7.4 - Mutations & Change Unit, Packet 4

Score
□ Above & Beyond
□ Meets Expectations
□ Near Expectations
□ Incomplete – *fix the following pages:*

First & Last Name: _____ Period/Hour:_____

NOTE: Packets are due after completing Part 5. Check each page to be sure all blanks are completed.

Driving Question: What is DNA and how does it work? How does DNA affect protein assembly?

Anchoring Phenomenon: Throughout this unit, we have explored what DNA is made from, and how its structure determines its function. We have also explored how transcription & translation produce proteins within a cell. We will now put all the pieces together to develop sophisticated explanations for the phenomena we have encountered in this unit.

Deeper Questions

1. What determines the traits of an organism?
2. How are traits inherited from parents?
3. Can we predict traits?

Schedule

Part 1: Introduction
- Summative Check-in Questions

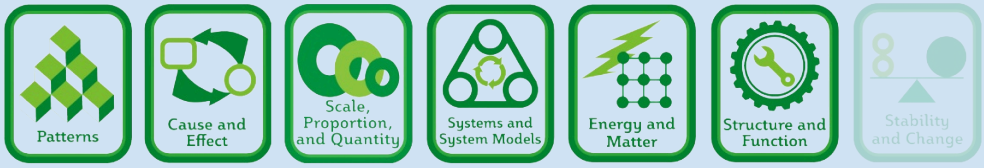
Part 2: Core Ideas
- Evaluating Sample Responses
- Writing a "Level 3" Response

Part 3: Life Connections
- Human Superpowers

Part 4: Review Game
- Jeopardy Review Game

Part 5: Final Review
- Final Q&A

NGSS Standards (*PEs* & *CCCs are summarized below. SEPs are noted throughout the packet*).
HS-LS1-2. Organization of interacting systems in multicellular organisms. HS-LS1-6. How carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. HS-LS1-5. How photosynthesis transforms light energy into stored chemical energy. HS-LS1-7. Cellular respiration is a chemical process whereby food molecules and oxygen molecules form new compounds resulting in a net transfer of energy.



Semester Schedule

5. Traits & Genes
5.1: What determines the traits of an organism?
5.2: How are traits inherited from parents?
5.3: Can we predict traits?
5.4: Unit Assessment

6. DNA & Proteins
6.1: What is DNA and how does it work?
6.2: How does DNA affect protein assembly?
6.3: Unit Assessment
6.4: How are genes modified? *(mini-unit)*

7. Mutations & Change
7.1: How does a protein get its shape & function?
7.2: How do mutations change genes & proteins?
7.3: How can mutations create new traits & species?
7.4: Unit Assessment
7.5: How Does Antibiotic Resistance Occur?

8. Biodiversity
8.1: How does biodiversity affect ecosystems? Why is biodiversity being lost?

These materials were partly developed with assistance from artificial intelligence.

Resource Links: Class Website; Part 1 Check-in Form; Jeopardy Review; Unit Summary; Practice Test; Unit Objectives; Human Superpowers Article;

Part 1: Introduction – Check-in Questions (7.4.1)

Overview: Show your readiness and demonstrate your understanding from this unit by completing this form.

Part 2: Critiquing Responses (7.4.2)

Directions: For each of the following, provide a brief written justification for why you think they earned a 1 (*still learning*), 2 (*acceptable*), or 3 (*sophisticated*). See below for a summary of each criteria for grading.
3 2 1 Complete: Do they fully address the entire question while addressing DNA, proteins, and/or traits?
3 2 1 Accurate: Is every aspect of the written response factually correct?
3 2 1 Precise: Are they effectively using terms from the course in a clear and specific manner?

Q: Use mutations and natural selection to explain why giraffes now have long necks.

Oscar: *The giraffes' DNA changed because the trees in their habitat became taller, causing them to evolve.*

Overall Score: _____/3 Comments: _____

Nina: *Giraffes were able to grow longer necks as they grew older by stretching to reach the taller trees, which caused their offspring to be born with longer necks.*

Overall Score: _____/3 Comments: _____

Bristol: *Giraffes with longer necks were better adapted to an environment with tall trees, so they were more likely to survive and reproduce.*

Overall Score: _____/3 Comments: _____

Chandra: *Random mutations alter DNA, causing harmful (disease-causing), neutral (silent), or advantageous (adaptive) changes, depending on the environment. Beneficial mutations, such as a longer neck in giraffes, enhance survival and reproduction, increasing the prevalence of the trait. This leads to new traits & species.*

Overall Score: _____/3 Comments: _____

Part 3: Life Connections - Human Superpowers (7.4.3)

Directions: Using prior knowledge, you'll consider how humans could change as a species via new traits.

Background: Like all living species, humans experience random mutations. Usually these are either harmful and cause genetic diseases, or are neutral and do not affect survival and reproduction (e.g., having brown vs. green eyes doesn't negatively affect your life). However, some people have inherited genes that give them almost superhuman abilities.

In the article linked below, you will explore how genetic mutations can lead to extraordinary abilities in humans. Examples include increased bone density to decreased sleep requirements, exceptional muscle mass, and reduced cholesterol levels. To learn more, read this article from Business Insider. Be prepared to discuss key points as a class.

Part 4: Jeopardy Review (7.4.4)

Directions: In this activity, you'll play a Jeopardy-style game to review course concepts. Rules are in the presentation. You can also use this for test preparation. Your instructor may use an alternative option like Gimkit or Kahoot.

Game URL: Mutations & Change Jeopardy

Part 5: Final Q&A (7.4.5)

Directions: For each objective, rank it as a 1 (*cannot understand or explain*), 2 (*understand but can't explain*), or 3 (*can understand & fully explain*). Review any content that is still unfamiliar and ask questions as needed. Pay special attention to items that are **bold**.

1. What determines the shape & function of a protein?
2. What is the difference between a **hydrophobic** amino acid and a **hydrophilic** amino acid, and how does this affect protein shape & function?
3. How does the **positive or negative charge** of some amino acids affect the shape of a protein?
4. How are **cysteine** amino acids unique? How do these amino acids affect the shape of a protein?
5. Sickle cell anemia occurs when a T-base in DNA is substituted for an A. How does changing a single base result in changes at the molecular, cellular, and bodily levels?
6. **What is a mutation?**
7. What is the **difference between an acquired mutation and a hereditary mutation?** Explain using examples of each.
8. What are the causes of hereditary and acquired mutations? What factors cause changes to DNA?
9. What are mutagens? What are examples of mutagens?
10. What is the **difference between a substitution mutation and a frameshift mutation**?
11. What are two causes of frameshift mutations?
12. **Why do frameshift mutations tend to have more impact than substitution mutations?**
13. What is a chromosomal mutation?
14. What determines whether mutations are beneficial, harmful, or neutral?
15. What is a silent mutation? What is an adaptation? How are these terms different?
16. Why do vultures and ostriches lack head feathers? How did this happen, and why is it common in some birds but not others?
17. **Whales changed a lot while sharks have changed very little during the same time despite sharing the same habitat. Why?**
18. **What is natural selection? How does natural selection relate to mutations?**
19. **What is evolution? How does evolution differ from natural selection?**
20. **Summarize and explain the four factors that are necessary for evolution to occur.**
21. What is a species? How does evolution by natural selection result in new species?
22. What is the difference between natural selection and artificial selection?
23. **"*Mutations occur randomly and independently from the environment.*" What does this mean?**
24. What evidence indicates that evolution by natural selection occurs? Address each of the following: *homologous structures; analogous structures; vestigial structures; DNA; fossils; and measurable evolution*.

