

# **Pets in the Classroom!**

**Utilizing GloFish to engage students in their understanding of DNA, genetics, and genetic technology.**

The GloFish aquarium has been a tremendous addition to our Biology (Living Environment) classroom. Students love setting up, caring for, cleaning/monitoring, and just plain enjoying the fish in the aquarium. What they don't realize early in the year, however, is the incredible advancements in genetic technology that have made these unique fish possible. It is only when we begin our extensive unit on DNA and Inheritance that they begin to appreciate how incredibly complex these little critters are!

After spending considerable time studying DNA, RNA, Protein Synthesis, and Inheritance, our unit culminates with a Genetics Debate. To introduce the debate, students are given the attached GloFish sheet and must use the website: [www.glofish.com](http://www.glofish.com) to help answer the questions. After a class discussion, students are then given the Genetics Debate questionnaire to fill out based on their preference. Students are placed in pairs, assigned one of their top 3 debate interests, and given either the Pro or Con side of the debate to defend. NYS Science Learning Standards (learning objectives), debate specifics and a grading rubric (evaluation) are also attached. After several days of research and putting together a well - organized Google slide presentation, debates begin!

**The following are the New York State P-12 Science Learning Standards (Derived from NGSS) met during this debate project.**

**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, (3) mutations caused by environmental factors and/or (4) genetic engineering. [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs including the relevant processes in meiosis and advances in biotechnology.] [Assessment Boundary: Assessment does not include recalling the specific details of the phases of meiosis or the biochemical mechanisms of the specific phases in the process.]

**Science and Engineering Practices (SEP)**

**Engaging in Argument from Evidence** Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in

science. □ Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence. (HS-LS3-2)

### Disciplinary Core Ideas (DCI)

LS1.A: **Structure and Function** □ All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (secondary to HS-LS3-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS1-1.) □

### Crosscutting Concepts (CCC)

#### Connections to Nature of Science

**Science is a Human Endeavor** □ Technological advances have influenced the progress of science and science has influenced advances in technology. (HS-LS3-2),(HS-LS3-3),(New NYSED PE)  
□ Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-2), (HS-LS33), (HS-LS1-8)

NAME \_\_\_\_\_

DATE \_\_\_\_\_

PERIOD \_\_\_\_\_



**DIRECTIONS:** Use [www.glofish.com](http://www.glofish.com) to help answer the following questions.

1. GloFish are **GMO's**. What does GMO stand for?
2. GloFish are also **transgenic** fish. What does transgenic mean?

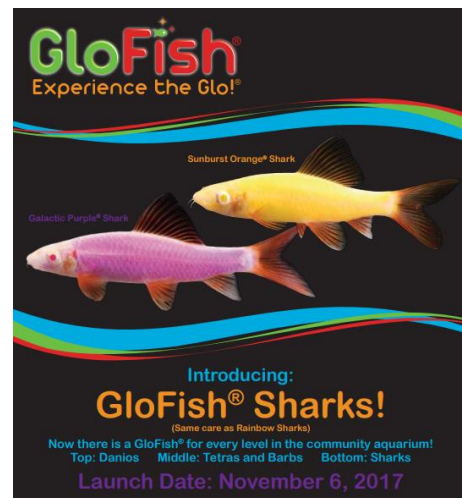
3. What 2 organisms do the fluorescent color genes present in the genetically modified GloFish originally come from? \_\_\_\_\_ + \_\_\_\_\_  
Are fluorescent genes naturally present in these 2 organisms? \_\_\_\_\_

4. Do fluorescent genes naturally occur in the genomes of tropical Zebra, Tetra, Barb, and Shark fish? \_\_\_\_\_ How did these fluorescent genes get into these fish?

5. When GloFish reproduce, do they pass their fluorescent traits onto their offspring? \_\_\_\_\_

6. Why do you think the GloFish website frequently uses the phrases, “born brilliant”, “born beautiful”, “brighter disposition”, and others like it on their website?

7. GloFish are the result of **genetic engineering**. The use of **genetic technology** must be accompanied by ethical considerations. Do you feel genetically altering organisms such as these fish is ethical? Why or why not?



NAME \_\_\_\_\_ PERIOD \_\_\_\_\_ DATE \_\_\_\_\_

**GENETICS - DEBATE TOPICS QUESTIONNAIRE**

Interest Level (1-7)
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**1. Genetic Animal Testing:**

Pro \_\_\_\_\_ Con \_\_\_\_\_

Explain:

**2. Designer Babies (includes 3 Parent Babies):**

Pro \_\_\_\_\_ Con \_\_\_\_\_

Explain:

**3. GMO's:**

Pro \_\_\_\_\_ Con \_\_\_\_\_

Explain:

**4. CRISPR CAS9:**

Pro \_\_\_\_\_ Con \_\_\_\_\_

Explain:

**5. Cloning:**

Pro \_\_\_\_\_ Con \_\_\_\_\_

Explain:

**6. Genetic Predisposition to Crime:**

Pro \_\_\_\_\_ Con \_\_\_\_\_

**Explain:**

**7. Mandatory DNA Testing for ALL citizens (DNA Database):**

Pro \_\_\_\_\_

Con \_\_\_\_\_

\_\_\_\_\_

**Explain:**

**GENETICS DEBATE INSTRUCTIONS**  
**LIVING ENVIRONMENT – MR. ALLEN**

**Instructions:**

DNA (genetic) technology has the potential to improve our lives dramatically. However, it also raises a large number of moral, ethical, social, and political issues. To put it another way, there are legitimate pros and cons to the use of genetic technology. In this project, you and an assigned partner will research one example of DNA technology and explore either the pros or cons of its use. You and your partner will then engage in a debate against two other classmates over the recommended use of that technology.

You will have several class periods to research and create your Google Slides presentation.

You must present evidence that work is being completed during each class period.

**Format:**

You and your assigned partner are to research one side of a particular genetics debate that I will give you.

Each pair will research their given position and prepare a **4 - 6 minute** debate in front of the class, in which you and your partner will present your side of the argument.

After both sides of the issue present, the audience will ask several questions of each pair, and pairs will be given the opportunity for rebuttal.

Audience members will vote anonymously for who they believe won the debate and the victors will receive 5 bonus points.

**Visual Aid:**

Each group must create a Google Slide (aka Power Point) presentation to use as a visual aid.

This slide presentation must contain images and text to summarize your arguments (text should only include main ideas).

**Tips:**

Your goal is to persuade your audience. Provide sufficient background information regarding your topic, but be sure to emphasize your side of the argument (pro or con).

Debates and rebuttals reflect FACT not your own personal opinions based on conspiracies.



