Name _____

EOR#11: Cancer & HeLa Articles (1 n 2)

^nnotation Directions: 1) Read in the textbook sections 8.8→8.10 and 11.18→11.21. 2) As you begin to read the 2 HeLa icles, your assignment is to interact with the text as an ACTIVE READER, providing thoughtful annotation that demonstrates mature thinking about the text as outlined in the Annotation Scoring Guide below. Use **Margin Notes** to have a conversation with the writer ... ask questions, argue their points, demand further information, challenge ideas you disagree with, etc. Remember, the goal of a reading annotation strategy is to help you become are more analytical and reflective reader who actually pauses to THINK about what you are reading. Leave your reading "fingerprints" all over the articlel (e.g., circle and define challenging vocabulary, thoughtful margin notes, underline important ideas, etc.,) **Caution**: Highlighting too much = nothing is most important

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Challenging Vocabulary: First **CIRCLE** (in the article) and then Define at least 5 challenging vocabulary words and provide a synonym

Challenging Word	Definition or Synonym

Annotating Scoring Guide

	1 Little Effort	2 Some Effort	3 Strong Effort
Vocabulary	➢ Some Unknown / challenging words are identified.	• All unknown/challenging words are circled and some are defined	Circled **and** defined (5 minimum) unknown / challenging words or.
Margin Notes	➢ Minimal Interaction with text	• **Interaction with the text is obvious** but struggles to dig deep. • Comments are lightweight; sometimes stray from main idea.	✓ **Mature thinking is obvious.** ✓ Connections made between related ideas in the text. ✓ Personal connections and comments are identified ✓ Questions and predictions
Reading for Meaning 1. Underline important ideas	➢ Some important ideas underlined.	• Main idea is partially or sometimes underlined. • Sometimes too much information is underlined	✓ Main ideas always underlined in each paragraph
Reading for Meaning 2. Writing a quality summary	➢ Weak summaries with no support	• Average summaries that need more support	✓ Insightful, well-supported summaries of text sections are written in own words

Reflections: Summarize the main ideas from each HeLa article in your own works below:

Article #1:

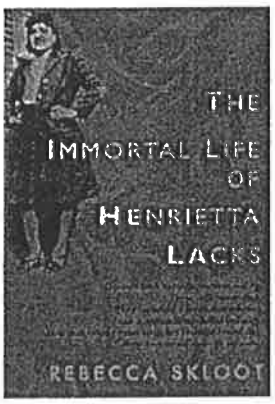
Article #2:

HeLa Articles Anticipation Guide

Directions: Respond **T/F** to each HeLa statement *twice*, once **BEFORE** reading and then again **AFTER** reading the 2 articles. If a statement is **FALSE**, write a corrected full statement in the box below the statement. *** Avoid the word **NOT** in any of your corrected statements *** Finally, indicate in the **cite text** box which article paragraphs contained the information relevant to the statement.

Before Reading T /F	HeLa Articles Statements	After Reading T/F
	1) Henrietta Lack's cells were kept for private research by a scientist named Dr. Gey until her descendants recently won a lawsuit demanding they be sold to other researchers.	
		Cite Text
	2) Henrietta Lacks willingly donated her breast cancer cells to science research	
		Cite Text
	3) The cells collected from Henrietta Lacks have only been used for cancer research	
		Cite Text
	4) The use of HeLa cells in research was recently banned.	
		Cite Text
	5) One advantage of using HeLa cells for research is that they die after 50 cell divisions so they do not grow out of control in a research lab.	
		Cite Text
	6) When compared to the genome of human reference cells, HeLa cells were found to have several missing chromosomes.	
		Cite Text
	7) One disadvantage of using HeLa cells is that they come in many different varieties because they have developed different types of errors over the years.	
		Cite Text
	8) In a famous lab experiment, HeLa cells were fused with chimpanzee cells to create the first hybrid cells ever created.	
		Cite Text
	9) HeLa cells have been used to test vaccines for polio and HIV.	
		Cite Text
	10) One reason researchers are excited about HeLa cells is because they were recently discovered to produce chemicals that cause cancer cells to die through apoptosis (PCD).	
		Cite Text

Article #1



How HeLa Cells Work by Shanna Freeman

HeLa cells are incredibly hardy, which makes them very useful for medical research.

How HeLa Cells Work

Have you ever heard of HeLa cells? They've been around for more than 60 years, but unless you're a medical researcher, the name probably
1A didn't crop up on your radar until recently, if at all. In the past decade or so, countless articles -- and one New York Times bestselling book -- have been written about them.

