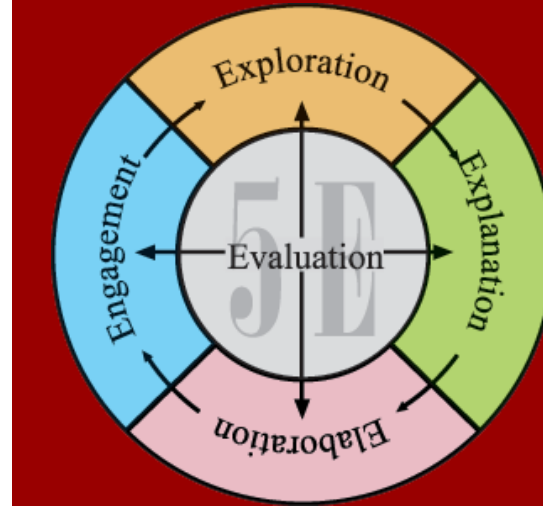


New Perspectives  
in Science  
Education  
Conference

Florence, Italy  
March 20-21, 2025



Dr. Martha M. Day  
Professor of STEM  
Education  
SKyTeach Co-Director  
[Martha.day@wku.edu](mailto:Martha.day@wku.edu)

Western Kentucky  
University

Increasing Student Identity with STEM....Culturally  
Relevant Pedagogy in the STEM Classroom Through  
Historical Perspectives



# Why include diverse perspectives in STEM Teaching?

“**Diverse perspectives** in STEM teaching **de-centers** dominant scientific narratives, promotes critical thinking, and offers a **deeper understanding** of the **social** and **political** roles of **science**.” Lee, E. et. al., 2023

“When **STEM faculty** teach **more inclusively** students....Increase their knowledge of **social identities** and **barriers** to **learning** in STEM classrooms, Change their attitudes about **student ability** in STEM and **modify** their teaching approaches to promote **inclusivity** and **cultural responsiveness**”, O’Leary, E., et. al., 2020





## Why include diverse perspectives in STEM Teaching?

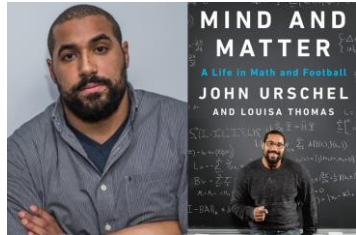
“Girls who engage in **STEM identity** work are more likely to **see themselves as scientists** than those who do not”, Hall & Butler, 2022

“**Student recognition as scientists** is strongly related to **long-term STEM motivation** in **minority students**”, Starr, C. et.al., 2020



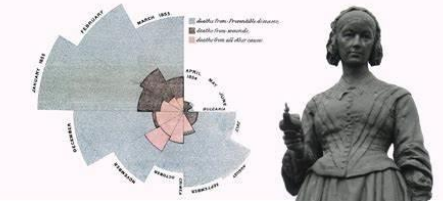


# Expanding Diverse Perspectives in STEM & Reforming Teaching Strategies



Dr. John Urschel MIT, NFL Math

*The Lady with the Pie Chart*



Florence Nightingale (Rose Charts)



Viet Tran and Seth Robertson, GMU (Sound waves to fight fires, Sound lesson)



Dr. Fabiola Gianotti, CERN



Hertha Ayrton, Arc Lamps



Emily Roebling, Brooklyn Bridge



Dr. Marian Diamond, Neurology



## 5E Lesson for SMED 340

Create and Teach a 5E Lesson in YOUR CONTENT AREA

Lesson Template Provided (Standards-Based, Objectives, 5E format)

A Pre- and Post- Assessment must be included

A substantive **historical component** MUST be included: Learning about a scientist/mathematician/inventor/invention in STEM using both a Primary and Secondary source.

At least one of the persons you showcased must be from a **marginalized group of individuals**.



## 5E Lesson for SMED 340

At least one **differentiation** component must be included: Learning Menu, Think Tac, Toe, Bloom's Chart or other approved differentiation activity



There must be EVIDENCE provided of at least **TWO Research-Based Effective Techniques** (Statement sort, similarity/differences, self evaluation, or other technique from the course textbook).



At least one **technology** component must be included (Flipgrid, Edpuzzle, Animoto, Kahoot!, Quizizz, Nearpod, Padlet, or other approved technology).

# Perspectives 5E Lesson Plan



- Pre-Service Teachers present a 2-day lesson

(Observed 1-2 times by professors)

- Five checkpoints

**Checkpoint One** Standards Taught & Topic (Communication with Field Teacher)

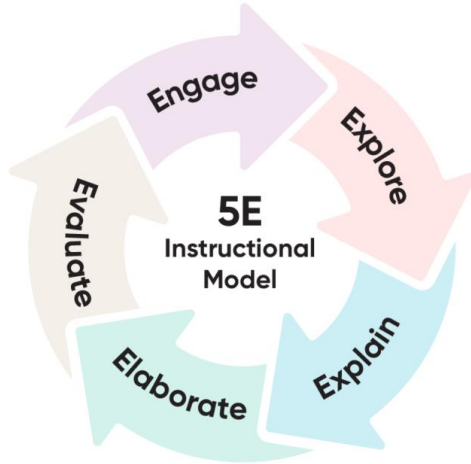
**Checkpoint Two** Lesson Concept and Outline

**Checkpoint Three** Lesson Concept (Differentiation Idea, Technology Idea, Research Based Strategy Idea, Historical Component Idea, Draft of Pre-Post Assessment)

**Checkpoint Four** Draft of Lesson Plan and Lesson Materials with Supply Order

**Checkpoint Five** Final Draft of Lesson Plan & Rehearsal

# The 5E Model of Inquiry Based STEM Pedagogy



***What does Culturally Relevant Pedagogy mean to you?***

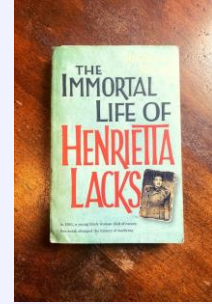


5E Perspectives Lesson Sample Developed  
by SKyTeach Student

# Henrietta Lacks



# and the Cell Cycle





# Next Generation Science Standards

## **HS-LS3: Heredity: Inheritance and Variation of Traits**

***Performance Expectation 1 (HS-LS3-1):*** Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

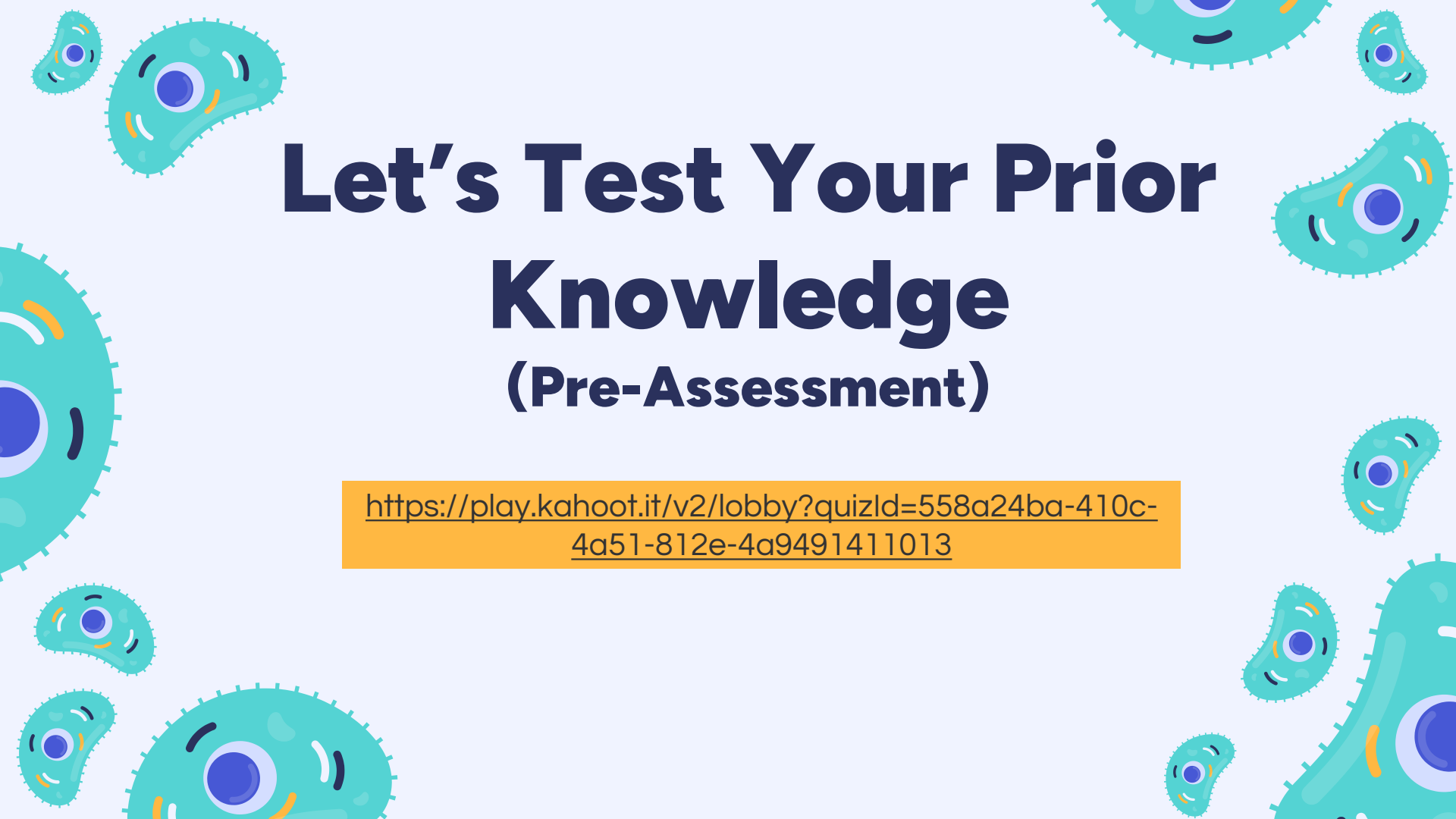
***Performance Expectation 2 (HS-LS3-2):*** Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

