Wizards of Wright

Lesson: Bio Tech

Background Info for Wizards:	Biotechnology is the science of changing living things to make human life better. Some examples include vaccines, pest resistant crops, and lactose free milk. In this lesson, we will be exploring the various ways that biotechnology helps humans. Then we will explore the early days of biotechnology and learn about fermentation through an experiment involving yeast. *Warm up the water in the electric teapot just before starting the lesson. The teapot will automatically turn off when the water is thoroughly heated. The water should stay warm in the pot until needed. Be sure that the electric tea pot is plugged in at a separate table.*
Materials:	Student Worksheets 1 electric teapot 6 single packages of yeast 6 empty bottles (fill line already marked) 6 balloons 6 single packets of sugar 6 funnels 6 trays
Lesson Time: ***60-80 minutes***	Introduction: 5 minutes Guided Lesson #1: 5-10 minutes Guided Lesson #2: 5-10 minutes Student Activity #1: 25 minutes Student Activity #2: 10-15 minutes Conclusion and Student Activity #3: 10-15 minutes
Learning Targets:	Students will learn that in the science field of Biotechnology, scientists change living things to make human life better. Students will explore various examples of biotechnology.

	Students will learn how fermentation was one of the earliest forms of biotechnology and that fermentation was used to keep food from spoiling. Students will discuss ways to save energy.
Introduction for Students: 5 minutes	Today we are going to talk about Biotechnology. Bio is short for biology, which is the study of all living things. Technology is another word for tools. Biotechnology then, is a tool that uses biology to make new products. Biotechnology uses the smallest parts of living organisms – the cells and molecules, to develop useful chemicals and products that help improve our lives and the health of our planet. Biotechnology is mainly used in agriculture, food science, and medicine. Modern biotechnology also provides breakthrough products and technologies to fight diseases, reduce our environmental footprint, feed the hungry, use less and cleaner energy, and have safer, cleaner, and more efficient industrial manufacturing processes. Some would say that Biotechnology exists to…Heal the world, Fuel the world, and Feed the world.
Guided Lesson #1: 5-10 minutes	A classification system was developed in biotechnology because the study and understanding has grown so quickly and includes a lot of different areas. To make it especially easy, they made the system color-coded. Some lists include 8-10 colors, let's talk about a few. **White Biotechnology** deals with industry - businesses or factories that make things – like cars, computers, and building materials. Biotechnology Engineers are working on ways to reduce the environmental impact from industries, produce biodegradable plastics, and create renewable fuel and alternate energy sources. **Green Biotechnology** plays an important role in the increased production of food to meet the demands of high populations, generating a production of crops that can tolerate a range of environmental conditions, as well as in developing crops that show resistance to environmentally damaging pests, fertilizers, and pesticides.

	Blue Biotechnology deals with marine plants and animals. These scientists are concerned with the health of our oceans. They work on ways to save coral reefs, and make sure that humans do not overfish. **Red Biotechnology** is focused on medicine and human health. This branch of biotechnology has given us vaccines, antibiotics, research studies, and disease research. **Yellow Biotechnology** refers to biotechnology used to improve nutrition and produce foods.
Guided Lesson #2: 5-10 minutes	**Say to students:** One of the benefits from Yellow Biotechnology is fermentation. We will learn about fermentation and the microorganism called yeast. **Ask students:** Can anyone tell me what they think a microorganism is? - Microorganisms are living things that are too small to be seen with just our eyes. They are normally viewed using a microscope. - Bacteria, viruses, and some molds are examples of microorganisms. Show the students a yeast packet. **Ask the students:** What do you know about yeast? - Yeast makes bread rise. - It creates enzymes, which are proteins that speed up chemical reactions in our body. - It is a microorganism. Refrigeration did not come along until 1859, and before then humans had to get creative when it came to keeping their food from spoiling. - Early on, cave dwellers discovered that aged meat had a better flavor than freshly killed meat. - Early humans fermented grains to make unleavened bread. - In the hot temperatures of North Africa, the early fermentation of milk created what we now know as yogurt. - Cheese involves the fermentation of milk or cream and is another ancient food created through fermentation. Fermented products are also involved in medicine. The Chinese used moldy soybean curd to cure skin infections 3,000 years ago. Central American Indians treated infected wounds with fungi. Penicillin is an antibiotic that destroys many disease-causing bacteria. It comes from a mold that grows in a fermenting mixture of substances.

	Today, we as consumers are actively seeking more sustainable and healthier products. Fermentation is a part of biotechnology that can offer several benefits for food producers—including sustainability, health, and product performance. This is a great example of Yellow Biotechnology. As we said before, yeast helps bread rise, but it also performs fermentation. Fermentation is a chemical change that happens through the work of tiny living things called yeasts, bacteria, and mold. These living things create substances called enzymes, and the enzymes break down food into chemicals.
Student Activity #1: 25 minutes	When bakers add yeast to bread dough, the yeast breaks down the sugars in the dough. While this happens, carbon dioxide gas is released. The escaping carbon dioxide makes the bread rise. Let's make that happen. **(Students will be working in small groups for this activity. Groups should be just 2-3 students. Ask the teacher if the groups have already been created. If not, wait while he or she does this.)** Each group will need: - a bottle (fill line already marked) - a balloon - a packet of yeast - a packet of sugar - a funnel - a tray to work on Explain to the students that to create fermentation, just like in baking bread, the **yeast** will break down **sugar** and create **carbon dioxide**. Explain that all work must be done on the tray, to avoid extra clean up. And that it's best if someone holds onto the bottle, to keep it steady, while they work. Allow students to work through the experiment themselves following directions on the sheet provided. **Give each group their set of materials, and a directions page.** - You, or the teacher, should be present at the table when water is poured. - As they are working, ask students to explain their observations. - Can they explain why this has happened?

	After students have completed the experiment, the bottles and the trays can stay out so the students can see if the reaction continues. Collect the rest of the materials.
Student Activity #2: 10-15 minutes	We've experimented with Yellow Biotechnology, now let's think about White Biotechnology. One of the objectives of White Biotechnology is for businesses and factories to find ways to use alternate energy sources. We should also consider using less energy at home and at school. People around the world are using more electricity as technology increases, and as populations increase, so does the demand for electricity. Very often we forget to be energy efficient. Whether we decide to use energy-efficient equipment or change the type of light bulbs we use, reducing the amount of energy we consume is good for the environment. Give each group or pair a worksheet: **The Energy I Use** They should work together to circle the things they have used or done in the last 24 hours. After they complete sheet #1, give groups a copy of sheet #2. - They should fill in the number of Energy points each of their activities scored. - Then add them up. - A total score of under 40 is considered "good at saving energy". As a class, discuss how much energy we ALL use, and some ideas on how we can begin to make a difference.
Conclusion and Student Activity #3: 10-15 minutes	Reiterate to the students: There are scientists that work with living things to help improve all our lives and they are called biotechnology engineers. The field of biotechnology has many sectors or branches. Ask students if they continued to see a reaction in their balloons. Students will need to carefully take the balloons off the bottles, throw the balloons away, dump out the ingredients inside, and return the bottles and trays to you.

	As this is being done, you can have the students do one last review. **Pass out one Bio Tech Student Worksheet to each student.** **Say to the students:** Based on what we talked about, talk with your group to fill in the third column. If there's time to discuss their ideas, please do.

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