covers research in the interdisciplinary field of bioelectronics. Repeatable for Credit.

SSPB 800 - GRADUATE RESEARCH

Short Title: GRADUATE RESEARCH

Department: Systems/Synthetic/Phys Biology

Grade Mode: Satisfactory/Unsatisfactory

Course Type: Research

Credit Hours: 1-15

Restrictions: Enrollment is limited to students with a major in Systems/Synthetic/Phys Biology. Enrollment is limited to Graduate level students.

Course Level: Graduate

Description: Graduate students will conduct independent research/thesis project under the direction of their advisor. Repeatable for Credit.