**Synthetic Biology**

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**Description:** Synthetic biology provides the ability to re-engineer and compose core biological processes in new ways to create robust living systems that address energy, environment, and medical applications. This concentration equips students with essential knowledge and skills on foundational design-oriented models, genetic circuit analysis and design tools, circuit fabrication, characterization, testing, and optimization. Students also study current and expected future applications of biological technologies along with relevant ethical aspects.

**Guide for class selection:** A student taking this concentration should usually enroll in 20.305, 2.18, and 20.129 to obtain exposure to the theoretical and experimental underpinnings of synthetic biology. It’s preferable to take 20.129 after at least one of 20.305 or 2.18, but definitely not required.

**Sample roadmaps**

**EXAMPLE 1:** Joint theory/experimental track

- Year 2: 20.020
- Year 3: 10.01
- Year 4: 20.305 (Fall) 20.129 and 2.18 (Spring)

**EXAMPLE 2:** Theory track

- Year 2: 20.020
- Year 3: 10.01
- Year 4: 20.305 (Fall) 20.385 and 2.18 (Spring) for theory track

**EXAMPLE 3:** Experimental track

- Year 2: 20.020
- Year 3: 10.01
- Year 4: 20.305 (Fall) 20.129 and 2.18 (Spring)

**EXAMPLE 4:** Choice of three courses

- Year 3 or 4: 20.305 (Fall) 20.129 and 2.18 (Spring)

**Restricted Electives**

- **20.305 Principles of Synthetic Biology** (U) same as 6.580 (Fall)
  Prereq: None

- **20.129 Biological Circuit Engineering Laboratory** (U)
  Prereq: Biology (GIR), Calculus II (GIR)

- **20.020 Introduction to Biological Engineering Design Using Synthetic Biology** (U)
  Prereq: None

- **20.385 Understanding Current Research in Synthetic Biology** (U)
  Prereq: 20.109, 20.320, or permission of instructor

- **2.18 Biomolecular Feedback Systems** (G) same as 6.027, 6.557 (Spring)
  Prereq: 18.03, Biology (GIR), or permission of instructor

- **10.01 Ethics for Engineers** (U)
  Prereq: None

**Electives**

- **20.440 Analysis of Biological Networks** (G)
  Prereq: 5.13, 5.07, 7.06, permission of instructor *2-0-4 (6 unit course)

- **8.591 Systems Biology** (G)
  Prereq: 18.03, 18.05; or permission of instructor

- **9.32 Genes, Circuits, and Behavior** (U)
  Prereq: 9.09, 9.10, 9.16, or 9.18

- **10.544 Metabolic and Cell Engineering** (G)
  Prereq: 7.05, 10.302, 18.03