

TED® Connection, Category 3 Electrifying Cancer

Overview

Mensa for Kids' TED Extensions are short, easy to use guides that help teachers, parents and youth use TED talks in a classroom or home setting. They are not written in a lesson plan format, but they do have a list of discussion questions, all at higher levels of thinking.



Watch the TED talk at:

http://www.ted.com/talks/bill_doyle_treating_cancer_with_electric_fields.html

THINK ABOUT IT:

1. Bill Doyle described the Tumor Treating Fields as a field of forces that attracts bodies with electric charges, comparing them to the force of gravity, and defined the Tumor Treating Fields in part by explaining what they are *not*. Describe gravity using three statements about what it is not.

Gravity is not:

2. The human body is an electrical thing, although it's not as electric as an eel. Your body can generate between 10 and 100 millivolts, while an electric eel can produce around 600 volts! If you could choose one thing to run on the electricity of your body (assuming you could generate more volts than you currently do), what would it be? Would your parents select the same thing?

3. Cancer cells rapidly divide and lead to uncontrolled tumor growth. Can you think of anything else that creates a problem if it is uncontrolled?

4. Doyle explained the cell division process of mitosis and how the TTF interrupted it. Watch this animation of mitosis to see what he means:
<http://www.cellsalive.com/mitosis.htm>.

The highly charged nature of the proteins in the “soup” of the cell allows this treatment to work. He does not say if they are positively or negatively charged. What do you think they are? _____

5. In the TTF therapy, transducers attached to a field generator create an artificial electric field. This field aligns the proteins and prevents them from dividing. Do you think that this treatment could be considered prevention, rather than treatment, because of this? How would you describe the difference between treatment and prevention?

6. Doyle explains that the cells will try to divide for several hours and will either commit cell suicide (apoptosis, or programmed cell death) or form unhealthy daughter cells after division. Ultimately, either course leads to cell death. Does it seem ironic to you that in order to help people live, we must learn to kill cells within their bodies? Can you think of any other thing in which you must do harm in order to do good?

7. The scientific name of the daughter chromosomes Doyle refers to is chromatids. Why do you think something would be called a “daughter” cell rather than a “son” cell?



8. Doyle says that the TTF treatment has no effect on normal, undividing cells. How important do you think that is?

9. The company that is working with this therapy is called Novocure. Imagine that you created a company to treat cancer. What would you call it?

10. In the trial Doyle referred to, some patients were given chemo while others had the TTF. Both groups enjoyed the same longevity, though the TTF patients had a better quality of life. Would you trade quality of life for longevity? If so, how much?

11. Doyle identified the three common treatments for cancer: surgery, chemotherapy and radiation. He said they all had advantages as well as disadvantages. Of the side effects of chemo and radiation that he mentioned, which did you think sounded the most problematic? Do you believe there is a point at which the treatment is worse than the disease? How would you decide? Who should decide?



12. What did you find most interesting about the scans of Robert Dill Bundi's brain?

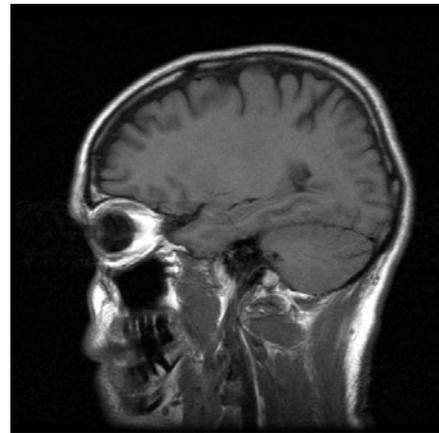
13. Doyle asserted that this treatment is effective on solid tumor cancers. Why do you think it would work less well with other types of cancers?

14. This treatment is being used on glioblastoma multiforme (GBM), a particularly virulent form of brain cancer. Brain cancers are named for the kind of cells the tumor arose from – astrocytes are star-shaped cells. According to Harvard’s brain tumor patient guide, GBM is a Grade 4 astrocytoma. The grade is determined by how aggressive or malignant a tumor is. To determine this, physicians evaluate:

- How many cells are dividing (mitosis)?
- How many newly-formed blood vessels are there in the tumor?
- Is there evidence that the tumor outgrowing blood supply (necrosis)?

Which of these three things seems the most threatening to you?

15. If you were a physician, would you rather treat a higher grade, less aggressive tumor or a lower grade, more aggressive tumor?



16. Tumors of neurons are very rare in adults. What did you learn about rapid cell division that makes this make sense?

17. The Harvard site also says one of three primary goals of treatment is to put cells in a non-dividing “sleeping” state for as long as possible. Why do you think division is such a key component of the treatment of cancer? How would you approach this if you were a cancer researcher?

18. The founder of Novocure, Yoram Palti, is both a physician (an M.D.) and a Ph.D., both very scientific degrees. However, on his LinkedIn profile, he lists his three specialties as:

- Independent learning capability
- Finding creative solutions by thinking “out of the box”
- Highly motivated, strong work ethic

For each of these three specialties, consider why they are important to cancer research. Do you think they can be developed, or are you just born with them?

DO IT:

- Perform an experiment yourself: <http://www.sciencebuddies.org/science-fair-projects/Intro-Genetics-Genomics.shtml>

READ ABOUT IT:

- *The Emperor of All Maladies: A Biography of Cancer* by Siddhartha Mukherjee

- *The Immortal Life of Henrietta Lacks* by Rebecca Skloot
 - *Complications* by Atul Gawande
 - *The Body Electric: Electromagnetism and the Foundation of Life* by Robert Becker
 - Cancer is found in the 616.994 section of the Dewey Decimal System, so you can browse that area of your local library for more books of interest.
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WATCH IT:

- *Burzynski, the Movie: Cancer Is Serious Business*
<http://topdocumentaryfilms.com/burzynski-the-movie-cancer-is-serious-business/>
 - TED talk by Stacey Kramer about how she views her brain tumor:
http://www.ted.com/talks/lang/en/stacey_kramer_the_best_gift_i_ever_survived.html
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SURF IT:

- CG animation of apoptosis (cell suicide):
<http://www.youtube.com/watch?v=9KTDz-ZisZ0>
- Shorter animation of apoptosis: <http://www.cellsalive.com/apop.htm>
- Find out more about three types of cell death
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC420517/>
- The Brain Tumor Society: www.tbts.org
- American Brain Tumor Association: www.abta.org
- Watch Robert Dill Bundi race his bike in the 1980 Summer Olympics:
<http://www.youtube.com/watch?v=zQzvkGDrJ0U>
- Harvard's brain tumor patient guide: brain.mgh.harvard.edu/patientguide.htm
- Novocure: <http://www.novocure.com/>
- Dr. Palti's LinkedIn Profile : <http://www.linkedin.com/pub/yoram-palti/10/566/b49>