The Game of LIFE and DEATH: Day 1

To Begin:

1. Get in groups of 4 players.

2. You are all the same type of animal that make up a group. You live in the ocean on a coral reef. As a group, choose what type of sea animal you all want to be. (You can be anything: slugs, fish, sea stars, crabs, squid...)

Write your animal type below:

_____

3. Take a coin. Flip your own coin 5 times. Each flip tells you one trait your animal will have. You can get heads or tails each trait. Circle your 5 traits below.

Trait	Heads	Tails
1. Coloration	bright 	dull 
2. Size	large	small
3. Defenses	armored spines 	no armor 
4. Speed	fast	slow
5. Grouping	always with others	always alone

Your animal is probably different from the other animals in your population.

This is called VARIATION.

There is variation in all animals. Just look around!

4. Now draw your animal from step 2 and include the traits you flipped for in step 3!

5. Your group of animals all live together with other animals like sharks. These sharks like to eat your type of animal.

6. Based on your animal's traits (step 3), do you think your animal on page 4 will survive with the hungry sharks?

Circle: Yes or No

7. The sharks attacked!

Some of you will live, but some will not because of variation. Score your animal based on its traits listed in step 3. Each player score your own animal below.

Tally points below:

Coloration bright = +0 dull = +1	
Size large = +0 small = +1	
Defenses armored spines = +1 no armor = +0	
Speed fast = +1 slow = +0	
Grouping always with others= +1 always alone = +0	
Total Score =	

8. Compare your score from step 7 to the rest of your group's scores. Did you have the highest score?

Circle: Yes or No

9. Can an animal’s traits affect whether it survives?

Circle: Yes or No

10. Which of the traits listed below could help keep you safe from hungry animals like the sharks. Circle:

a. bright
b. large
c. fast
d. always alone

11. If all of your animals were identical (the group had **NO** variation) would some have been more likely to survive than the others when the sharks attacked?

Circle: Yes or No

12. Write the names of the two people with the two highest scoring animals from step 7 below.

- If there is a tie for first place, both players win.

- If there is a tie for 2nd place, the tied players should roll a die. Write the name of the person who rolls the largest number. Repeat until there is a winner.

_____ & _____

Good job! These two players' animals survived to go on to the next round!

The other players' animals did not survive ☹

But don't worry, you will be a new animal next time we play!

Glossary

trait- something that describes a person, animal or plant. It can be measured. It can be different from one individual to another.

coloration- how something is colored

dull- not having much color

defense- something that protects or guards

armor- the covering on certain animals that protects them against attack

grouping- a collection of people or things that are in one place or are related to one another

population- things that are alike and found in the same area

variation- a slightly different form or version of something

Glossary Continued

survive- to continue to live, not die

determine- deciding something

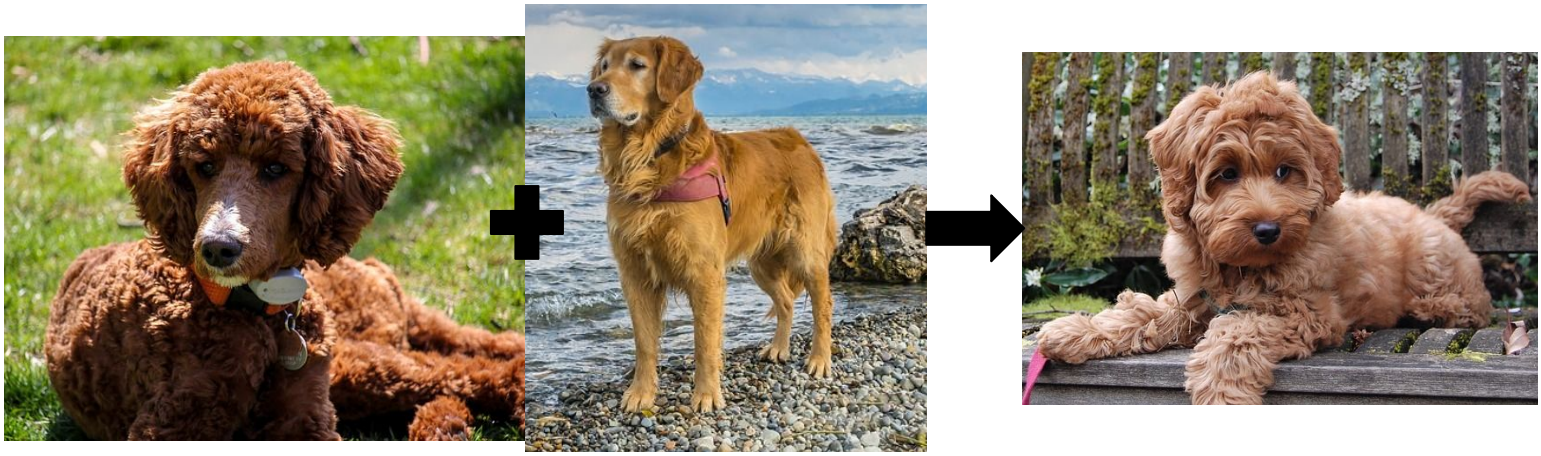
affect- causes a change in or influences

identical- the same

The Game of LIFE and DEATH: Day 2

13. The two highest scoring animals from step 12 survive. They are the parents of the all of the animals for the next round of the game.