***Performance Expectation 3 (HS-LS3-3):*** Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.



Oh Happy Day!

**You will need to get  
out a computer.**



# Let's Test Your Prior Knowledge (Pre-Assessment)

<https://play.kahoot.it/v2/lobby?quizId=558a24ba-410c-4a51-812e-4a9491411013>

# Engage: What is ethics?





# EXPECTATIONS

With our next activity, there will be differing opinions... that is okay!

We will not be questioning the integrity of others, or bully.

We will...

1. Be Nice
2. Listen to what others have to say even if we don't agree
3. Not get loud or defensive

Any Questions?



# This or That

Is it okay to take an ink pen from a bank?

Is it okay to sell a car to someone without telling them all the negative details?

Is it okay to take something from someone else without them knowing (stealing)?

# This or That

Is it okay for someone to talk about you and what you do if they don't say your name?

Is it okay for your information to get spread all over the world?

Is it okay to take something from someone else without them knowing, share it with others all over the world, not give credit to the person they took it from or their family even if it saves thousands of lives?



# THE FIRST LINE OF IMMORTAL HUMAN CELLS

TEDEd





**Explore: Let's  
Learn More  
about  
Henrietta**







# Let's Go Back To Ethics

After watching the videos,  
Was taking Henrietta Lacks's cells  
ethically correct? Why or Why Not?

## KAGAN STRATEGY

Write your answer on a post-it note

← Stand up, hand up, pair up

Share your thoughts with your  
partner

Stand up, hand  
up, pair up

StandUp, HandUp,  
PairUp



### • Steps

1. When I say "Go" you will stand up, hand up, pair up.
2. Keep your hand high in the air until you have a partner.
3. I will ask a question and give think time.
4. You will interact with your partner using Rally Robin or Timed Pair Share.

## All this talk...

We have talked a lot  
about cells, but what  
are they?





# How Do Cells Replicate?

Raise your hand if when you were little you fell and scraped your knee?

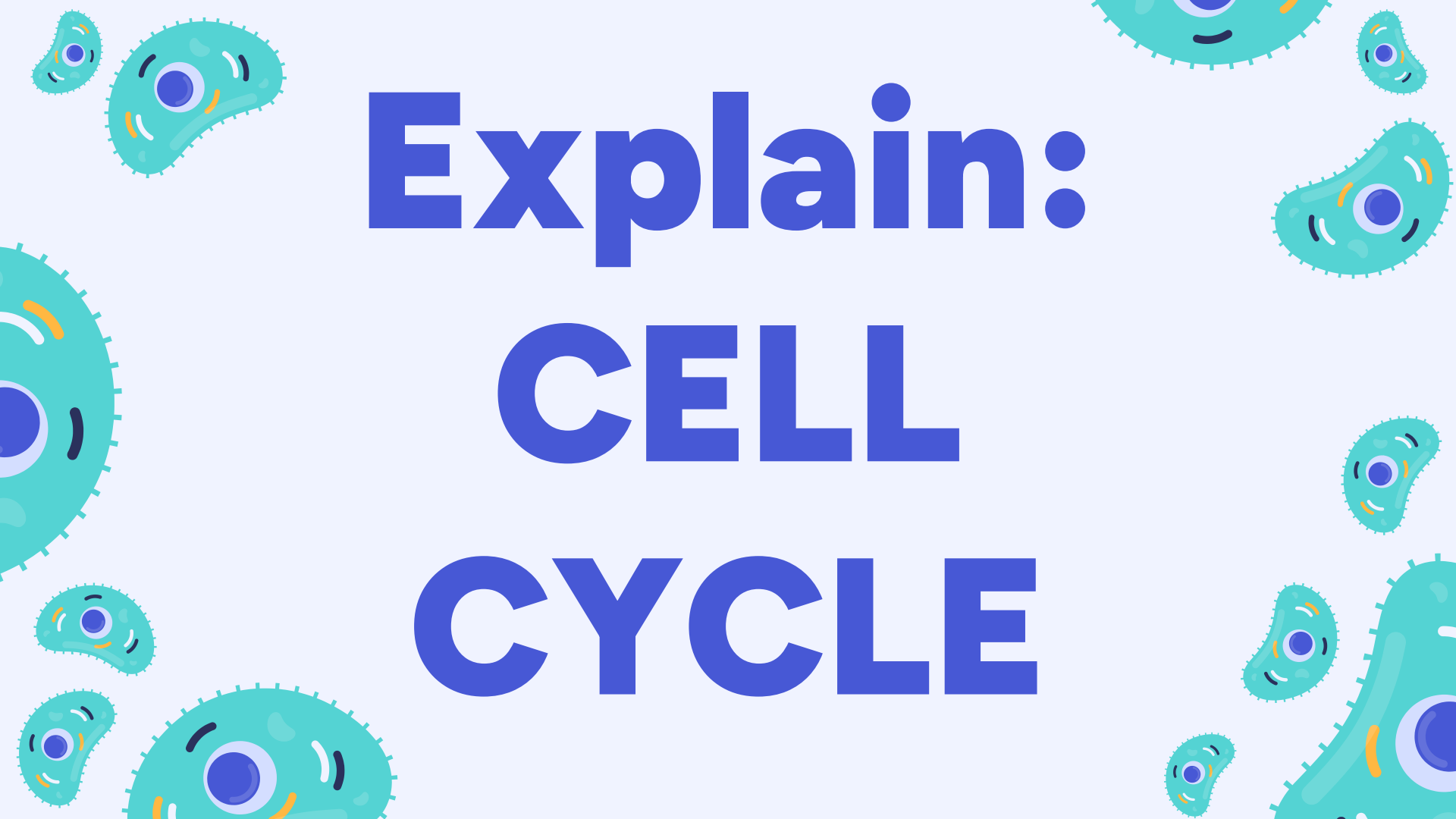
Now raise your hand if that same scrape you had on your knee when you were little is still there?