But what's a HeLa cell? It's a **line**, or population, of cells, taken from a person and used in scientific research. Cell lines are often named after the people from whom they were
1B originally derived, and HeLa comes from the first two letters in the name Henrietta Lacks. Cell lines are used in all kinds of ways, such as studying the effects of diseases or developing medications and vaccines, and play an invaluable role in medicine today.

But HeLa cells were the first -- the first line of human cells to survive in vitro (in a test tube). Named after a cancer patient, the cells were taken from Lacks' tissue samples and grown by
1C a researcher named Dr. George Gey in 1951. Dr. Gey quickly realized that some of Lacks' cells were different from normal cells. While those died, they just kept on growing. After more than 50 years, there are now billions and billions of HeLa cells in laboratories all over the world. It's the most commonly used cell line, and it's known to be extremely resilient.

The fact that HeLa cells have been used in some very important, groundbreaking medical research is interesting enough, but there's another part of the story -- and that part is why
1D Oprah might be making a movie about HeLa. Henrietta Lacks had no idea that her cells were taken and used in this way, and neither did her family. And while the cells became commercialized (researchers can buy a vial of them for $250) Lacks' family has lived without healthcare and in poverty. Henrietta Lacks' story isn't just about her contribution to medical research; it's about the ethics of biomedical research and the practice of informed consent. But let's start at the beginning, with Henrietta herself.

The Woman Within

1E For a long time, researchers who were curious enough to ask were told that HeLa cells were named after "Helen Lane" or "Helen Larson." Medical journals wrote about the line and a few did mention Henrietta's real name, but few people paid attention. That part just wasn't considered important.

The real Henrietta Lacks was a young African-American mother living outside of Baltimore, Maryland. While pregnant with her fifth child, she felt what she described to cousins as a "knot." After childbirth, Lacks experienced
1F abnormal bleeding. Her doctor discovered a lump on her cervix and sent a sample of it to a lab. The result was a diagnosis of cervical cancer. The only hospital in the area at the time

1F that would treat African-American patients was Johns Hopkins, so that's where Lacks went for treatment.

1G While her husband and children often waited in the car outside, she endured radiation treatments (which were done at the time by inserting tubes of radium around her cervix and sewing them into place) as well as X-ray treatments. The cancer spread despite these and other treatments, however, and caused Lacks horrible pain. She died in the hospital at the age of 31 on October 4, 1951. She had been diagnosed just nine months earlier.

1H During her radiation treatments, a doctor removed some tissue samples from Lacks' cervical tumor. She had signed the usual forms consenting to treatment for her cancer, but was not asked for her permission to remove the tissue samples, nor was she informed that it had been done, but this wasn't unusual. The tissue was sent to Dr. Gey in the Tissue Culture Laboratory at Johns Hopkins. Dr. Gey had been trying to grow human cells in the lab for decades, but they always died within a few days. Lacks' cells were unique. He isolated one of them and got it to divide -- and it just kept going. He named the line HeLa.

My Immortal Cells

1I All of the body's normal cells experience the effects of aging over time, known as **cellular senescence**. Repeated divisions cause the cell's DNA to become unstable, and sometimes toxins form. This means that eventually the cells are unable to divide, and the cell dies. This is called **programmed cell death** (**PCD**), **apoptosis** or even **cellular suicide**. It's part of the normal process for many cells, and it varies depending on the type of cell.

1J While it may sound awful, PCD can be a good thing. It's how fingers and toes are formed in utero (fetuses start out with webbed appendages) and how our immune system kills off cells that are infected by viruses. When grown in a laboratory setting, PCD generally occurs after about 50 cell divisions. But that's what sets HeLa apart. Under the right conditions, HeLa cells form an immortal cell line; they divide indefinitely. Remember that HeLa cells were grown from a tissue sample from Lacks' cervical tumor. Cancerous cells don't experience PCD, and Lacks' particular cells were especially hardy. Just like the cancer grew and spread quickly through Lacks' body, HeLa cells grow and spread quickly in vitro. Nobody knows quite why. Lacks had both the human papillomavirus (HPV) and syphilis, so one theory is that these helped suppress PCD in the cells.

1K Dr. Gey didn't seek to profit off HeLa, though. After publishing his research, he received requests from other researchers for samples of HeLa, and he was happy to provide them for free. Now HeLa cells are being used all around the world, with more than 60,000 medical journal articles published about their use and at least 11,000 patents related to their use. There are thousands of other cell lines, but HeLa remains the most popular because it is easy to grow, store and ship.

