Title of Module: Super Organisms

Subject or Unit of Study: Biotechnology, Synthetic Biology

GRADE LEVEL: _____

LENGTH OF DEMO/LESSON:

STUDENT OBJECTIVES:

Students will learn the following concepts:

1) Synthetic biologists solve problems by applying engineering principles to living materials.

- 2) Synthetic biology uses the engineering design process.
- 3) Synthetic biology is interconnected with society.

NEXT GENERATION SCIENCE STANDARDS

NGSS Performance	MS-LS1-2: From Molecules to Organisms: Structures and Processes
Tasks	• Develop and use a model to describe the function of a cell as a whole and ways parts
	of cells contribute to the function.
	HS-LS1-2.
	Develop and use a model to illustrate the hierarchical organization of interacting
	systems that provide specific functions within multicellular organisms.
NGSS Disciplinary	MS - LS1.A: Structure and Function
Core Ideas (DSI)	Within cells, special structures are responsible for particular functions, and the cell
	membrane forms the boundary that controls what enters and leaves the cell.
	HS - LS1.A: Structure and Function
	• Multicellular organisms have a hierarchical structural organization, in which any one
	system is made up of numerous parts and is itself a component of the next level.
NGSS Cross-Cutting	CCC 4 – Systems and Models
Concepts (CCC)	• Models (e.g., physical, mathematical, computer models) can be used to simulate
	systems and interactions—including energy, matter, and information flows—within
	and between systems at different scales.
	CCC 6 - Structure and Function
	Investigating or designing new systems or structures requires a detailed examination
	of the properties of different materials, the structures of different components, and
	connections of components to reveal its function and/or solve a problem.
	Interdependence of Science, Engineering, and Technology
	Engineering advances have led to important discoveries in virtually every field of
	science, and scientific discoveries have led to the development of entire industries
	and engineered systems.
NGSS Science and	SEP 2 - Developing and Using Models
Engineering Practices	 Develop and use a model to describe phenomena.
(SEP)	SEP 5 - Constructing explanations (for science) and designing solutions (for engineering)
	 Construct an explanation based on valid and reliable evidence obtained from a
	variety of sources (including students' own investigations, models, theories,
	simulations, peer review) and the assumption that theories and laws that describe
	the natural world operate today as they did in the past and will continue to do so in
	the future.



COMMON CORE STANDARDS

CC-ELA/Literacy	SL.8.5
Standards	 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2)
	SL.11-12.5
	 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and
	interactive elements) in presentations to enhance understanding of findings,
	reasoning, and evidence and to add interest. (HS-LS1-2)
CC-Math	6.EE.C.9
	 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. (MS-LS1-2)

MATERIALS

- Activity and facilitator guides
- Activity sign and holder
- Superhero worksheets
- Super Organisms worksheets
- Background art and holders
- Scissors
- Tape
- Markers
- Reference Sheet: Synthetic Biology

SAFETY

Students should use caution when handling scissors

LEARNING ACTIVITY OR PROCEDURE:

Explicitly layout the lesson or demonstration

Please see the Building with Biology facilitators guide for hands-on student activity

ASSESSMENT:

Provide an assessment to measure student progress of objectives.

STEM CAREERS:

Agricultural and/or Food Scientist Bioengineer Geneticist Quality Control/Quality Assurance Technician Research Scientist Synthetic Biologist

ADDITIONAL RESOURCES:

Apply any links or additional information for students or teacher including videos, websites, etc.



TEACHER NOTES:

Things to talk about:

- How is designing a superhero similar to or different from building a microorganism to solve a problem?
- What could happen if you let your super organism go in the wild? Could anything happen that you didn't plan for?