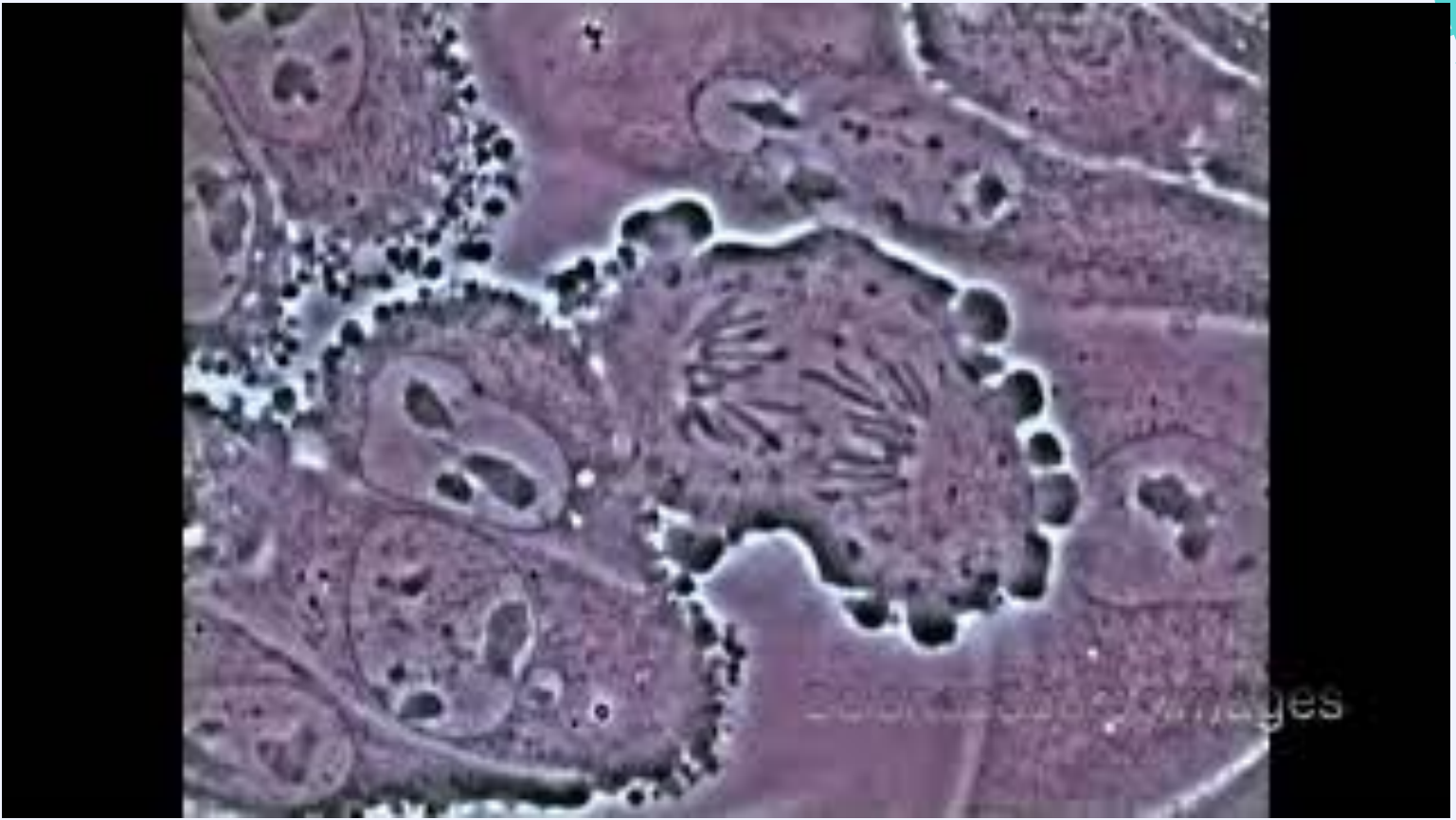
## WHY IS THAT??





# Explain: CELL CYCLE





Colorized Scanning Images



Write a six-word story over what you saw in the video (Cell Cycle)

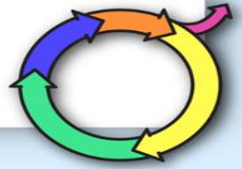
# Quick Write Using Chat GPT

The slide features several stylized, cartoonish cells in shades of teal and blue. Each cell has a prominent blue nucleus and small orange and yellow structures. Some cells have short, radiating lines representing cilia or microvilli. The cells are scattered around the edges of the slide, with a larger one in the top right and another in the bottom right, and smaller ones in the top left and bottom left.

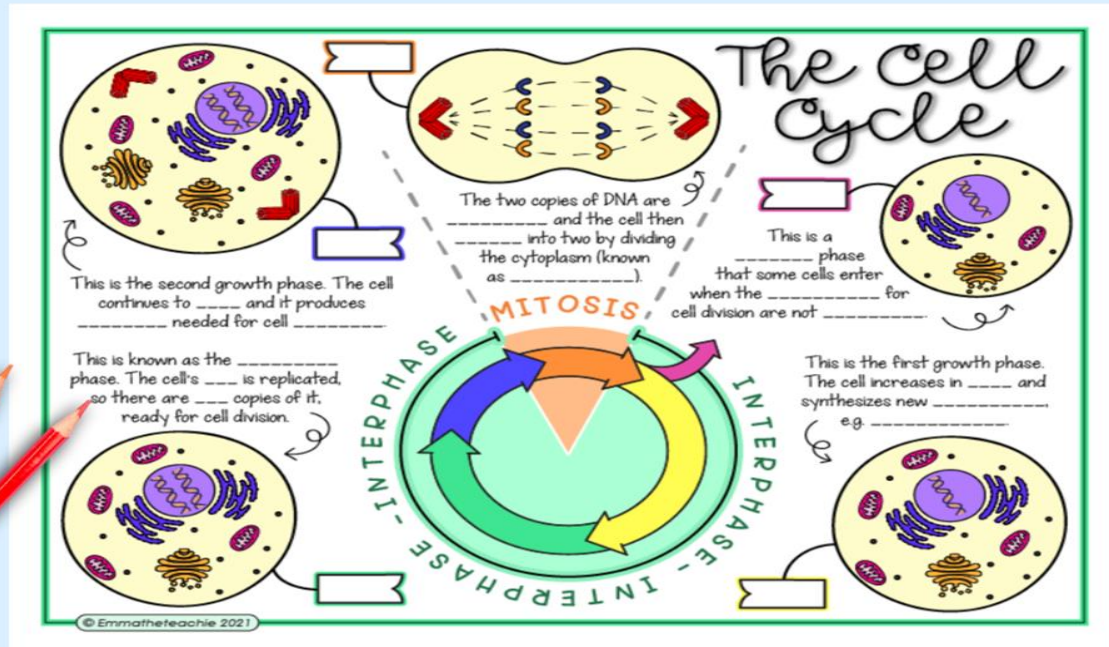
# Cell Cycle Overview

We are going to complete some doodle notes over the cell cycle. When you are completing your notes, make sure to write down words that you don't know the meaning of on a separate piece of paper.

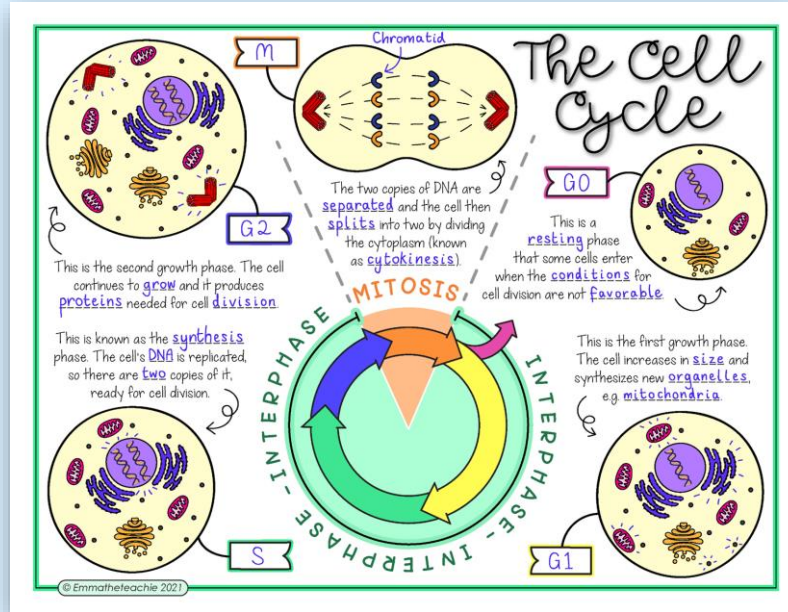
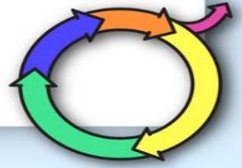
# The Cell Cycle



