Day 1: Driving Question: How does a single cell become many different kinds of cells?

A) Watch the two videos provided on the class website – Unit 6
   https://sciencemathhelpcenter.weebly.com/unit-6---cell-growth--development.html
   and generate a list of at least 5 questions that you may have about what you have seen.

   Video: Tadpole eggs to frogs
   Video: Planaria

B) Students share questions with class and narrow down the list of questions to the top 3 questions.
   Write the 2 to 3 main questions here...

Day 2: Driving Question: How does a single cell become many different kinds of cells?

C) As a small group or individually, complete the following... Then share your responses with the class.
   
   (1) What ‘thing/substance’ in the cell is DIRECTING all the cells’ activities in the tadpole and planaria?

   (2) What ‘compound’ in the cell is carrying out all the functions of the cell?
D) As a small group or individually, complete the following... Then share your responses with the class.

Combine the roles of ‘DNA’ and ‘Proteins’ together in one sentence.


E) As a small group or individually, complete the following... Then share your response with the class.

What can we say about EVERY cell as it relates to ‘DNA’ and ‘Proteins’ in one sentence?

Every cell ...

____________________________________________________________________________________

___________________________________________________________________________________


Day 3: Driving Question: How does a single cell become many different kinds of cells?

F) Share responses as a class and develop one answer that will answer both of the following questions...

(1) By which process did one cell divide into many cells in the egg?
(2) By which process did the planaria regenerate?


G) Use the presentation provided on the class website – Unit 6 ‘Mitosis and Cell Cycle Presentation’ respond to the following https://sciencemathhelpcenter.weebly.com/unit-6---cell-growth--development.html

Slide 1:

What are somatic cells? (this is hard – but try)

What are daughter cells?

Slides 2, 3, 4: Describe or use Pictures to describe the following terms (no Google Definitions):

Genome
Chromatin
Chromatids
Chromosomes
Centromere
Karyotype

Slide 3:

What are histones?

What does “Double Helix” mean?
H) Use the presentation provided on the class website – Unit 6 ‘Mitosis and Cell Cycle Presentation’ respond to the following [link](https://sciencemathhelpcenter.weebly.com/unit-6---cell-growth--development.html)

Use Slides 5 thru 14: See Class Activity on slide 14

**Class Activity**

Match the ‘C’ Term with the proper definition or phase

a) cell life cycle ___ supercoil
b) chromatin ___ uncoiled DNA & histones
c) chromosome ___ S-phase
d) chromatid ___ chromatids join here
e) copying DNA ___ M-phase & Interphase
f) centromere ___ G1 & G2 phase
g) cell growth ___ 2 sister chromatids
h) cytokinesis ___ supercoiled DNA
i) coiling of DNA ___ cell splits
Day 4: Driving Question: How does a single cell become many different kinds of cells?

View 3 videos that show Mitosis and Cytokinesis in real life and in models.

1) Use the presentation provided on the class website – Unit 6 ‘Mitosis and Cell Cycle Presentation” respond to the following
   https://sciencemathhelpcenter.weebly.com/unit-6---cell-growth--development.html

Use Slides 15 thru 35:  See Class Activity on slide 35

Class Activity

Match the Plant Cell with the appropriate step of the Cell Cycle
(Interphase, prophase, metaphase, anaphase, telophase/cytokinesis)

1. cell #1
2. cell #2
3. cell #3
4. cell #4
5. cell #5
6. cell #6
7. cell #7
8. cell #8

DNA (chromatin) supercoils into chromatids
Sister chromatids join at centromere
Nuclear envelop starts to disappear
Centrioles start to form spindle fibers

Other organelles replicate while cell carries out cellular functions

Replication: DNA (chromatin) replicates

Cell grows and carries out cellular functions such as: respiration, transcription, translation, and other functions

NO longer goes Through cell division

Undo Prophase activities
J) Use the presentation provided on the class website – Unit 6 ‘Mitosis and Cell Cycle Presentation” respond to the following
https://sciencemathhelpcenter.weebly.com/unit-6---cell-growth--development.html

Use the first slide and second to last slide:

Question: Asexual reproduction in multicellular organisms is called __________________________

Question: Asexual reproduction in one-celled organisms is called ____________________________

Day 5: Driving Question: How does a single cell become many different kinds of cells?

K) Success Criteria – Teacher & Self-Assessment

Learning Target: DNA Structure

Answer each question with a ‘C’ term from the presentation.

