

ABS-934 Synthetic Biology (3-0)

Educational Objectives

1. After completion of this course, students will identify aspects of biotechnology that inhibit and enable the faster, more reliable programming of natural systems. They will be able to analyze and apply an abstraction hierarchy to the design of biological systems. State-of the art techniques in the cutting edge research of synthetic biology will also be taught along with the brief description of key milestones.

Course Outcomes

2. The students will learn the various aspects of cutting edge research in synthetic biology. The synthetic biology approach helps students to learn molecular biology, genetic engineering and microbiology methods in an engineering setting.

3. **Course contents**

- a. Introduction
- b. The Synthetic Cell
- c. Genome Refactoring
- d. Tools for genome engineering and synthetic biology
- e. Bacteriophages as Templates for Refactoring
- f. DNA assembly
- g. Synthetic genetic polymers, functioning to store and propagate information by genetic alphabet expression
- h. Modular Parts and Circuits
- i. Spatial Regulation
- j. Co-Localization
- k. Compartmentalization
- l. Platforms for Genetic Design Automation
- m. Standards

- n. Systems Biology markup language
- o. Synthetic Biology Open Language
- p. Repositories
- q. Registry of Standard Biological Parts (iGEM Registry)
- r. Standard Biological parts Knowledge
- s. BioFab
- t. BacilloBricks
- u. Inventory of Composable Elements.
- v. GDA Software Tools
- w. Synthetic Biology software suite
- x. Genetic engineering of cells
- y. Intelligent biological simulator
- z. Sequence editor and optimizers
- aa. Synthetic Biology approaches to regenerative medicine
- bb. Microbial Synthetic Biology
- cc. Synthetic Biology and industrial applications (Chemicals Production)
- dd. Societal Challenges Posed by Synthetic Biology

4. **Recommended books**

- a. Bacterial Sensors: Synthetic Design and Application Principles, Jan Roelof van der Meer, Morgan & Claypool Publishers (2010).
- b. Genome Refactoring, Natalie Kuldell and Neal Lerner, www.morganclaypool.com, Morgan & Claypool Publishers (2010).
- c. Methods in microbiology, 40) Colin Harwood and Anil Wipat (Eds)-Microbial Biology-Academic Press (2013).

- d. Synthetic Biology: Methods in Molecular Biology (1073), Karen M. Polizzi and Cleo Kontoravdi (Editors), Springer Protocols, Humana Press, (2013).
- e. Synthetic biology volume1: Current Topics from the Encyclopedia of Molecular Cell Biology and Molecular Medicine, Robert A. Meyers, Wiley-Blackwell (2015).
- f. A brief history of synthetic biology, D. Ewen Cameron, Caleb J. Bashor and James J. Collins, NATURE REVIEWS | **MICROBIOLOGY**, VOLUME 12 (2014).