## DOODLE NOTES

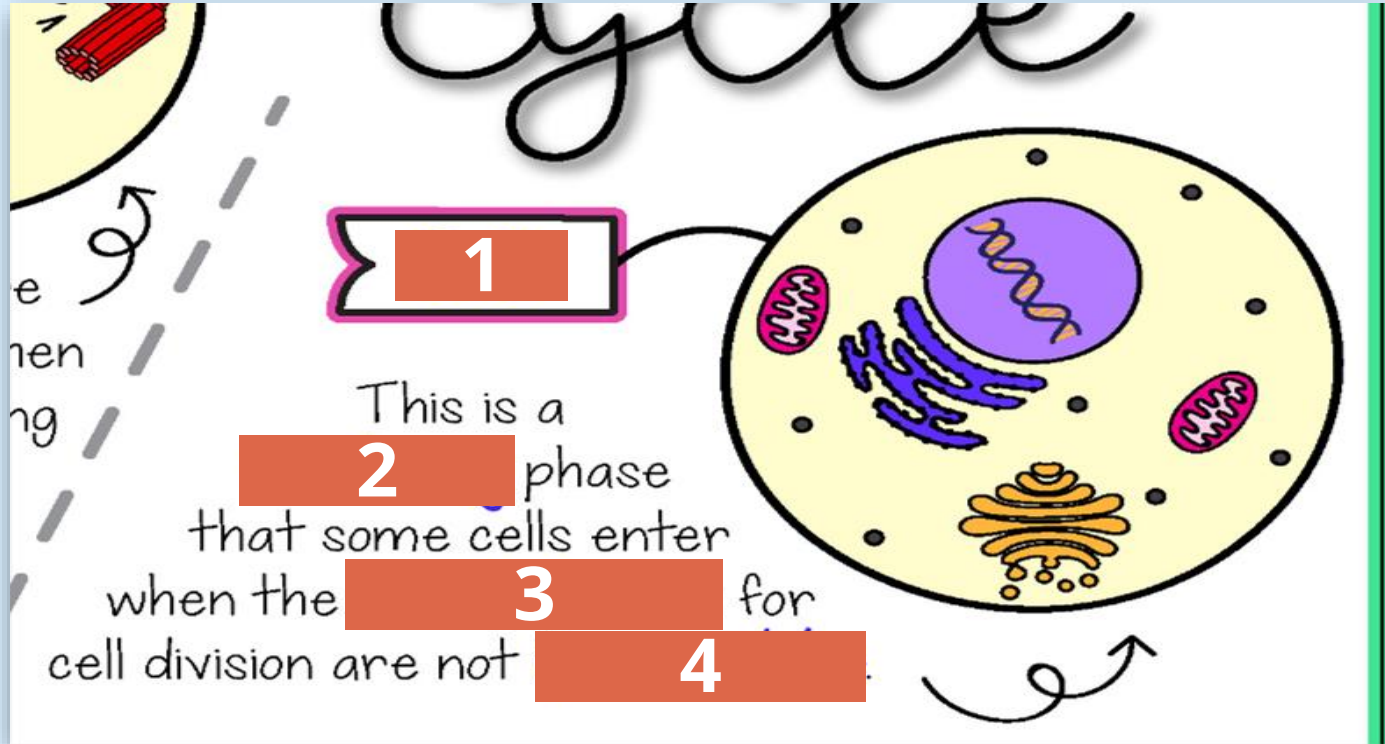
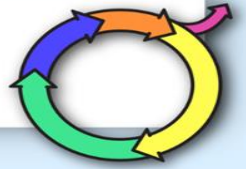


# The Cell Cycle

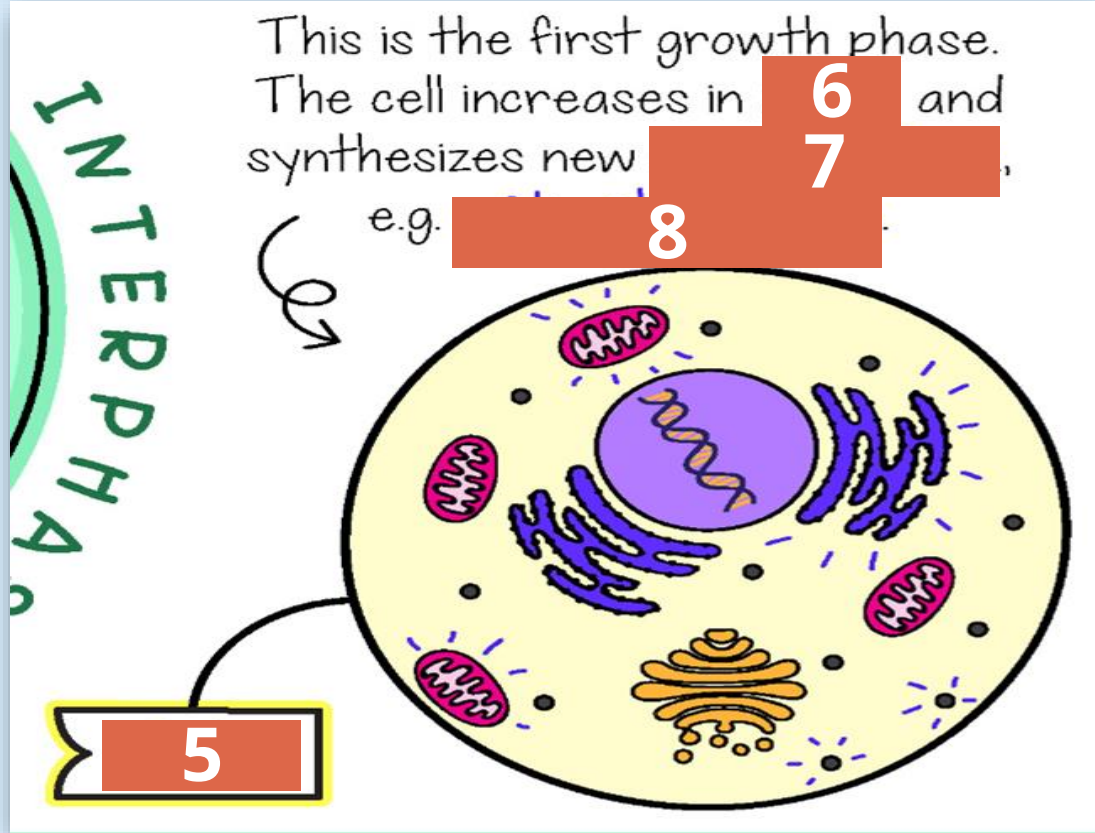
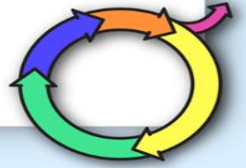