1) The term used to describe a cell splitting into two separate cells _______________________________

2) The term used to describe where two sister chromatids join ______________________________

3) The term used to describe DNA & histones that are uncoiled ______________________________

4) The term used to describe two sister chromatids that are joined _____________________________

5) What takes place during the S-phase of Interphase ______________________________

Learning Target: Cell Cycle

Select the correct phase of Interphase or M-phase for each question.

<table>
<thead>
<tr>
<th>G1-Interphase</th>
<th>S-Interphase</th>
<th>G2-Interphase</th>
<th>Prophase</th>
<th>Metaphase</th>
<th>Anaphase</th>
<th>Telophase</th>
<th>Cytokinesis</th>
</tr>
</thead>
</table>

6) Chromatin replicates ______________________________

7) Chromosomes line up along the middle of the spindle fibers ______________________________

8) Nuclear membrane disappears ______________________________

9) Chromatin supercoil into chromatids – chromatids then join to form chromosomes ______________________________

10) Chromosomes separates into 2 sister chromatids along spindle fibers ______________________________

11/12) Cell carries out cellular respiration (2 answers) ____________________________ and ____________________________

13/14) Which two phases overlap (2 answers) ____________________________ and ____________________________

15) Spindle fibers begin to form ______________________________

16/17) Plant cells carry out photosynthesis (2 answers) ____________________________ and ____________________________

18/19) Proteins are made in the ribosomes (2 answers) ____________________________ and ____________________________

Rate your level of Understanding:

3 = Mastery/Expert      2 = Good Understanding      1 = Partial Understanding     0 = Very Little/No Understanding
Day 6: Driving Question: How does a single cell become many different kinds of cells?

‘Molecules’ in egg determine cell’s future role
These ‘molecules’ don’t separate equally during mitosis

Gene Expression
leads to
Cell Differentiation

1. All cells of an organism have identical DNA
2. Due to the presence of specific ‘molecules’ or ‘signals’, different genes are activated or “expressed” ... **GENE EXPRESSION**
3. Different genes expressed => different proteins are made
4. Different proteins => different structures and different functions for each cell
5. **CELL DIFFERENTIATION**
6. Once a cell is differentiated (in vertebrates), cells cannot become any other type of cell
L) As a small group or individually, complete the following... Then share your response with the class.

How do cells, with identical DNA, develop into different structures that have different functions?

M) As a small group or individually, complete the following... Success Criteria – Teacher & Self-Assessment

Learning Target:
What is a “gene”?

Write a single sentence that correctly uses the terms “cell differentiation”, “gene expression” and “proteins”.

Rate your level of Understanding:
3 = Mastery/Expert  2 = Good Understanding  1 = Partial Understanding  0 = Very Little/No Understanding

Summary: What we know so far:

<table>
<thead>
<tr>
<th>Terms</th>
<th>Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNA</td>
<td>1. DNA has instructions (recipes) for making proteins.</td>
</tr>
<tr>
<td>Gene</td>
<td>2. A segment of DNA (gene) is responsible for a different protein or part of a protein.</td>
</tr>
<tr>
<td>Proteins</td>
<td>3. Proteins control all the functions in a cell</td>
</tr>
<tr>
<td></td>
<td>4. Every cell has a complete set of instructions for all proteins needed by the organisms</td>
</tr>
<tr>
<td>Mitosis</td>
<td>5. Growth occurs when cells divide by MITOSIS</td>
</tr>
<tr>
<td></td>
<td>6. In mitosis, a cell divides to form 2 new cells with identical DNA.</td>
</tr>
<tr>
<td></td>
<td>The DNA of the daughter cells is identical to that of the parent cell.</td>
</tr>
<tr>
<td>Gene Expression</td>
<td>7. Different genes are activated (expressed) in different cells as embryo develops. For each gene expressed, a different protein is made.</td>
</tr>
<tr>
<td>Cell Differentiation</td>
<td>8. Different proteins cause cells to develop different structures and different functions.</td>
</tr>
</tbody>
</table>
Day 7: Driving Question: How does a single cell become many different kinds of cells?

Stem Cells

...can replicate themselves

...can differentiate into many cell types

Adult Stem Cells...

...can only become certain types of cells (such as different types of blood cells)

Embryonic Stem Cells...

...can differentiate into ANY cell type

However, current biology research has allowed us to reprogram any somatic cell (such as a skin cell) into behaving as an embryonic stem cell

(For example, skin cells)
As a small group or individually, complete the following... Then share your response with the class.

Why are stem cells so important?

Why would a DNA mutation in a stem cell be more devastating than a mutation in a somatic cell?

How did current biology research solve the ethical question of using embryonic stem cells?

