

SBI4U	Biotechnology Mini-Project
Molecular Genetics	

Topics

Examples of Applications of Biotechnology in Creating GMOs

Medicine	Example
Human Gene Therapy	Somatic and germline genetic engineering for treating or curing genetic diseases such as cystic fibrosis, haemophilia, muscular dystrophy, sickle cell anemic, or diabetes.
Recombinant Pharmaceuticals	For the production of insulin, human growth hormone (hGH), or blood clotting factors.
Vaccines	Genetically engineering viruses that can still confer immunity, but lack the infectious sequences.
Antisense Therapy	The development of antisense drugs to treat cancers, diabetes, asthma, arthritis, HIV/AIDS, high cholesterol, or hemorrhagic fever viruses.
Research	Example
Gene Function Discovery	
Loss of function experiments	Using gene knockouts in which an organism is engineered to lack the activity of one or more genes to determine the role of that gene.
Gain of function experiments	The logical counterpart of knockouts. These experiments are sometimes performed in conjunction with knockout experiments to more finely establish the function of the desired gene.
Tracking experiments	Seek to gain information about the localization and interaction of a desired protein. For example, using green florescent protein (GFP) to visualize the product of genetic modification.
Agriculture/Industry	Example
Genetically modified foods/transgenic crops	Genetically modifying foods or crops to be drought, temperature, or insect resistant. Creating pharmaceutical crops to incorporate edible vaccines or drugs.
Bioremediation	Using genetically engineered bacteria to clean up oil spills and other toxic waste.
Biofuels	Using genetically engineered organisms to produce renewable energy resources (e.g., GM bacteria to produce diesel fuel).

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ESSENTIAL QUESTIONS

- 1. What is the technology and what is it used for?** See **Table 1** for more information for Q# 1-2.
- 2. What is one focused example of how genetic modification is applied in relation to the topic?**
- 3. What are the specific scientific techniques and processes involved in the technology?**
 - a) How is DNA involved in this technology? What is done to DNA in this technology?
 - b) What does the technology “look like”? Provide a diagram or construct a model depicting specific procedures and/or equipment used; e.g., the steps of the polymerase chain reaction (PCR)
- 4. What is the impact of this technology on society (social, legal and/or ethical)?**
 - a) Advantages (1-2)
 - b) Disadvantages (1-2)

Category/Criteria for Success	Level 4	Level 3	Level 2	Level 1
Content	5	4	3	2 0
<ul style="list-style-type: none"> o Content knowledge (Essential questions #1-3) 	Student demonstrates full knowledge of the topic (more than required). A highly effective explanation or diagram is included	Student demonstrates a fair understanding of the topic, but fails to elaborate. A satisfactory explanation or diagram is included	Student is uncomfortable with the topic and is able to demonstrate only basic concepts. A explanation or diagram is included but is poorly represented	Student demonstrates limited understanding of the topic and cannot answer questions about their product. No explanation or diagram is included
Making Connections	5	4	3	2 0
<ul style="list-style-type: none"> o Impact of technology (Essential questions #4) 	Student addresses the impact on society with a high degree of effectiveness	Student addresses the impact on society with considerable effectiveness	Student addresses the impact on society with some effectiveness	Student addresses the impact on society with limited effectiveness, or not at all
Communication	5	4	3	2 0
<ul style="list-style-type: none"> o Clear and organized manner 	Students communicates with a high degree of clarity and resents information with a high degree of organization	Student communicates with considerable clarity and presents information with considerable organization	Student communicates with some clarity and presents information with some organization	Student communicates with limited clarity and presents information with limited organization

HELPFUL RESOURCES

BioCanada is a tool to help you locate information on biotechnology from the Government of Canada. Access policies, research activities and resources from the departments and agencies of the Government of Canada. Find information on R&D, health, ethics, the environment, and the business of biotechnology.

<http://www.biportal.gc.ca/english/BioPortalHome.asp?x=1>

<http://www.biogateway.gc.ca/english/linksearch.asp?x=1&formAction=SubjectArea>

The National Human Genome Research Institute was established in 1989 to carry out the role of the National Institutes of Health (NIH) in the International Human Genome Project (HGP). The HGP was developed in collaboration with the United States Department of Energy and begun in 1990 to map the human genome. Access credible information regarding health, education, research, issues and news in genetics.

<http://www.genome.gov/>

Genetics Tutorial and Resource website - <http://learn.genetics.utah.edu/>

Nature Science Journal - <http://www.nature.com/genetics/index.html>