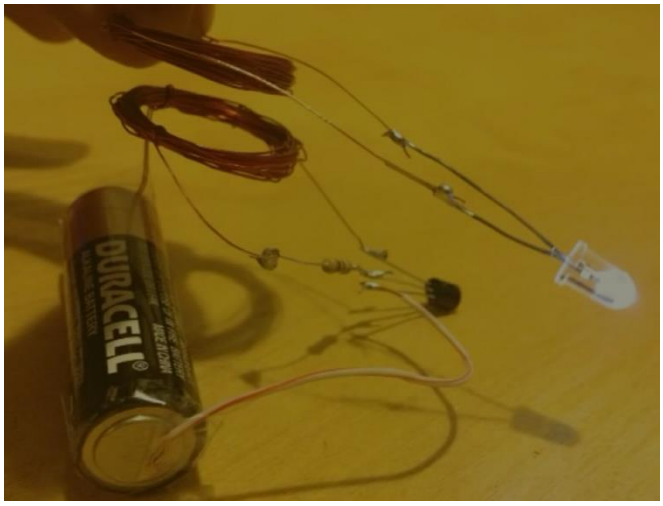
Can we avoid becoming cyborgs?

Subject Area(s) **Biology**

Associated Unit **Biotechnology**

Lesson Title **Can we avoid becoming cyborgs?**



ADA Description: Battery powered transmission circuit with L.E.D. light to help demonstrate how wireless power transfer works.

Caption: Wireless Electricity Transmission Circuit

Grade Level 9

Time Required 150 minutes (3 – 50 minute periods)

Materials: NPN Transistor 2N3904, Resistor 1 Kilo OHM, L.E.D. Light, 1.5 Volt AA Battery, and insulated copper wire

Cost: $20.00

Summary:

As technology becomes a larger part of our world, students should understand the effects that it could have on society. In this lesson, students will explore the different devices available that function as an artificial pacemaker. Students will then be introduced to Near Field Communication (NFC)technology and how it is used in the biomedical field. A demonstration will be given using a simple wireless electricity

transmission circuit, this can be built following this tutorial. Students will then participate in a debate regarding the positives and negatives of biotechnology

Engineering Connection

During this lab, students will be exposed to the various devices that are currently used as a pacemaker. Students will then explore NFC technology and how it can be applicable in pacemaker technology.

Engineering Category

Choose the category that best describes this lesson's amount/depth of engineering content:

1. Relating science and/or math concept(s) to engineering

Keywords Circulatory system, Pacemaker, Sinus Node, Biotechnology, and NFC (Near Field Communication)

Educational Standards (List 2-4)

State STEM Standard

CPALMS, 2008, SC.912.L.16.10, Grades: 9-12

Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.

ITEEA Standard, Standard 4, Grades K-12

Students will develop an understanding of the cultural, social, economic, and political effects of technology.

ITEEA Standard, Standard 14, Grade K-12

Students will develop an understanding of and be able to select and use medical technologies.

Pre-Requisite Knowledge

Prior to this lesson, students should know the basic concepts in regards to the heart and the circulatory system.

Learning Objectives

After this lesson, students should be able to:

- Know the function of the pacemaker
- Understand the effects technology may have on culture, economics, and government policies
- Understand the importance of evidence-based arguments.

Introduction / Motivation (5E – Engage)

To start, students will watch a video of a live human heart beating. Gather some thoughts on what the students know regarding the human heart and what regulates the pumping of the blood. What happens if a person's heartbeat becomes irregular? What has scientists created to help solve this problem.

Use the wireless electricity transmission circuit to demonstrate to students how NFC technology works. Proceed to explain how scientists are now investigating how to implement this technology into pacemakers.

Use this video of Former U.S. president Dick Cheney discussing why he disabled the wireless on his pacemaker to lead the discussion towards biotechnology's impact on society.

Lesson Background & Concepts for Teachers (5E – Explain)

Provide students with rubric and explain to students they will be participating in a debate on the positives and negatives effects of biotechnology on society. Students will have one class period to collect evidence to support both sides and should be citing their findings. Inform students that they will be required to use this evidence and the debate to write a 2-page essay debating biotechnology.