Individually, complete the following: Success Criteria – Teacher & Self-Assessment

How can Planaria regenerate their head?

Rate your level of Understanding:

| 3 = Mastery/Expert | 2 = Good Understanding | 1 = Partial Understanding | 0 = Very Little/No Understanding |

Day 8: Driving Question: How does a single cell become many different kinds of cells?

1) Use the class website –Unit 6 - click on the tab to view presentations on Homologous Structures vs Analogous Structures
   https://sciencemathhelpcenter.weebly.com/unit-6---cell-growth--development.html
   * Read the article

2) Use the class website –Unit 6 - click on the tab to view the presentation on Comparative Anatomy and Embryology
   https://sciencemathhelpcenter.weebly.com/unit-6---cell-growth--development.html
   * Read the article
   View the first video embedded in the article on Homologous Structures
   View the second video embedded in the article on Vestigial Structures

3) Complete Boxes O, P, and Q using these articles and videos...
0) Complete the following Compare & Contrast chart with the details you learned from the articles and videos.

<table>
<thead>
<tr>
<th>Homologous Structures</th>
<th>Analogous Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Homologous Structures and Analogous Structures**
(what they have in common)

P) Answer these two questions using the articles and videos.

  What are Vestigial Structures?

  List 6 examples of Vestigial Structures.

Q) Answer this question using the articles and videos.

  What 2 structures are common in all embryos of Vertebrates?

Day 9: Driving Question: How does a single cell become many different kinds of cells?

R) Use the class website – Unit 6 – view the diagram on **Twins – Identical vs Fraternal**
  [https://sciencemathhelpcenter.weebly.com/unit-6---cell-growth--development.html](https://sciencemathhelpcenter.weebly.com/unit-6---cell-growth--development.html)

  Name two ways that Identical Twins are different from Fraternal Twins.

  1)

  2)

Rate your level of Understanding:
3 = Mastery/Expert    2 = Good Understanding    1 = Partial Understanding    0 = Very Little/No Understanding
Day 9: Driving Question: How does a single cell become many different kinds of cells?

Study Guide – Unit 6

1) Label each cell with the appropriate step in the Cell Cycle.

2) Describe what is happening in each step.

3) What happens during each stage of Interphase?

4) Do the muscle cells in your heart have the same DNA as the cells that make up your eyeball? Justify your answer.
5) What does Figure A represent? What do we call these structures?

Analogous Structures
Appendages (wings) that have similar function (flight) but have different internal structures.
The internal structures are different because they came from different ancestors.

6) What does Figure B represent? What do we call these structures?

Homologous Structures
Appendages that have different functions (fly, swim, walk) but have similar internal structures.
The internal structures are similar because they came from a common ancestor.

7) What does Figure C represent? What does this show about vertebrates?

Embryos of vertebrates have similar structures.
All vertebrate embryos had (1) gill slits and (2) a tail.
Comparative Embryology of vertebrates indicates that vertebrates had a common ancestor.

8) Which of the 3 figures above represent organisms that came from a common ancestor?

Justify your answer.

Figure B and C
Both groups have similar structures, therefore it is believed they came from a common ancestor.

10) Which of the 3 figures above represents organisms that DID NOT come from a common ancestor?

Justify your answer.

Figure A
These organisms had different structures. It is believed they did NOT have a common ancestor.
11) What are vestigial structures? Give some examples.

Structures that are smaller or not fully formed and do not function/work. It is believed that these structures did work in a past ancestor. Examples: appendix, coccyx (tailbone), goosebumps.

12) How are Adult and Embryonic Stem Cells the same? How are they different?

Same: Both Adult and Embryonic Stem Cells have not yet determined their specific function/job in the body.

Different: Embryonic Stem Cells can become any type of cell in the body. Adult Stem Cells can only become any type of groups of cells such as:
- any type of blood cell
- any type of muscle cell
- any type of nerve cell
- any type of cells that make up connective tissue such as bone, ligaments, or tendons.

13) What is the difference between Fraternal Twins and Identical Twins?

Fraternal Twins are the result of 2 eggs and 2 sperm cells. Fraternal Twins are just like any set of 2 brothers, or 2 sisters, or brother/sister…except they were born on the same day.

Identical Twins are the result of 1 egg and 1 sperm. Identical Twins have the Identical DNA when first formed. Identical Twins must be either 2 identical boys or 2 identical girls.

14) Use the following phrases in a sentence. segments of DNA/genes proteins cells structure & function

Each cell can turn on/activate/express different segments of DNA/genes which results in different proteins being made which causes the cell to have a specific structure & function.