Lesson 4

Lab Sheet: Glow Comparison Carousel Activity - Genetics Focus

Name: _____ Date: _____

Group Members: _____

Introduction

In this activity, you will explore different ways living things can "glow" or appear to glow, with a special emphasis on the underlying genetic principles. You'll compare natural biofluorescence, where organisms produce their own light or re-emit absorbed light, with artificial methods like dyes and genetic engineering (GloFish). As you rotate through the stations, you'll gather information to compare and contrast these fascinating phenomena through a genetic lens.

Station 1: Natural Biofluorescence – The DNA Within

Materials: Images/videos of natural biofluorescent fish (e.g., coral reef fish), information about natural biofluorescence.

1. **Observe:** Look closely at the images and videos of naturally biofluorescent fish. Describe the glow you observe.

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2. **Genetic Origin:** Based on the information provided, is the ability to biofluoresce a trait that is inherited? Explain how the instructions for this glow are likely stored and passed down in these organisms.

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3. **Mechanism:** Briefly explain the biological process (e.g., specific proteins, chemical reactions) that allows these organisms to produce or re-emit light naturally. How is this process linked to their genetic code?

Station 2: GloFish – Genetic Engineering and Gene Expression

Materials: Information about GloFish science and genetic engineering.

1. **What is GloFish?** Explain what GloFish are and specifically how genetic engineering was used to give them their glowing trait.

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2. **The "Glow" Gene:** Describe the origin of the gene that makes GloFish glow. How was this specific gene transferred into the fish's genome, and what does it instruct the fish's cells to do?

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3. **Inheritance and Expression:** If two GloFish reproduce, will their offspring glow? Use the terms "gene," "trait," and "inheritance" in your explanation. How is the glow trait expressed in each generation?

Station 3: DNA vs. Dye – Heritable vs. Non-Heritable Traits

Materials: Information comparing DNA-based glow (like GloFish) to temporary dyes.

1. **Temporary Glow:** Describe how a "temporary glow" is achieved in animals (e.g., painted fish, temporary dyes). Why is this type of glow considered "temporary" and "non-heritable" from a genetic perspective?

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2. **Genetic Basis of Traits:** Compare the genetic basis of the glow in GloFish versus a fish that has been temporarily dyed. How does the location of the "glowing instruction" (in the DNA vs. external application) determine whether the trait is passed on?

3. **Similarities and Differences:** List one similarity and one key difference in the *source* of the glowing characteristic between GloFish (genetic engineering) and a fish that is simply dyed.
    - **Similarity:**

      _____
    - **Key Difference (Genetic):**

      _____

Class Synthesis: Genetic Mechanisms of "Glow"

After rotating through all stations, use the information you've gathered to complete the following Venn diagram and answer the discussion questions, focusing on genetic concepts.

Venn Diagram: Methods of "Glow" (Genetic Perspective)

Draw a Venn diagram comparing **Natural Biofluorescence**, **GloFish (Genetic Engineering)**, and **Dyes (Temporary)**.

- In the overlapping sections, write characteristics that are shared between the methods, particularly focusing on how the glow is *produced* or *manifested*.
- In the unique sections, write characteristics that are specific to that method, emphasizing the *genetic or non-genetic basis* of the glow.

Discussion Questions

1. **Heritability and DNA:** Define "heritable trait" and "non-heritable characteristic." Using examples from this activity, explain how the presence or absence of a specific gene in an organism's DNA determines whether a glowing trait is passed down to its offspring.

2. **Gene Expression:** How does the concept of "gene expression" apply to both naturally biofluorescent organisms and GloFish? What must happen at the cellular level for the "glow" gene to produce its effect?

3. **Ethical Implications of Genetic Modification:** Discuss the ethical considerations surrounding the genetic engineering of organisms like GloFish. How does our ability to manipulate an organism's genome raise questions about environmental impact, animal welfare, and human responsibility?

4. **Broader Impact:** How does studying these diverse methods of "glowing" enhance our understanding of fundamental genetic principles, such as heredity, gene function, and the potential applications (and challenges) of biotechnology?