On the day of the debate, inform students which side they will be debating on. Provide students with examples of appropriate dialogue. Timing students during talking points will help ensure every student has an opportunity to speak.

Vocabulary / Definitions

Word	Definition
Pacemaker	An artificial device for stimulating the heart muscle and regulating its contractions.
Biotechnology	Technological application that uses biological systems, living organisms or derivatives, to make or modify products or processes for specific use.
NFC (Near Field Communication)	Technology that enables 2 electronic devices to establish communication by bringing them within distance of each other.

Associated Activities (5E – Explore)

Students will be given one class period to research both sides of the argument and reliable sources to use during the debate. This can be extended to longer time if the teacher deems necessary.

Assessment (5E – Evaluate)

Pre-Lesson Assessment

Teacher collected data through discussion and open-ended questioning.

1. What factors can affect the heart's ability to function?
2. What is the pacemaker's role in the circulatory system?
3. What can you tell me about biotechnology?

Post-Introduction Assessment
Student participation in debate

Lesson Summary Assessment
2 page Essay discussing the positives and negatives of biotechnology. Essay should include ideas on how to solve any negatives they find, if possible.

Homework
N/A

Lesson Extension Activities (5E – Extension)

Students can read about further explore biotechnology. These websites are good starting places.

- https://www.bio.org/what-biotechnology
- http://www.nature.com/nbt/index.html

Additional Multimedia Support
Internet access for videos

References

1. Youtube.com: Wireless electricity transmission circuit, 04/07/2015

   https://youtu.be/-7DgPmkg-74

2. Youtube.com: Live beating Heart and Heart Surgery, 11/28/2012

   https://youtu.be/uR4t__B-Zwg

3. ABC news: Cheney Reveals Fear of Pacemaker Hack, 10/21/2013

   http://abcnews.go.com/GMA/video/dick-cheney-60-minutes-interview-reveals-fear-pacemaker-20632056

Contributors
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Classroom Testing Information
N/A

Attachment: Biotechnology Debate Rubric

Class Debate – Pros vs. Cons Biotechnology

Student Name: _____

CATEGORY	4	3	2	1
Use of Facts/Statistics	Every major point was well supported with several relevant facts, statistics and/or examples.	Every major point was adequately supported with relevant facts, statistics and/or examples.	Every major point was supported with facts, statistics and/or examples, but the relevance of some was questionable.	Every point was not supported.
Information	All information presented in the debate was clear, accurate and thorough.	Most information presented in the debate was clear, accurate and thorough.	Most information presented in the debate was clear and accurate, but was not usually thorough.	Information had several inaccuracies OR was usually not clear.
Rebuttal	All counter-arguments were accurate, relevant and strong.	Most counter-arguments were accurate, relevant, and strong.	Most counter-arguments were accurate and relevant, but several were weak.	Counter-arguments were not accurate and/or relevant
Respect for Other Team	All statements, body language, and responses were respectful and were in appropriate language.	Statements and responses were respectful and used appropriate language, but once or twice body language was not.	Most statements and responses were respectful and in appropriate language, but there was one sarcastic remark.	Statements, responses and/or body language were consistently not respectful.

Attachment: Pros vs. Cons Biotechnology Essay

Essay: Biotechnology: Pros vs. Cons				
Student Name: _____				
CATEGORY	4	3	2	1
Quality of Information	Information clearly relates to the main topic. It includes several supporting details and/or examples.	Information clearly relates to the main topic. It provides 1-2 supporting details and/or examples.	Information clearly relates to the main topic. No details and/or examples are given.	Information has little or nothing to do with the main topic.
Organization	Information is very organized with well-constructed paragraphs and subheadings.	Information is organized with well-constructed paragraphs.	Information is organized, but paragraphs are not well-constructed.	The information appears to be disorganized. 8)
Sources	All sources (information and graphics) are accurately documented in the desired format.	All sources (information and graphics) are accurately documented, but a few are not in the desired format.	All sources (information and graphics) are accurately documented, but many are not in the desired format.	Some sources are not accurately documented.
Mechanics	No grammatical, spelling or punctuation errors.	Almost no grammatical, spelling or punctuation errors	A few grammatical spelling, or punctuation errors.	Many grammatical, spelling, or punctuation errors.