

Planner

Activity	Description	<u>Materials and Technology</u>	<u>Additional Materials</u>	<u>Approximate Timing</u>	<u>Page Number</u>
Task 1: What is a sustainable future?					
<i>Discover</i>	Develop a personal identity map showing the different parts of who you are and create a futures mood board showing your ideas about the future.	<ul style="list-style-type: none"> • Paper • Pens or pencils • Objects that represent you (optional) • Class board or poster paper • Photos or magazines (optional) 		25 minutes	7
<i>Understand</i>	Survey your community to discover different perspectives on a sustainable future.	<ul style="list-style-type: none"> • Paper • Pens or pencils 		25 minutes + survey time	12
<i>Act</i>	Examine the Sustainable Development Goals, consider how biotechnology can play a role in a sustainable future, and pick the guide parts you want to use.	<ul style="list-style-type: none"> • Paper • Pens or pencils 	<u><i>Futures Mood Board</i></u>	25 minutes	17



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Task 2: How can biotechnology help create a sustainable future?					
Discover	Explore what biotechnology is and how it plays a role in your life.	<ul style="list-style-type: none"> • Paper • Pens or pencils 		25 minutes	20
Understand	Extract DNA and investigate different ways DNA can be used or changed.	<ul style="list-style-type: none"> • Alcohol • DNA source, fruit or other • Containers • Fork or spoon • Water • Salt • Detergent • Filter • Skewer or toothpick 		45 minutes	27
Act	Consider different perspectives on using biotechnology for a sustainable future and create a list of ethical concerns.	<ul style="list-style-type: none"> • Paper • Pens or pencils 	<u>Futures Mood Board</u>	25 minutes	35



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Task 1: Should we use biotechnology to change the food we eat?					
<i>Discover</i>	Analyze your food to investigate food systems in your community and around the world. Then interpret global hunger data.	<ul style="list-style-type: none"> • Paper • Pens or pencils 		40 minutes	50
<i>Understand</i>	Investigate genetic modifications, then work as a group to design genetically modified plants that address common food security issues around the world.	<ul style="list-style-type: none"> • Paper • Pens or pencils 	Printout of Figure 2-6 (optional)	40 minutes	54
<i>Act</i>	Explore hopes and concerns about the use of GMOs to combat food insecurity, then investigate your country's GMO policy and what can be done to support or change it.	<ul style="list-style-type: none"> • Paper • Pens or pencils 	<u><i>Ethical Concerns List</i></u> (Part 1)	25 minutes	59



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Task 2: How can biotechnology help food systems contribute to a more sustainable future?					
Discover	Model the amount of farmable land in the world to identify harmful farming techniques and their impact on your local community.	<ul style="list-style-type: none"> • Paper • Pens or pencils • Scissors 		25 minutes	66
Understand	Explore how biotechnology is helping restore and create farmable land around the world and in your community.	<ul style="list-style-type: none"> • Paper • Eight small objects • Pen or pencils • Specific investigations may need additional items 		25 minutes + community investigation time	73
Act	Communicate your findings and ideas on farming techniques to take sustainable action.			15 minutes + action time	81



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Task 1: How can biotechnology change the materials we use?					
<i>Discover</i>	Explore materials and sustainability and create profiles for materials in your own environment.	<ul style="list-style-type: none"> • Paper or class board • Pens or pencils 		45 minutes + investigation time	93
<i>Understand</i>	Investigate biotechnology and sustainable materials and make your own bioplastic.	<ul style="list-style-type: none"> • Microwave-safe container • Cornstarch • Cooking oil • Pipette or eyedropper (optional) • Water • Food coloring (optional) • Spoon • Microwave or other heat source, such as a stovetop 	<u><i>Sustainability Profile</i></u> for plastic water bottle (Discover activity)	60 minutes	99
<i>Act</i>	Consider the impact of innovative materials and share a new material with your community.		<u><i>Ethical Concerns List</i></u> (Part 1)	40 minutes + action time	106



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Task 2: Can we create the materials we need using cells and biotechnology?					
Discover	Discover ways scientists are using living things to create new materials.	<ul style="list-style-type: none"> • Paper or class board • Pens or pencils 		30 minutes	109
Understand	Investigate the need for 3-D bioprinting, create a model, and consider challenges and the future of the field.	<ul style="list-style-type: none"> • Paper or class board • Pens or pencils • Circular sprinkles (nonpareils, couscous, sand, or other small, round granules) • Peanut butter, toothpaste, or a gel-like material • Sandwich or plastic bags 	Printouts of Figures 3-17 (1 copy) and 3-18 (4 copies) (optional)	65 minutes	113
Act	Think about ethical concerns about using biotechnology to create materials and share them with others.	<ul style="list-style-type: none"> • Paper • Pens or pencils 	<u>Ethical Concerns List</u> (Part 1) <u>Futures Mood Board</u> (Part 1)	20 minutes	122