- Parents pass down traits to their children.
- If both parents have the same trait, like brown hair color of the dogs, the trait will be passed on to their puppy.
- If parents have different traits, curly hair and straight hair, the puppy could get either trait. There is a random 50:50 chance. This puppy got curly hair.



14. Each player will now become one of the babies of this pair. You can get traits from either parent.

- If both parents have the same trait, like both have bright coloration, you can only get that type of the trait from your parents. Circle it in the table below.
- If the parents have different traits, like one is bright and one is dull, you can get either type. You should flip your **own** coin to see which type you get. You may get something different than others in your group. Circle in the table below.

Trait	Heads	Tails
1. Coloration	bright 	dull 
2. Size	large	small
3. Defenses	armored spines 	no armor 
4. Speed	fast	slow
5. Grouping	always with others	always alone

15. The next round of animals come from the parents in step 12. Now your animal has the traits from step 14, but it may be a little bit different from other animals in your group.

But wait! There was a small change in your animal's DNA (the code for traits) before it was born. This small change in the code is called a mutation.

- Mutations occur in all living things like these peacocks. The mutation took away the peacock's color.

- Mutations occur randomly, but are sometimes caused by the environment.

- Mutation may cause a change that benefits a living thing (positive mutation), harms a living thing (negative mutation), or has no effect on the living thing (neutral mutation).

- Neutral mutation is most common. It is not positive or negative.

16. Each of you roll the die once to find out what mutation your animal will have. Circle:

1. You have shiny scales that attract attention
2. You easily get sick
3. You have an extra fin
4. You can't produce babies
5. You have a dance that attracts attention
6. There was a mutation in your DNA, but it did not cause a change in any of your traits

17. Now draw your same type of animal, but with the traits from step 14 and include the mutation from step 16!

18. Do mutations add variation (differences between animals)?

Circle: Yes or No or Maybe

19. The environment has changed!

All the sharks have been caught. Without sharks to worry about, animals can take time to choose a mate to produce babies with. This is called **mate choice**. Animals choose a mate based on traits that they find attractive or beneficial.

Female peahens choose the brightest male peacock.

20. Based on your animal's traits (step 14) and its mutation (step 16), do you think your animal on page 17 will likely be able to attract a picky mate?

Circle: Yes or No

21. Which mutations listed below do you think could help to attract a mate?
(Can circle more than 1)

a. shiny scales
b. easily gets sick
c. an extra fin
d. crazy dancing behavior

22. Only the favorite animals get to mate. Two animals with the highest score get to be the parents for the next group of animals. Score your own animal with its mutation.

Tally points below:

Coloration	bright = +1 dull = +0	
Size	large = +1 small = +0	
Defenses	armored spines = +1 no armor = +0	
Speed	fast = +1 slow = +0	
Grouping	always with others = +1 always alone = +0	
	My Score =	
Beneficial mutations	shiny scales = +2 crazy dancing = +1	
Harmful mutations	can't produce babies= -2 easily gets sick = -1	
Neutral mutations	extra fin = 0 no change = 0	
	Total Score with mutations =	

23. Write the names of the two people with the two highest scoring animals from step 22

- If there is a tie for first place, both players win.

- If there is a tie for 2nd place, the tied players should roll a die. Write the name of the person who rolls the largest number. Repeat until there is a winner.

_____ & _____

24. Which traits were helpful in attracting a mate? (Can circle more than 1)

a. bright
b. small
c. slow
d. large

25. Did your animal's mutation let you add or subtract a point?

Circle:

a. add
b. subtract
c. neither

26. Are mutations always beneficial?

Circle: Yes or No

27. Can mate choice affect if an animal survives?

Circle: Yes or No or Maybe

28. How does coloration help an animal survive and mate?

Circle:

a. Being bright is good for mating, but bad for surviving with sharks.

b. Being dull is good for mating and surviving the sharks.

c. Being bright is good for mating and surviving the sharks.

29. Did adding or subtracting a point for your animal's mutation affect its chance of surviving?

Circle: Yes or No

30. Did mutation always affect survival for all of the animals in your group?

Circle: Yes or No

Glossary

random- something that happens by chance

DNA- the thing that contains information about the traits of a living thing

mutation- a random change in the DNA (information about the traits of a living thing)

environment- everything that surrounds an animal and affects its growth and health

beneficial- something good or favorable

neutral- something that makes no difference

attract- get the attention of

produce- to create something

mate- the animal that lives or has babies with another animal

mate choice- one animal chooses another to have babies with based on the things it likes about that animal

competition- something working against another

The Game of LIFE and DEATH: Day 3

31. The two highest scoring animals from step 23 chose each other. They are the parents of the animals in the next round.

- If both parents have the same trait (both are bright) you can only get that type of the trait from your parents. Circle it in the table below.
- If the parents have different trait (one is bright and one is dull) you can get either type. You should flip your **own** coin to see which type you get. You may get something different than others in your group. Circle in the table below.
- Both parents' pass on their mutation.

