Systems, Synthetic and Physical Biology (SSPB) is a new discipline that draws upon principles from physics, chemistry, engineering, and mathematics and integrates experimental biochemical, cell biological, and molecular genetics approaches with computational design, simulation, and modeling to anticipate the properties of complex and multiscale biological systems. The Graduate Program in SSPB represents a cooperative effort by faculty in the schools of Natural Sciences and the Engineering to provide training in this highly interdisciplinary field. This program is overseen by the Institute of Biosciences and Bioengineering (IBB) and overseen by an executive committee composed of members from any of the participating departments.

The interdisciplinary nature of the SSPB program allows students to achieve their graduate degree requirements by taking select classes from any of the participating departments and performing their dissertation research under supervision of any faculty associated with the program.

Systems, Synthetic, and Physical Biology does not currently offer an academic program at the undergraduate level.

**Master's Program**

- Master of Science (MS) Degree in the field of Systems, Synthetic, and Physical Biology*

**Doctoral Program**

- Doctor of Philosophy (PhD) Degree in the field of Systems, Synthetic, and Physical Biology [ga.rice.edu/programs-study/departments:programs/engineering/systems-synthetic-physical-biology/systems-synthetic-physical-biology-phd]

* Although students are not normally admitted to a Master of Science (MS) degree program, graduate students may earn the MS as they work towards the PhD.

**Director**

Jonathan J. Silberg, BioSciences

**Professors**

Pedro J.J. Alvarez, Civil and Environmental Engineering
Gang Bao, Bioengineering
George N. Bennett, BioSciences
Cecilia Clementi, Chemistry
Michael W. Deem, Bioengineering
Lydia Kavraki, Computer Science

Marek Kimmel, Statistics
Anatoly B. Kolomeisky, Chemistry
Christy F. Landes, Chemistry
Herbert Levine, Bioengineering
Jianpeng Ma, Bioengineering
Frederick C. MacKintosh, Chemical and Biomolecular Engineering
Luay K. Nakhleh, Computer Science
Jose Nelson Onuchic, Physics and Astronomy
George Phillips, BioSciences
Ka-Yiu San, Bioengineering
Yousif Shamoo, Bioengineering
Peter G. Wolynes, Chemistry

**Associate Professors**

Matthew Bennett, BioSciences
Michael Diehl, Bioengineering
Ido Golding, Bioengineering
Oleg A. Igoshin, Bioengineering
Ching-Hwa Kiang, Physics and Astronomy
Michael H. Kohn, BioSciences
Robert M. Raphael, Bioengineering
Laura Segatori, Chemical and Biomolecular Engineering
Junghae Suh, Bioengineering
Jeffrey J. Tabor, Bioengineering

**Assistant Professors**

Caleb Bashor, Bioengineering
James Chappell, BioSciences
Xue Gao, Chemical and Biomolecular Engineering
Isaac Hilton, Bioengineering
Natasha Kirienko, BioSciences
Xaq Pitkow, Electrical and Computer Engineering
Jacob Robinson, Electrical and Computer Engineering
Lauren Stadler, Civil and Environmental Engineering
François St-Pierre, Electrical and Computer Engineering
Aryeh Warmflash, BioSciences
Han Xiao, Chemistry
David Zhang, Bioengineering

**Adjunct Professors**

Ramon Gonzalez, Chemical and Biomolecular Engineering
Amina A. Qutub, Bioengineering
Susan M. Rosenberg, Biochemistry & Cell Biology

For Rice University degree-granting programs:
To view the list of official course offerings, please see Rice’s Course Catalog ([https://courses.rice.edu/admweb/ISWKSCAT.cat?p_action=cata](https://courses.rice.edu/admweb/ISWKSCAT.cat?p_action=cata))

To view the most recent semester's course schedule, please see Rice’s Course Schedule ([https://courses.rice.edu/admweb/ISWKSCAT.cat](https://courses.rice.edu/admweb/ISWKSCAT.cat))
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.

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.
Course Level: Graduate
Description: The course summarizes techniques for quantitative analysis and simulations of basic circuits in genetic regulation, signal transduction and metabolism. We discuss engineering approaches adapted to computational systems biology and aim to formulate evolutionary design principles explaining organization of networks in terms of their physiological demands. We discuss biochemical simulation methodology and software as well as recent advances in the field. Topics include end-product inhibition in biosynthesis, optimality and robustness of the signaling networks and kinetic proofreading. More emphasis on recent advances in the field - paper reading and presentations. Cross-list: BIOE 552. Recommended Prerequisite(s): Basic knowledge of biochemistry, cell biology, linear algebra, and ordinary differential equations is expected.

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.
Description and Code Legend

Note: Internally, the university uses the following descriptions, codes, and abbreviations for this academic program. The following is a quick reference:

Course Catalog/Schedule
- Course offerings/subject codes: Courses from various subjects may apply toward this program

Program Description and Code
- Systems, Synthetic, and Physical Biology: SSPB

Graduate Degree Descriptions and Codes
- Master of Science degree: MS
- Doctor of Philosophy degree: PhD

Graduate Degree Program Description and Code
- Degree Program in Systems, Synthetic and Physical Biology: SSPB

CIP Code and Description
- SSPB Major/Program: CIP Code/Title: 30.0101 - Biological and Physical Sciences

Classification of Instructional Programs (CIP) 2010 Codes
and Descriptions from the National Center for Education Statistics: https://nces.ed.gov/ipeds/cipcode/