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Task 1: How can we diagnose diseases using biotechnology?					
Discover	Explore what you know about diagnosing disease and how this relates to genetic variants.			20 minutes	135
Understand	Determine which disease is causing a patient's symptoms and identify the genetic variant. Consider the risks of genetic diseases related to ancestry.			30 minutes	141
Act	Take on the role of genetic counselor and share with others ethical and personal considerations related to genetic testing.		<u>Ethical Concerns List</u> (Part 1)	20 minutes	145
Task 2: How can we fix genetic diseases using biotechnology?					
Discover	Consider what you know about disease treatment. Use an analogy to explore the stages of diagnosis, design, and delivery of gene therapy.	<ul style="list-style-type: none"> • Paper or class board • Pens or pencils 		20 minutes	150
Understand	Model gene therapy options and investigate ongoing gene therapy clinical trials.	<ul style="list-style-type: none"> • Paper • Pens or pencils 		30 minutes	154
Act	Develop a communication plan to share more about the diagnosis, design, and delivery of gene therapy with your community.		<u>Futures Mood Board</u> (Part 1) <u>Ethical Concerns List</u> (Part 1)	20 minutes + action time	160



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Task 1: How should we use and protect genetic data?					
Discover	Explore how genetic data relates to your identity. Discover more about how genetic data is collected and the information it contains.		<i>Identity Map</i> (Part 1)	25 minutes	171
Understand	Consider your concerns about uses of genetic data. Conduct interviews to understand community concerns.	<ul style="list-style-type: none"> • Pens or pencils • Paper 		30 minutes + interview time	175
Act	Analyze different perspectives on the ownership and use of genetic data. Choose one perspective to share with another person or group.	<ul style="list-style-type: none"> • Pens or markers • Poster paper or class board 		25 minutes	182
Task 2: How can environmental genetic data help identify and solve problems?					
Discover	Search for evidence of living things and find out how the evidence from eDNA can help answer questions.	<ul style="list-style-type: none"> • Pens or pencils • Paper 		35 minutes + search and observation time	187
Understand	Analyze case studies of investigations using eDNA and design your own investigation.	<ul style="list-style-type: none"> • Pens or pencils • Paper 		60 minutes	191
Act	Develop your ideas about the ethical considerations and other perspectives on the use of genetic data and use these ideas to modify your eDNA investigation.	<ul style="list-style-type: none"> • Pens or pencils • Paper 	<i>Ethical Concerns List</i> (Part 1)	25 minutes	201



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Task 1: How can biotechnology make our communities cleaner?					
Discover	Observe air, land, or water pollution in your community.	<ul style="list-style-type: none"> • Paper • Pencils or pens 		45 minutes + observation time	212
Understand	Create a model of different pollution problems and how biotechnology can help make them better. Then apply what you have learned to a problem you observed.	<ul style="list-style-type: none"> • Paper • Pencils or pens • Scissors 	Printout of Figure 6-5 (optional)	40 minutes	217
Act	Consider different perspectives on how you could address the problem you identified and create a plan.	<ul style="list-style-type: none"> • Paper • Pencils or pens 		50 minutes	223
Task 2: How can biotechnology help restore biodiversity to ecosystems?					
Discover	Model the importance of genetic diversity to an ecosystem.	<ul style="list-style-type: none"> • Paper • Pencils or pens • Scissors 	<u>Identity Map</u> (Part 1) Printout of Figures 6-11 and 6-12 (optional)	30 minutes	229
Understand	Investigate the potential of biotechnology to restore biodiversity to ecosystems.	<ul style="list-style-type: none"> • Paper • Pencils or pens • Scissors 	Printout of Figures 6-13 and 6-14 (optional)	20 minutes + investigation time	237
Act	Create a set of rules about the use of biotechnology to encourage conservation. Share these rules or a conservation plan you create with others.	<ul style="list-style-type: none"> • Paper • Pencils or pens 		20 minutes + action time	241



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Task 1: How can biotechnology help with security?					
Discover	Explore how biometrics work and how you use them.	<ul style="list-style-type: none"> • Paper • Pencils • Clear adhesive tape 		25 minutes	256
Understand	Model facial recognition technology and consider any issues with how it is used.	<ul style="list-style-type: none"> • Paper • Pens or pencils • Straight edge 	Printouts of Figures 7-8 and 7-10 (optional)	25 minutes	262
Act	Draft a set of rules for when and how you think biometrics should be used.	<ul style="list-style-type: none"> • Paper • Pens or pencils 	<u>Ethical Concerns List</u> (Part 1)	20 minutes	268
Task 2: What are the threats to security presented by biotechnology?					
Discover	Explore possible outcomes of bio-threat scenarios.	<ul style="list-style-type: none"> • Paper • Pens or pencils 		20 minutes	273
Understand	Investigate bio-threat vulnerabilities within your community and think about possible ways to prevent problems.	<ul style="list-style-type: none"> • Paper • Pens or pencils • Computer (optional) 		30 minutes + investigation time	276
Act	Share information about bio-threats with your community.	<ul style="list-style-type: none"> • Paper • Pens or pencils • Computer (optional) 		15 minutes + action time	280



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Task 1: How will I help create a sustainable world using biotechnology?					
Discover	Use your <i>Futures Mood Board</i> to decide what future you want to take action to support.	<ul style="list-style-type: none"> • Paper • Pens or pencils 	<i>Futures Mood Board</i> (Part 1)	20 minutes	289
Understand	Come to consensus and plan your action.	<ul style="list-style-type: none"> • Paper • Pens or pencils 	<i>Identity Map</i> (Part 1)	45 minutes	291
Act	Implement your action plan and reflect on your action.		<i>Futures Mood Board</i> (Part 1)	15 minutes + action time	293