Trait	Heads	Tails
1. Coloration	bright 	dull 
2. Size	large	small
3. Defenses	armored spines 	no armor 
4. Speed	fast	slow
5. Grouping	always with others	always alone

I also have these 2 mutations (one from each parent):

_____ & _____

32. There was another mutation in each of your animals' DNA for the next round!

Roll the die once to find out what mutation your own animal will have.
Circle:

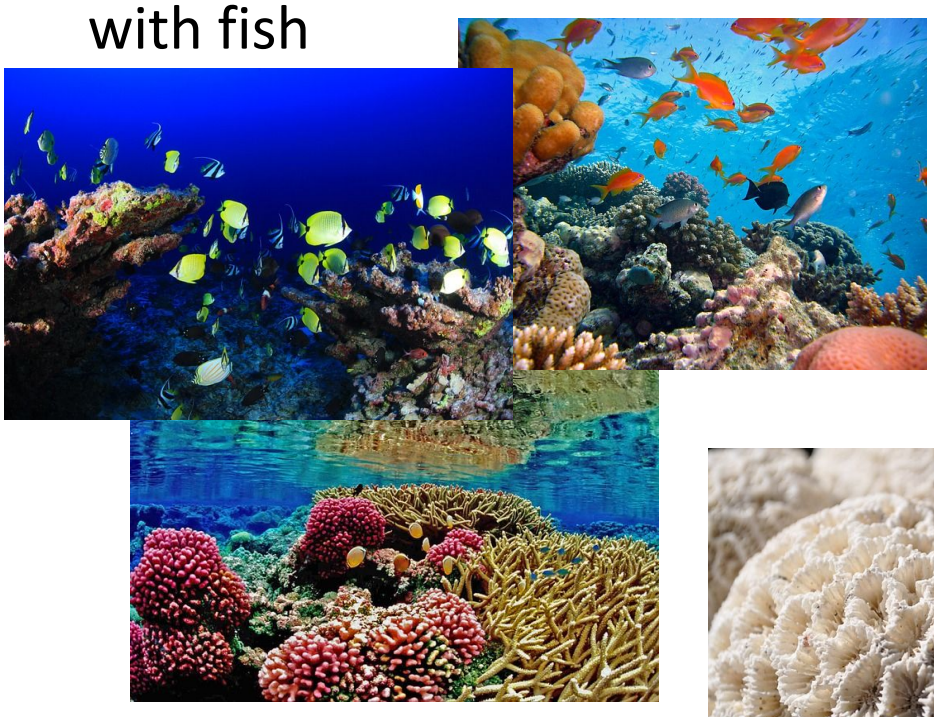
1. You have a strong smell that attracts sharks
2. You develop hard teeth that allow you to eat coral skeleton
3. You have huge lips
4. You prefer to live out in the open ocean instead of on a reef
5. You get cleaned off by shrimp that remove things that make you sick
6. There was a mutation in your DNA, but it did not cause a change in any of your traits

33. Now draw your same type of animal, but with the traits from step 31 and the mutation from step 32!

34. The environment has changed because of people!

Humans have caused the Earth to warm up. Coral reefs can't survive if the ocean gets too warm. If the coral reefs die, they become white skeletons and animals cannot live there.

Healthy reef with fish



white dying reef with few fish

35. Based on your animal's traits (Step 33), do you think your animal will to survive on the dying coral reef?

Circle: Yes or No

36. Which traits do you think would be helpful on the dying coral reef that also has sharks?
Circle:

a. dull coloration
b. smell that attracts sharks
c. small size

37. Because the reef is dying, not all of the animals can find food and survive. Score core your own animal and its mutation.

Tally points below:

Coloration	bright = +1 dull = +0	
Size	large = +1 small = +0	
Defenses	armored spines = +1 no armor = +0	
Speed	fast = +1 slow = +0	
Grouping	always with others = +1 always alone = +0	
	My Score =	
Beneficial mutations	teeth to eat coral = +2 cleaned by shrimp = +1	
Harmful mutations	smell that attracts sharks = -2 prefer the open ocean = -1	
Neutral mutations	huge lips = 0 no change = 0	
	Total Score with mutations =	

38. Which traits were best for the dying coral reef?

Circle:

a. dull coloration
b. smell that attracts sharks
c. small size

39. Other rounds showed that animals like sharks or being choosy about a mate can affect an animal's chances of surviving and moving to the next round.

Can humans have a similar effect?

Circle: Yes or No

Summary

40. When groups of animals change over time because of things like other animals eating them, or when only some animals are able to find a mate, or because of human activities, it is called **natural selection**.

Does natural selection help groups of animals fit where they live?

Circle: Yes or No

41. Did you have an animal that was a perfect fit to where it lived at the end of the game?

Circle: Yes or No

42. Does natural selection create animals that are perfect?

Circle: Yes or No

Glossary

develop- to grow or bring into existence

support- providing enough food, shelter, etc. for something to live

skeleton- the inside structure that can support something

natural selection- a process in which those that are best suited to their environment survive and are able to have babies over time

perfect- something that does not have mistakes or issues

effect- a change resulting from an action or occurrence