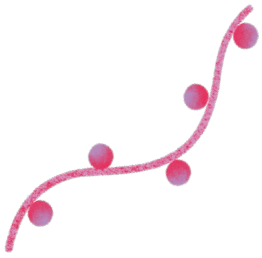
Alternative Proteins

UNIT 6 RECAP

Unit 6 looks at how local and global struggles can be mitigated or solved through genetic engineering (GE) technology. GE organisms - living things that have had their genetic code altered through biotechnology - range from microbes, such as bacteria, to plants we eat, and the animals used in food production and for medical research. There are likely many foods you eat every day that you may not realize are genetically engineered. The technologies behind genetic engineering allow scientists to alter DNA and transfer genes from one organism to another in the hopes that new proteins will be made by the GE organism. Genetically engineering crops and livestock can help to increase yield, enrich them with nutrients, and help withstand drought and disease. The success of Golden Rice production in the Philippines provided a solution for vitamin deficiency-related health issues by genetically engineering rice—a staple food of the country—to produce the extra vitamin A that people lacked due to their limited diets. Genetic engineering is changing farming; GE technology is also creating new solutions in health and medicine, research, and conservation. While the promise of GE for improving human health is great, there are still ethical questions that must be answered about the impacts of these new technologies.

INSPIRATION 1

When we think about genetic engineering, we usually think GMO "frankenfoods" or of babies with traits handpicked by their parents. However, scientists are coming up with ways that GE can be used to help species and ecosystems by eradicating invasive species and altering genomes to help animals and plants adapt to a changing climate. Yet, ethical questions remain when genetic manipulation is used to rescue species on the brink of extinction.



PROBLEM

Can and should genetic engineering be used to save species and ecosystems that are threatened with destruction and extinction?

SOLUTION DESIGN DRIVING QUESTIONS

What are some of the major conservation issues that the world faces currently?

Are there genes that are linked to adaptations for survival?

Does CRISPR have applications in conservation?

What applications can genetic engineering have in conservation?

What is synthetic biology and how does it differ from genetic engineering?

Are there potential negative consequences from GE in conservation?

What are examples of GE working to help ecosystems or threatened species

What would be the costs of taking or not taking action to save species and ecosystems using GE?

RESOURCES

Can Genetic Engineering Save Our Planet's Biodiversity? | College of Natural Resources News

CRISPR a Tool for Conservation, Not Just Gene Editing | UC Davis

Synthetic Biology

Study reveals the untapped potential of living cell banks in global conservation efforts

Should Genetic Engineering Be Used as a Tool for Conservation?—Yale E360

Using genetics to conserve wildlife | Pursuit by The University of Melbourne

Direct and indirect impacts of synthetic biology on biodiversity conservation—PMC

Alternative Proteins

INSPIRATION 2

The development of Golden Rice was one of the first widely publicized and successful cases of GE foods helping a population at risk of disease caused by nutritional deficiency. The rice that was engineered to biosynthesize beta-carotene allowed people in the Philippines to get the vitamin A that their limited diet was lacking. The CDC reported that more than 21,000 people (about the seating capacity of Madison Square Garden) in the U.S. died from malnutrition in 2022. How is this possible? Many of the most affordable or readily available foods are heavily processed, meaning that many of the original nutrients are destroyed. Could a new generation of GE foods help ensure that disadvantaged people will receive adequate vitamins and nutrients in their diets?

PROBLEM

Could genetically engineering foods help improve nutrition and health for children and adults in low-income areas and disadvantaged communities in the United States?

SOLUTION DESIGN DRIVING QUESTIONS

What nutrients from foods are most important for a person's health?

Are there diseases that are linked to poor nutrition and food insecurity in the U.S.?

Is there a difference in nutritional deficiencies between communities of various races, ethnicities, and socioeconomic status?

What limits access to healthy foods for all people in the U.S.?

Can foods available in areas considered "food deserts" be genetically engineered to contain nutrients that people lack?

RESOURCES

Good as Gold: Can Golden Rice and Other Biofortified Crops Prevent Malnutrition? | Science in the News

Micronutrient Inadequacies in the US Population: an Overview | Linus Pauling Institute | Oregon State University

As US life expectancy lags, nutritional deficiency is an often overlooked factor | CNN

Processed Foods and Health | The Nutrition Source | Harvard T.H. Chan School of Public Health

Melted, pounded, extruded: Why many ultra-processed foods are unhealthy | The Washington Post

The truth about nutrient deficiencies—Harvard Health Publishing

On Linkages: Access To Healthy Food in A Low-Income Urban Community: A Service-Learning Experience—PMC

How GMOs Can Bridge the Gap Between Healthy Food and Low Income Communities | Move for Hunger

Study: Eliminating GMOs would take toll on environment, economies | Agriculture News | Purdue University