Curriculum Supplement Series

Bioengineering a Sustainable World

ISB Systems Education Experiences

In this high school curriculum module, students in environmental science, biology, integrated science, biotechnology and STEM courses use the example organism of green algae to explore how we can pursue solutions to complex problems such as climate change. Lessons may be completed independently or as a class.

THE NEED

To increase scientific literacy in the areas of systems thinking, sustainability, and biotechnology in order to prepare students to solve real world issues, ***we need to***:

Teach students how to analyze problems by breaking the system down to its individual parts so they can understand how they operate in context of multiple inputs and outputs

Develop students' understanding & utilization of cross-disciplinary strategies to address the growing demands of complex problems.

OUR APPROACH

We have developed and are field testing a curriculum module to teach sustainable practices through the lens of green biotechnology.

The module teaches students how microalgae can potentially supplement aspects of petroleum consumption with renewable sources of bio-energy and bio-products.

The module includes videos, case studies, and activities to teach students systems thinking at multiple scales, from global biogeochemical cycles to gene regulation.

Bioengineering a Sustainable World		
Name of Lesson	**What students learn ...**	**Periods (50 min)**
1. Systems Biology & the Carbon Cycle	- What products come from petroleum & how algae can replace some of those items. -The carbon cycle and its inputs & outputs affecting the planet	1-2
2. Bioengineering & Sustainability	-The basics of the central dogma & apply that knowledge to bioengineering. -To explore current events related to bioengineering & present their findings.	2-3
3. Gene Regulatory Networks & Phenotypes	-What a gene regulatory network is & how it is involved in gene expression. -How the environment affects genes that lead to alternative phenotypes through gene regulatory networks.	1-2
4. Biotechnology Solutions	-To apply math to predict resource allocation and cost at a market scale -The basics of the CRISPR/cas9 gene editing system as an example of biotechnology that can be applied to global issues. -To address a need or problem by creating a hypothetical biotech company	2-3

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