Saving Lives After Death

1L Although initially HeLa was developed for use in cancer research, that was just a start. HeLa cells have even been sent to outer space, proving that cancer cells can grow there. Almost since its creation, the HeLa cell line has been used in many different ways, and it even helped found entire fields of study. For example, doctors essentially created the field

of **virology** -- the study of viruses -- after infecting HeLa cells with everything from measles to mumps so they could observe how the viruses affected the cells. This led to the creation of some of the vaccines in use today. Genetic medicine might not be possible without HeLa
1L cells, as researchers discovered that the cells' chromosomes were visible when treated with a specific stain. In the mid-1960s, HeLa cells were fused with mouse embryo cells to create the first cell hybrid, which helped researchers begin the process of mapping the human genome.

The most well-known early use of HeLa involves a disease that has been eradicated in the Western hemisphere. In the early 1950s, the United States was stricken by fear of contracting the infectious, paralytic disease called polio. Outbreaks were on the rise, with about 60,000 cases in 1952, and there was a huge push to come up with a vaccine. That year researcher
1M Jonas Salk created the vaccine, and part of the testing process used HeLa cells. HeLa cells have also been instrumental in studying tuberculosis, HIV and human papillomavirus (or HPV, which eventually resulted in a vaccine). Researchers have used them to test medications for cancer and Parkinson's disease, and they've even been used to test products like cosmetics.

Article #2

Famous "HeLa" Human Cell Line Gets Its DNA Sequenced

The genome of the cell line, which originated from a deadly cervical tumor taken from a patient named Henrietta Lacks, is riddled with errors, raising questions about its continued use in research

March 15, 2013 |By Ewen Callaway and Nature magazine

The research world's most famous human cell has had its genome decoded, and it's a
2A mess. German researchers this week report the genome sequence of the HeLa cell line, which originates from a deadly cervical tumor taken from a patient named Henrietta Lacks.

Established after Lacks died in 1951, HeLa cells were the first human cells to grow
2B well in the laboratory. The cells have contributed to more than 60,000 research papers, the development of a polio vaccine in the 1950s and, most recently, an international effort to characterize the genome, known as ENCODE.

Previous work showed that HeLa cells, like many tumors, have bizarre, error-filled genomes, with one or more extra copies of many chromosomes. To get a closer look at these alterations, a team led by Lars Steinmetz, a geneticist at the European
2C Molecular Biology Laboratory in Heidelberg, Germany, sequenced the popular 'Kyoto' version of the cell line and compared the sequence with that of a reference human genome. The team's results are published in *G3*.

Steinmetz's team confirmed that HeLa cells contain one extra version of most chromosomes, with up to five copies of some. Many genes were duplicated even more
2D extensively, with four, five or six copies sometimes present, instead of the usual two. Furthermore, large segments of chromosome 11 and several other chromosomes were reshuffled like a deck of cards, drastically altering the arrangement of the genes.

Without the genome sequence of Lacks' healthy cells or that of her original tumor, it is
2E difficult to trace the origin of these alterations. Steinmetz points out that other cervical tumors have massive rearrangements on chromosome 11, so the changes in the HeLa cell may have contributed to Lacks' tumor.

Potential uses

Having been replicating in labs around the world for six decades, HeLa cells have also accrued errors not present in the original tumor DNA. Moreover, not all HeLa cells
2F are identical, and Steinmetz says that it would be interesting to chart the cell's evolution.

Whatever their origin, the genetic changes raise questions over the widespread use of HeLa cells as models for human cell biology, Steinmetz says. For instance, his team
2G found that around 2000 genes are expressed at levels higher than those of normal human tissues because of the duplications. Alternative cell lines, such as induced pluripotent stem cells generated from patient skin cells, offer a more accurate window on human biology, he says.

Mathew Garnett, a cancer biologist at the Wellcome Trust Sanger Institute near Cambridge, UK, says that HeLa cells could prove useful for studying aspects of the
2H biology of cervical tumors, such as their response to cancer drugs. In recent years, the genomes of many cervical tumors have been sequenced, and so it should be possible to see how these compare with the HeLa genome.

Steinmetz also points out that thousands of research papers based on HeLa cells, along with HeLa resources such as genetically manipulated lines and now a genome,
2I means that labs will continue to stock the cells, even if they are not a perfect model of human biology. "These are not going to go out of fashion over the next 10 years," he says. "I'm not sure where we're going to be 20 years from now."