Toothpick Fish Simulation

Name	Date	Core
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Toothpick Fish Purpose: To model the relationships between genotype and phenotype & to explore how frequency of traits in a population can be affected by environmental factors.

Materials:

- 1 "gene pool" container paper cup
- 8 green toothpicks

• 8 red toothpicks

toothpicks

• 8 yellow toothpicks

Phenotype Information: The colored toothpicks represent three different alleles (*forms of a gene*) that controls one fish trait: scale color. The table below tells you which alleles are dominant, which are recessive, and which are incompletely dominant.

- The green allele (G) is dominant to all other color genes
- The pink allele (R) is recessive to green and incompletely dominant to yellow
- The yellow allele (Y) is recessive to green and incompletely dominant to red
- Incompletely dominant alleles result in an orange color

REMEMBER: EACH TOOTHPICK REPRESENTS A GENE, NOT A FISH... each fish is a pair of toothpicks!

1. Fill out table A by figuring out all the possible **genotypes** that can make each **phenotype**.

Table A. Possible fish phenotype and genotype

Phenotype (fish color)	ALL Possible Genotypes
Green Fish	
Pink Fish	
Yellow Fish	
Orange Fish	

- 2. Based on the answers you gave in the table above, answer the questions below. (You may use Punnett Squares if you wish.)
 - a. Can two red fish mate and have green offspring? Why or why not?
 - b. Can two orange fish mate and have red offspring? Why or why not?
 - c. Can two green fish mate and have orange offspring? Why or why not?

Lab Procedure:

- 1. Make a first generation of fish. To do this, pull out alleles (toothpicks) <u>in pairs</u> without looking at them. Set them aside carefully so that they stay in pairs. Keep pulling out pairs until all the alleles in your gene pool are gone.
 - NOTE: This process simulates the way offspring are formed by sperm from the male fish combining randomly with eggs from the female fish.
- 2. Once you have drawn all your pairs, Determine what color each fish (pair of toothpicks) would be, and count up how many fish there are of each color. **Record that information in Table B**
- 3. Once you've recorded all your data, put all the toothpicks back in the gene pool (cup)... then draw again to create your second generation! Record your data in Table B... then repeat this process one more time to create the third generation of fish.

Table B: Change in fish population over time

Environment	Generation	Green	Pink	Orange	Yellow
There is a lot of green seaweed growing everywhere. All colors of fish are able to	First				
hide from predators pretty well!	Second				
	Third				
Herbicide spilled into the lake and all the	Surviving fish from				
seaweed died off, leaving only bare rocks	Third generation				
and sand only yellow and orange fish can escape predators & survive to reproduce!	Fourth Generation				

Oh No! The herbicide called *Round-up* spilled into the lake from nearby lawns and parks! It strong herbicide killed all the seaweed, leaving behind only bare brownish-yellow rocks and sand. **Only Yellow and orange fish can hide from** predators in this environment... all green and pink fish get eaten before they can reproduce!

- 4. Record the number of surviving fish of each color in table B
- 5. Empty the Gene Pool (cup).
 - a. For each surviving orange fish, put 1 pink and 1 yellow toothpick back in the gene pool.
 - b. For each surviving yellow fish, put 2 yellow toothpicks back in the gene pool.
- 6. Draw your fourth and final generation of fish, and record the data in table B.

Analysis Questions

- 1. Which phenotype was the most common before the herbicide spill?
- 2. How did the herbicide spill change the fish population?
- 3. Did any alleles disappear entirely after the herbicide disaster? If so, which ones?
- 4. Green alleles are dominant, and the Pink alleles are recessive.
 - a. Which allele disappeared fastest when the environment became hostile to them?
 - **b.** Explain why. Use the words dominant, recessive, genotype and phenotype in your explanation.