

HSSP Synthetic Biology Syllabus

What is life? What is synthetic biology?

What does synthetic mean? What does biology mean? Is life "special"? What do synthetic life forms look like? What counts as alive? Why use biology for engineering? We'll think about the different layers of organization in biological systems and how each one can be engineered, and start to explore DNA as an object to engineer with.

Splicing DNA

DNA is the code of life, written as a linear string of chemical letters, making up words that can be cut out of their natural context and pasted into our designed sequences. We'll learn about the chemistry and biology that governs gene splicing technology, walk through the state-of-the-art protocols used in synthetic biology labs today, and think about ways we can make it faster and easier.

DNA devices

The expression of genes in cells is tightly controlled by many complex mechanisms that create switchlike, oscillatory, or logic-gate behavior. Synthetic biologists can design similar gene control devices by connecting simple DNA parts in new ways that aren't found in nature. We'll learn about some examples of natural DNA control elements and how they are used in creating synthetic DNA devices.

Applications of synthetic biology

Much of the promise of synthetic biology still lies in the future. What kinds of applications are possible? What kinds of devices are being used in biotechnology today? What will synthetic biology look like in the future? How will synthetic biology shape our world in the future? How will people use biological devices?

Design your own microbe

Using all of the tools that we learned about during the class students will split into small groups and design their own biological system. What do you want microbes to be able to do? How will you build it? What kind of parts will it be made out of? What will it look like?