PAGE 1

# The Cell Cycle



# The Cell Cycle

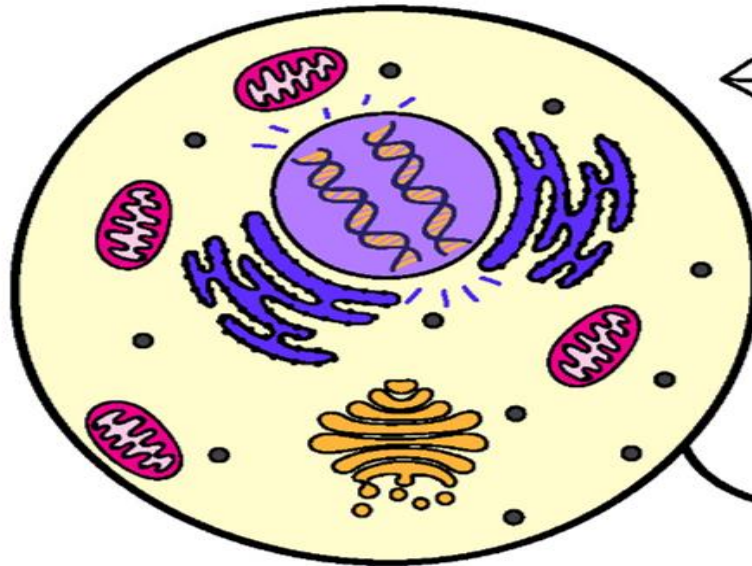




# The Cell Cycle

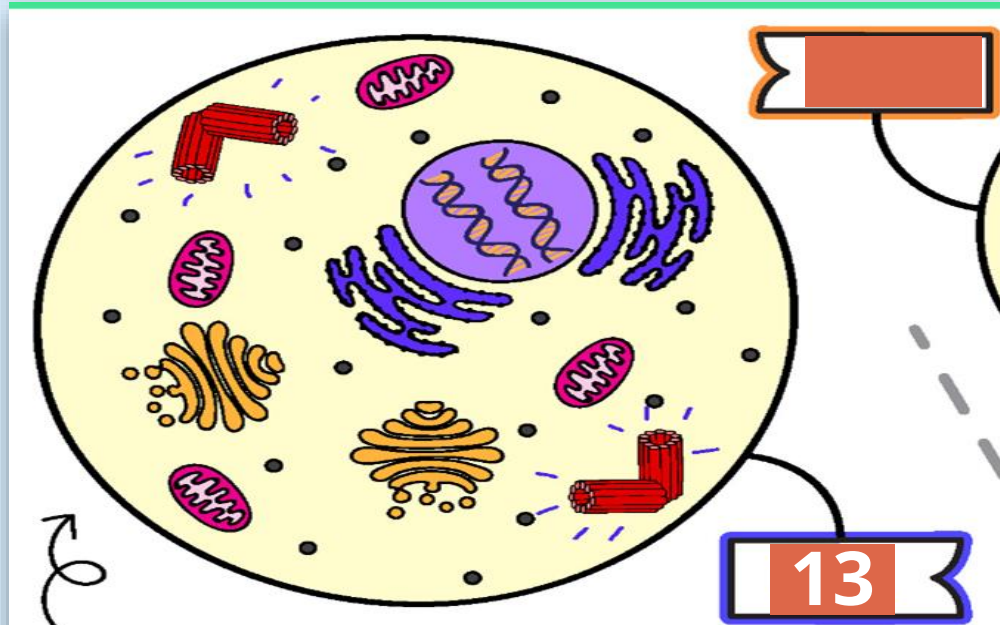


This is known as the **10** phase. The cell's **11** is replicated, so there are **12** copies of it, ready for cell division.



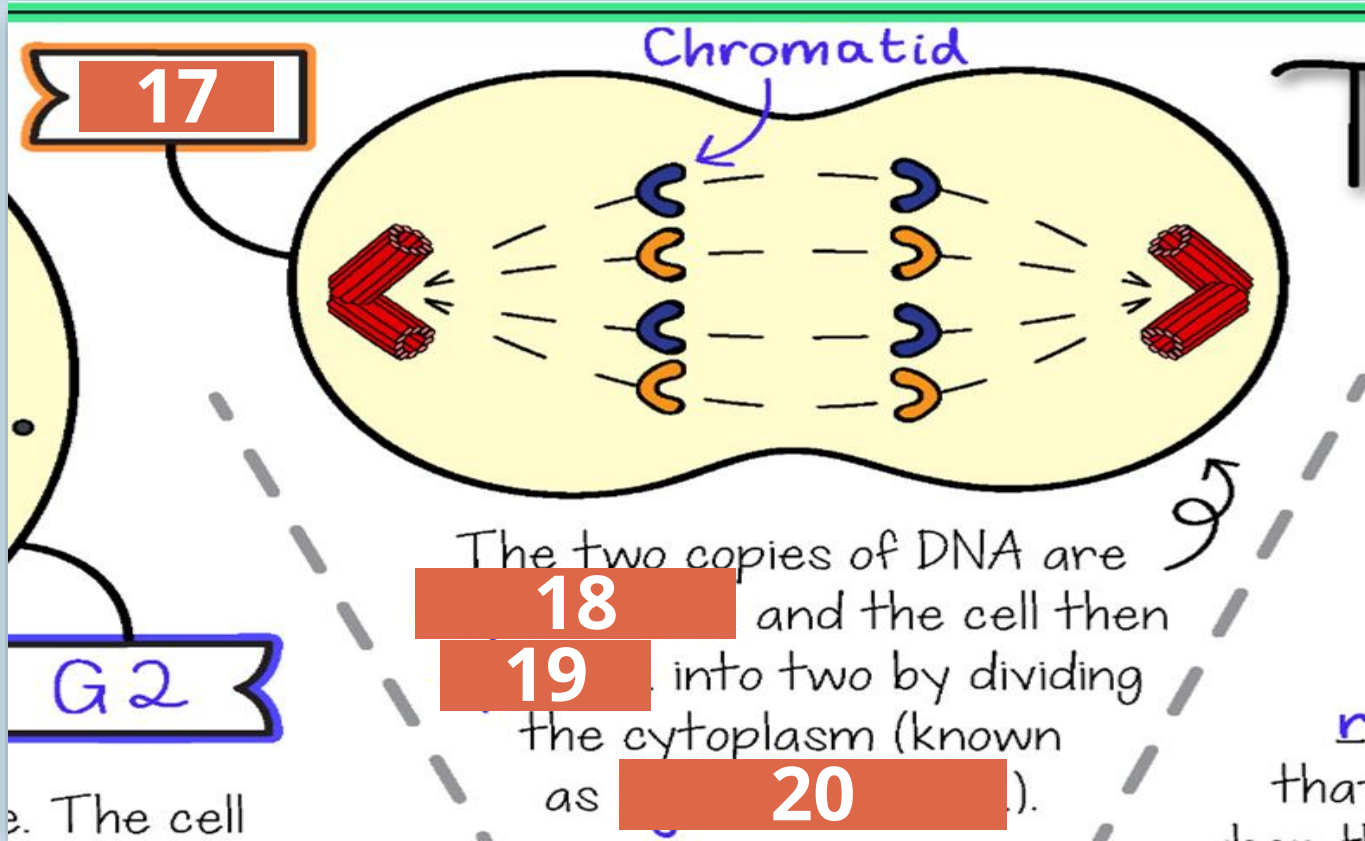
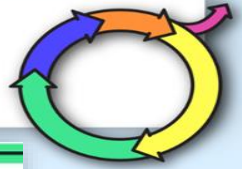
**9**

