**BioBuilder UBD**

**Big Idea 1:** Synthetic biology is based on Engineering.

**Essential Question:** How does synthetic biology use engineering principles to create genetic systems that improve human lives?

**Enduring Understandings:**

1. Synthetic Biologists create genetic systems and alter cells to improve life and solve problems.
2. Synthetic Biologists apply engineering design principles in the design of their genetic systems.
3. Synthetic Biologists apply engineering principles such as abstraction, standardization, modularity, and modeling to the creation of genetic systems.

**Big Idea 2:** Synthetic biology is based on Biology.

**Essential Questions:** How does synthetic biology use biological principles to improve human lives? How does synthetic biology expand our understanding of biology?

**Enduring Understandings:**

1. Synthetic biology uses and expands on our understanding of molecular genetics.
2. Synthetic biology uses and expands on our understanding of cellular and molecular interactions.
3. Synthetic biology uses and expands on our understanding of evolution.

**Big Idea 3:** Synthetic biology research and implementation has societal implications.

**Essential Questions:** How do synthetic biologists balance risks with rewards in their research?

**Enduring Understandings:**

1. Synthetic Biologists must consider risk as well as reward offered by their designs.
2. Synthetic Biologists must use existing biosafety precautions as well as create new methods to maintain safety.
3. People will have to consider the extent to which they will use novel genetic systems and genetically modified organisms.

**Essential Knowledge:**

By the conclusion of this curriculum, the student will be able to:

* Explain how synthetic biology as an engineering discipline differs from genetic engineering.
* Explain the population growth curve of bacteria.
* Explain an abstraction hierarchy and apply it to the engineering of biology.
* Define and properly use synthetic biology terms: *part, device, inverter, measurement.*
* Define and properly use molecular genetics terms: *promoter, ribosome binding site ("RBS"), open reading frame ("ORF"),terminator, plasmid.*
* Explain the engineering paradigm and the role of tuning a system.
* Explain the functioning of the lac operon and how it can be used as a measurement tool.
* Define and properly use synthetic biology terms: *system, gain, tuning*.
* Define and properly use molecular genetics terms: *two component system, transcriptional activation, phosphorylation.*
* Relate the bacterial photography system to the two component signaling system.
* Explain the role that modeling can play in design, and name some ways that models differ from reality.
* Define and properly use synthetic biology terms: *chassis, system, device, minimal cell, sensor, color generator.*
* Define and properly use molecular genetics terms: *operon, gene expression, bacterial transformation.*
* Explain the role of chassis in synthetic biology and engineering.
* Discuss the risks associated with synthetic biology research and implementation.

**Essential Skills:**

By the conclusion of this curriculum, the student will be able to:

* Culture bacteria using proper microbiology methods.
* Measure the growth of a bacterial population.
* Measure a kinetic chemical reaction.
* Model a biological system using electronic parts and a computer program.
* Conduct and interpret the results of a bacterial transformation.
* Detail a project at the level of system(s), devices and parts.
* Summarize, analyze, and synthesize information from PowerPoints, scientific articles, and case studies.
* Think critically and decisively in the resolution of scientific/ethical issues.
* Question and solve data problems.
* Communicate verbally and in writing scientific findings and group decisions.
* Show self direction in homework, case study, and research assignments.
* Self evaluate performance.
* Effectively use computer technology to enhance learning.
* Write lab reports.