# The Cell Cycle

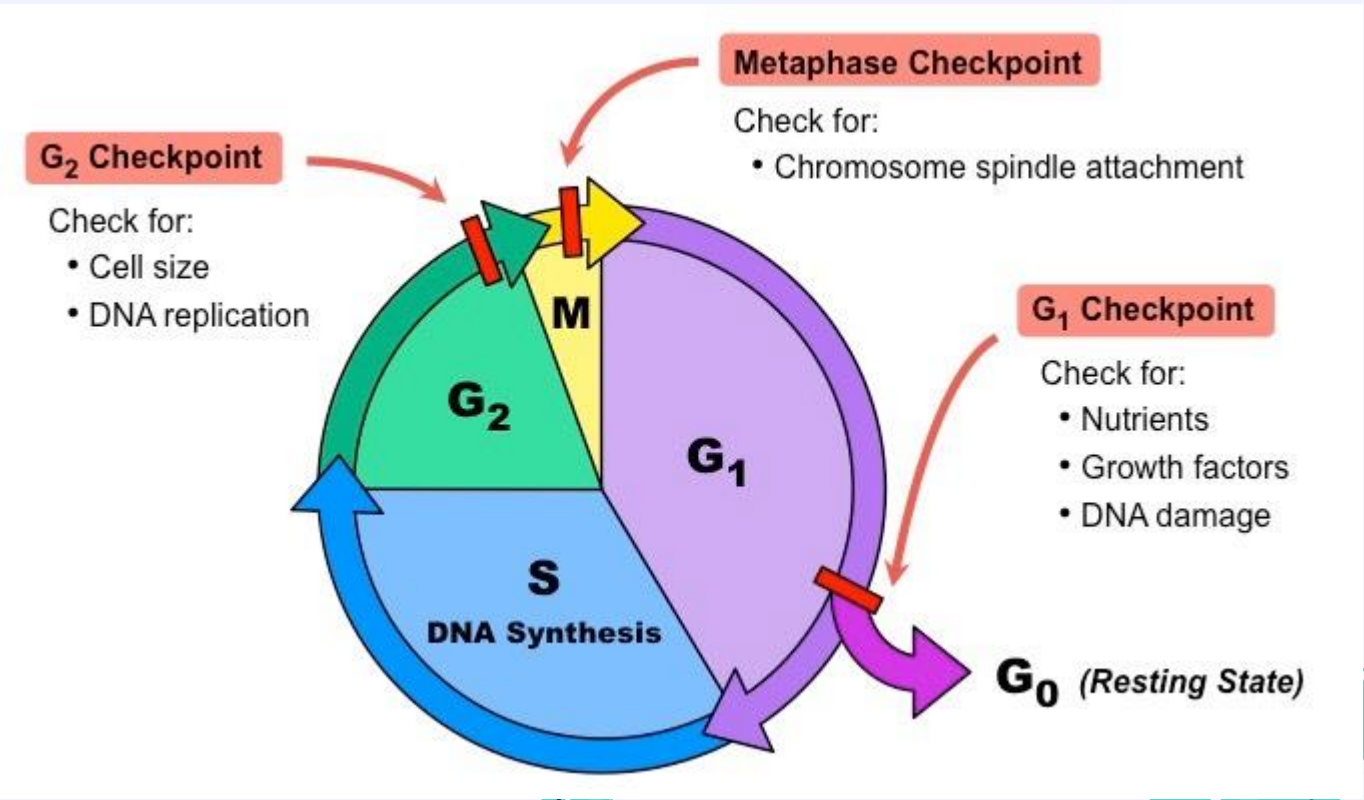


This is the second growth phase. The cell continues to **14** and it produces **15** needed for cell **16**.

# The Cell Cycle



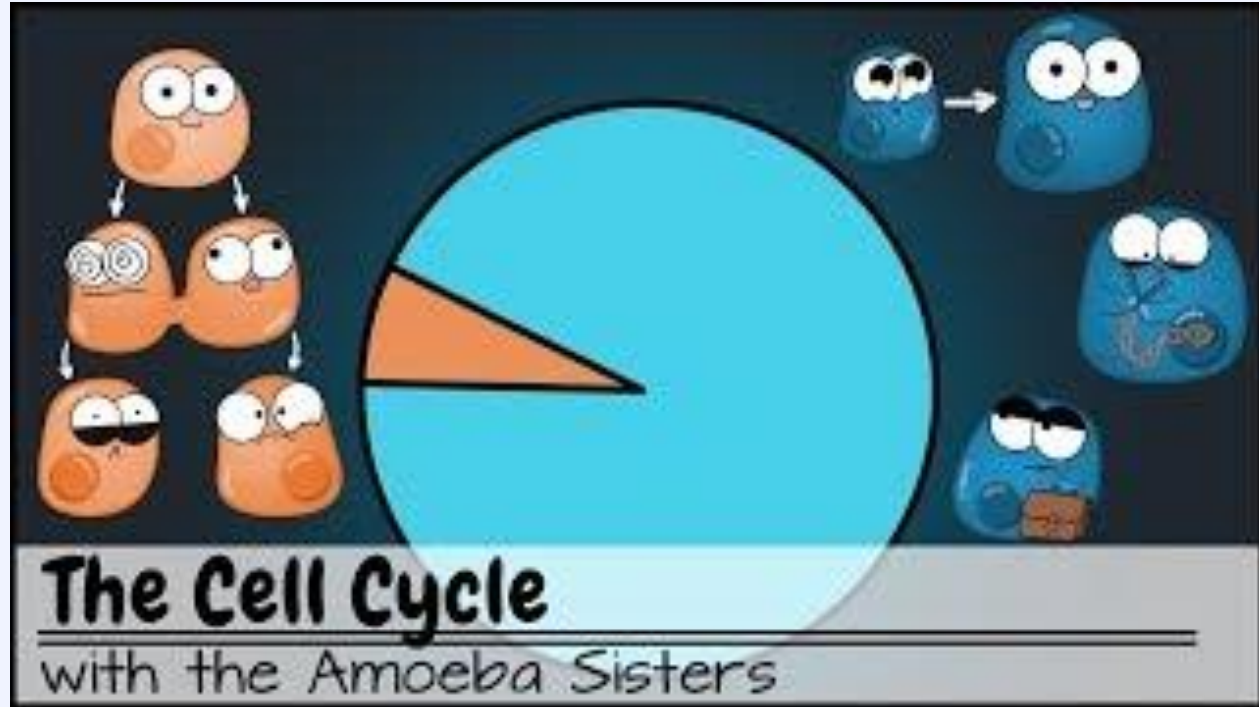
# CHECKPOINTS



# THE CELL CYCLE: Regulation and disruption

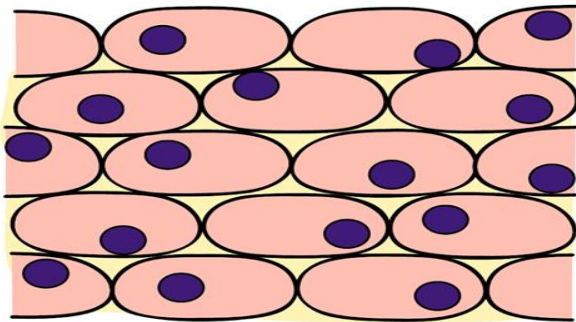
- The cell cycle must be regulated to ensure that the cell only divides under favorable conditions.
- If the conditions are unfavorable, the cell may enter the G<sub>0</sub> phase.
- When errors are detected, the cell may undergo apoptosis - programmed cell death.
- Cancerous cells result from uncontrolled cell division.

# Amoeba Sister

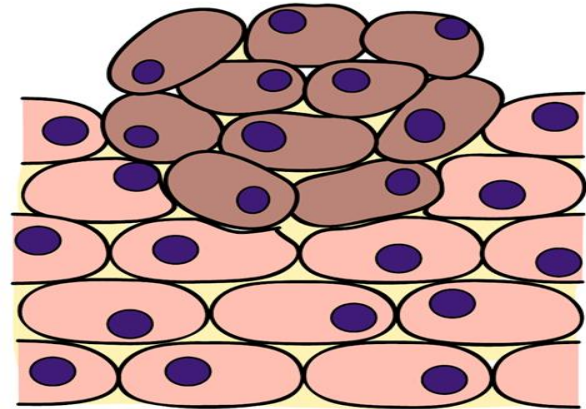


# THE CELL CYCLE: Regulation and disruption

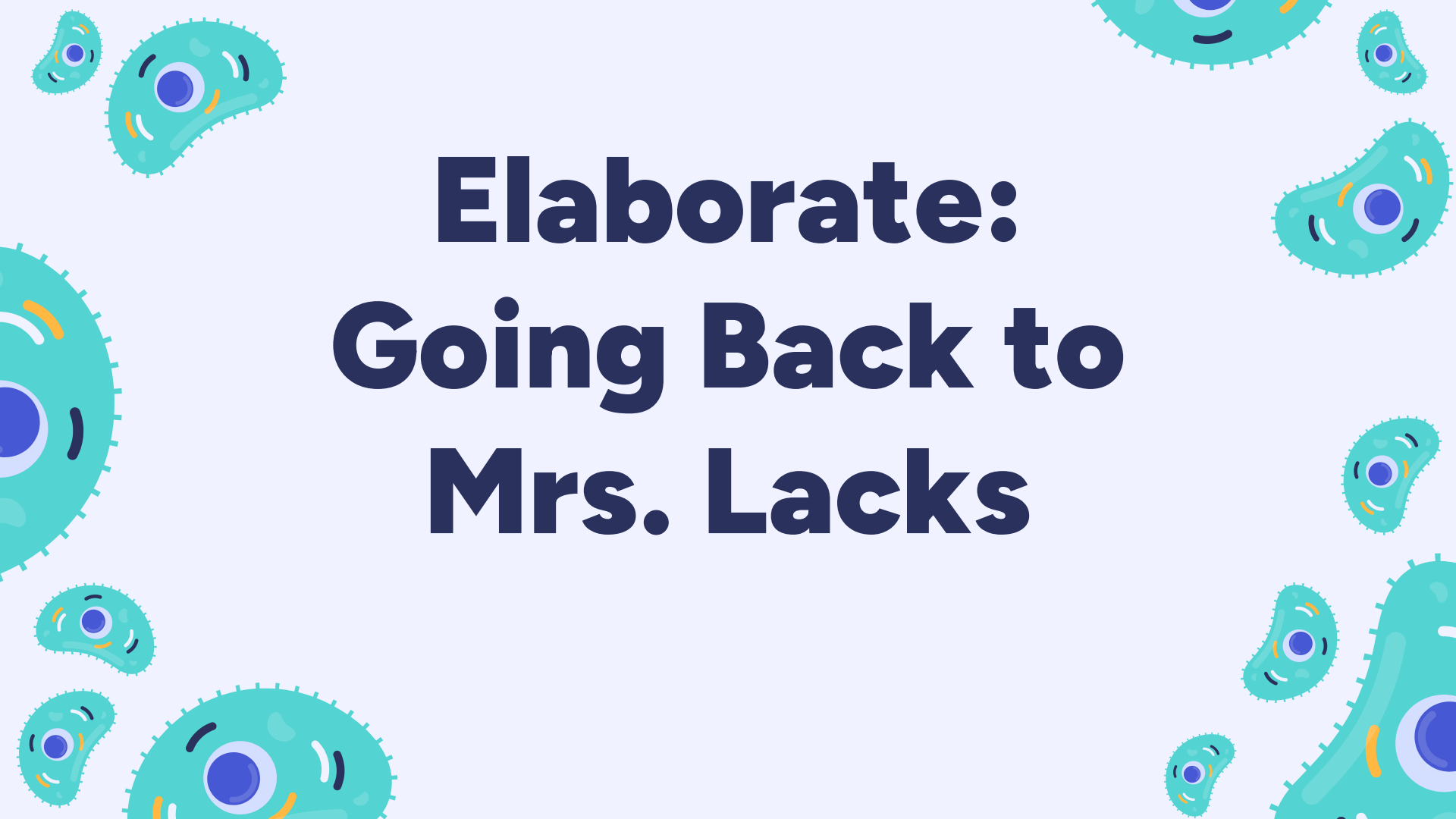
Occasionally, DNA errors **are** missed - if the mutation occurs in a gene that regulates the cell cycle, the cell can become cancerous. This means it divides uncontrollably, so that many more cells are produced than are needed - this is what causes tumors. Growing tumors can put pressure on organs, reducing their ability to function.



Normal skin tissue

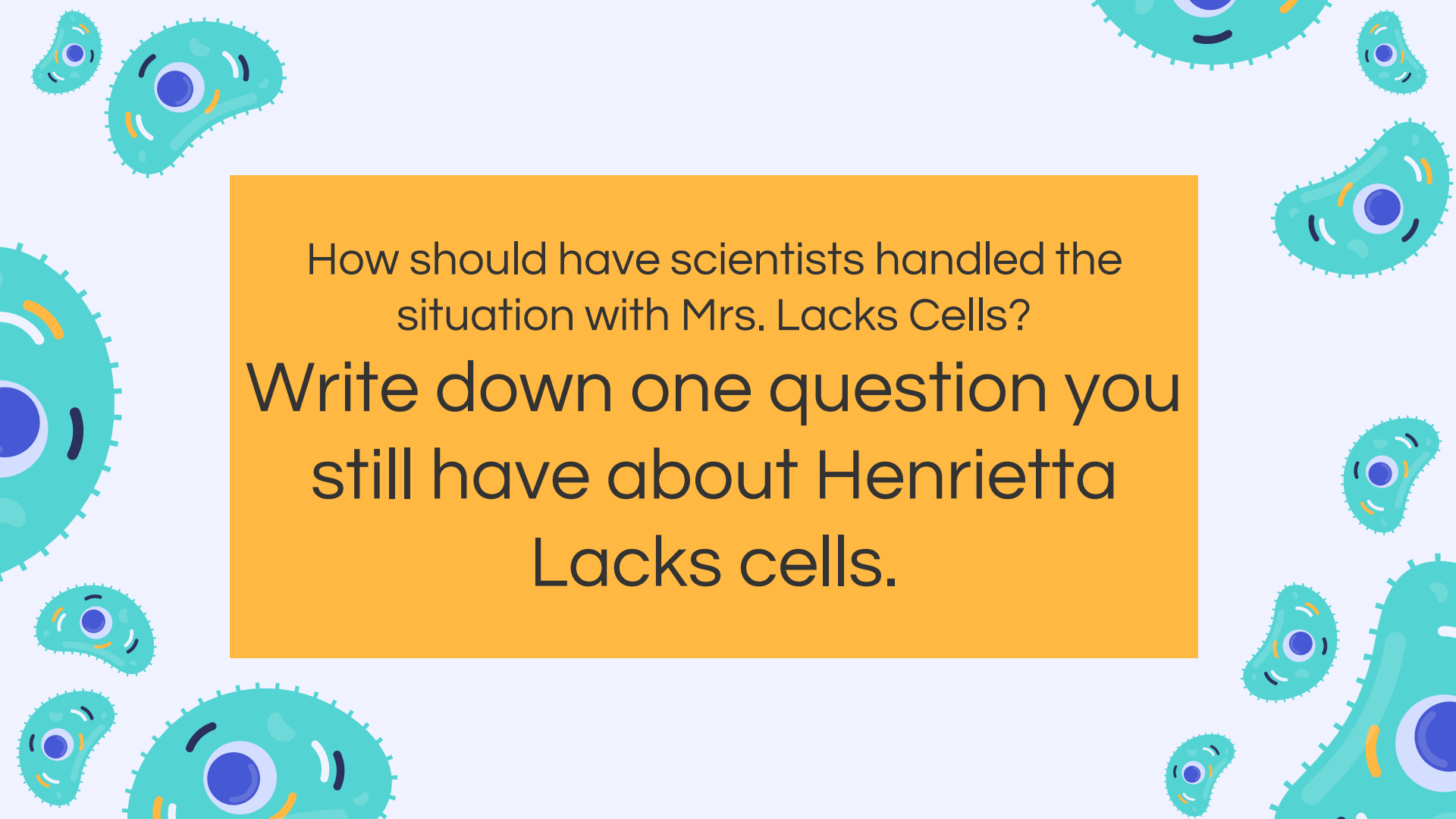


Skin tissue with cancerous cells forming a tumor



# **Elaborate: Going Back to Mrs. Lacks**



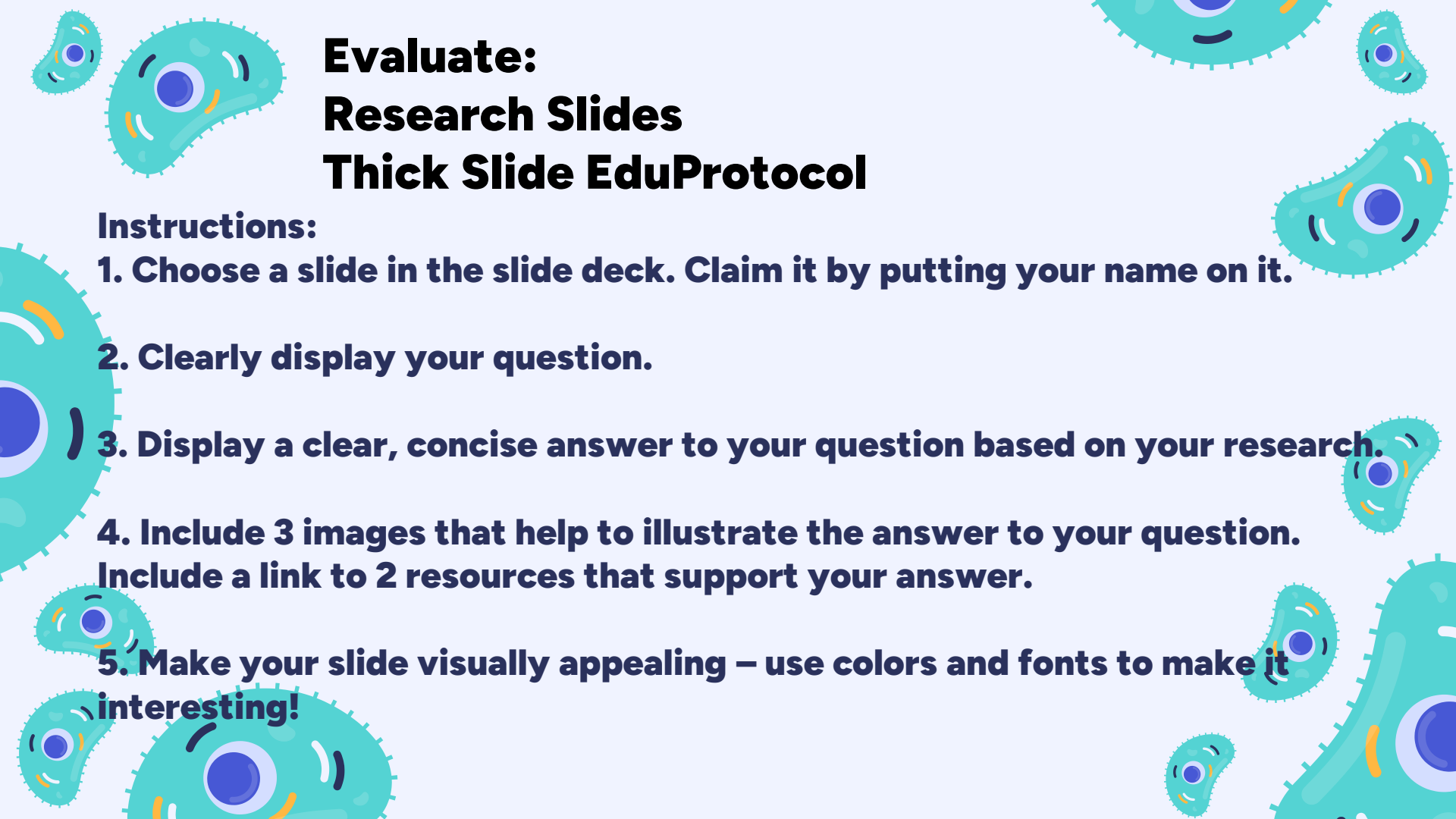


How should have scientists handled the situation with Mrs. Lacks Cells?

Write down one question you still have about Henrietta Lacks cells.



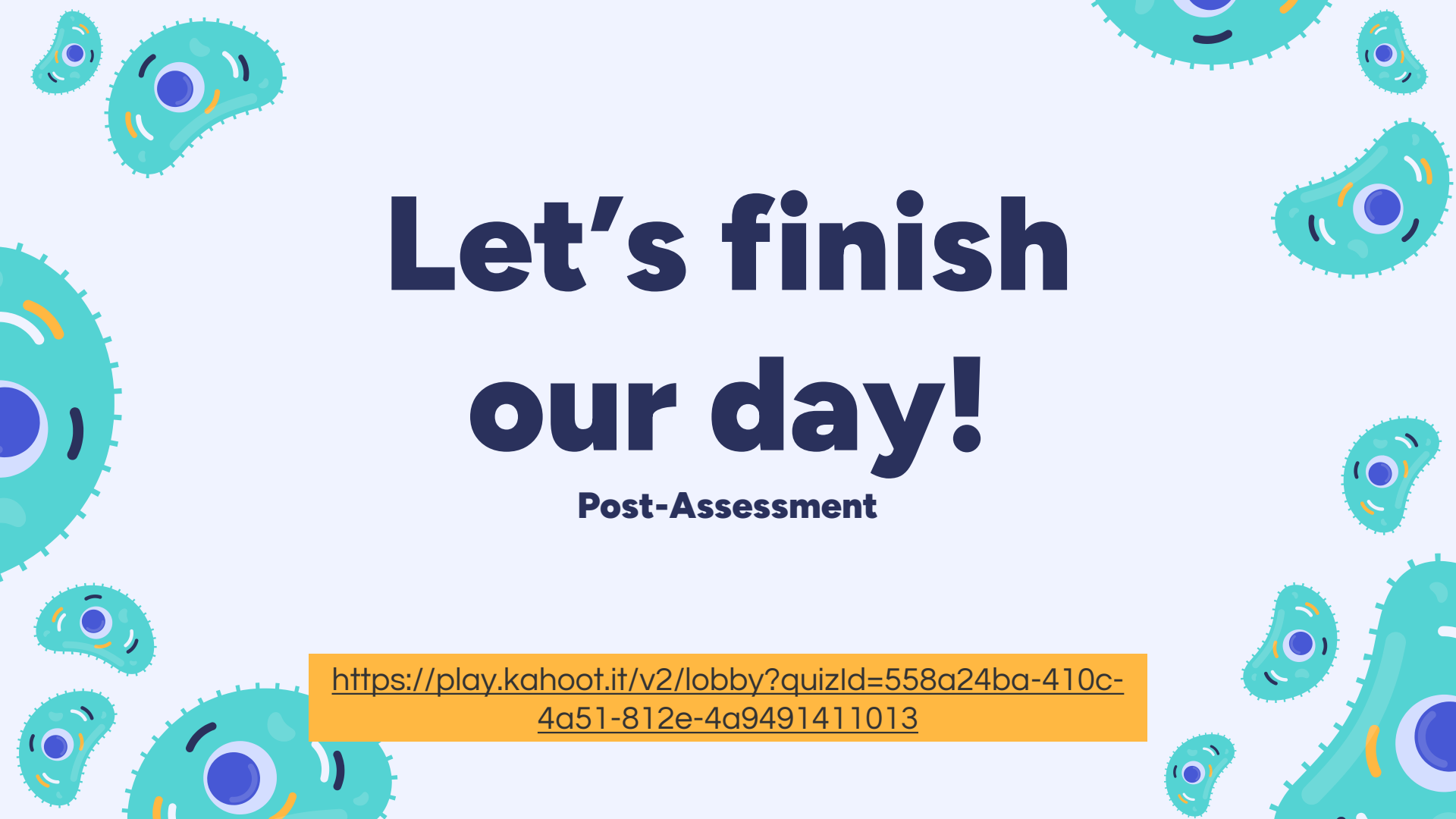
**The science and  
research of cells  
is still important  
to this day.**



# **Evaluate: Research Slides Thick Slide EduProtocol**

## **Instructions:**

- 1. Choose a slide in the slide deck. Claim it by putting your name on it.**
- 2. Clearly display your question.**
- 3. Display a clear, concise answer to your question based on your research.**
- 4. Include 3 images that help to illustrate the answer to your question. Include a link to 2 resources that support your answer.**
- 5. Make your slide visually appealing – use colors and fonts to make it interesting!**

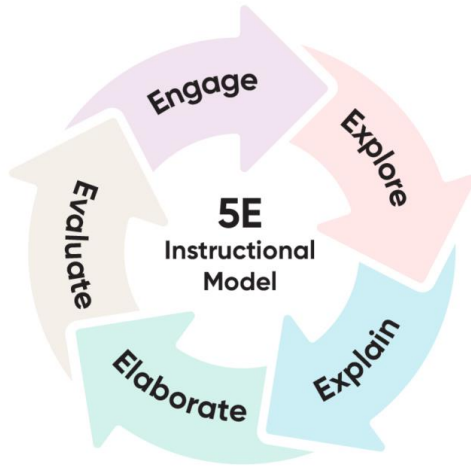


# Let's finish our day!

**Post-Assessment**

<https://play.kahoot.it/v2/lobby?quizId=558a24ba-410c-4a51-812e-4a9491411013>

# The 5E Model of Inquiry Based STEM Pedagogy



***How does this model differ from traditional STEM LESSONS?***

**What items made the lesson culturally relevant?**

Questions?

# Related Projects

**Painting The Classroom:**  
Pigments & The Paint They Create

This session brings art into the **science** classroom as we venture into the process of how paints are made. We will be generating one pigment and paint using easy to obtain materials and help incorporate the arts to more engage student learning.

Using self-made paints and pigments, every teacher will have a little more color to add to their classrooms!

**Sign Up**

**MON | APRIL 10TH**  
**4:30 PM - 7:30 PM**  
**Kelly Thompson Hall**  
**RM 1008, WKU**

**PARTICIPANTS WILL RECEIVE A \$25 STIPEND, 3 HRS PD CREDIT, & DINNER!**  
**- Open to Pre & InService Teachers -**

For more information  
Contact [jillian.burkhalter@wku.edu](mailto:jillian.burkhalter@wku.edu)



**Dr. Pesterfield**  
SkyTeach Co-Director, WKU



**Trevor Webster**  
Science Teacher, BGHS



**John Lazarus**  
Paint Launch Manager, GM

## STEM-TIP grant (Teacher Industry Partnership)

**Pairing a STEM Teacher  
with an Engineer to  
deliver standards-based  
model lessons**

# References



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