

Zoe Dives Deep: Secrets of Heredity

Grade 6

science

underwater-explorers

Students will be able to explain how traits are passed from parents to offspring through genes, and distinguish between inherited and acquired traits.

Name: _____

Date: _____

1. Zoe dives down to a coral reef on her first mission. She spots a clownfish with bright orange stripes. Circle the correct answer: Is the clownfish's orange color an inherited trait or an acquired trait?

2. Zoe writes in her dive log: 'The clownfish has fins, orange stripes, and a scar from a rock.' True or False: The scar is an inherited trait.

3. Zoe finds a rare find: a sea turtle nest with 3 eggs. All three hatchlings have the same shell pattern as their mother. Fill in the blank: The hatchlings got their shell pattern from their mother's _____, which carried the instructions inside her DNA.

4. Zoe discovers a unique item: a journal left by a past explorer. It lists two clownfish parents. Parent A has one copy of the orange-stripe gene (Oo). Parent B also has one copy (Oo). Zoe knows that O (orange stripes) is dominant and o (no stripes) is recessive. What are the four possible gene combinations their offspring could inherit? List all four.

5. Zoe observes two anglerfish near a hidden treasure chest on the seafloor. Anglerfish A grew its glowing lure because of its genes. Anglerfish B lost part of its fin in a net. Explain: Which of these traits could be passed to offspring, and why?

6. Zoe opens the hidden treasure chest and finds a special object: a glass vial holding DNA from an unknown deep-sea fish. She observes the fish has large eyes (dominant trait, E) and no scales (recessive trait, ss). The fish's genotype for eye size is Ee and for scales is Ss. Zoe hypothesizes that this fish could pass on recessive traits to offspring even though they are not visible. Is Zoe's hypothesis correct? Explain using the words genotype, phenotype, and recessive.

7. Zoe uses the special object — the DNA vial — to compare the mystery fish's genes to two known species. She finds the mystery fish shares 12 out of 20 genes with Species X and 18 out of 20 genes with Species Y. Zoe hypothesizes the mystery fish is more closely related to Species Y. Which biological concept best supports her hypothesis, and what does shared DNA reveal about heredity across generations?

8. Zoe has completed her mission. She discovered that the mystery fish in the hidden treasure chest is a newly found species — now named Zoefishus deepus in her honor. Scientists want to protect this species. Zoe writes a report explaining why inherited traits matter for species survival. Using what you learned today, write 3 to 4 sentences explaining: (1) how traits are passed to offspring, (2) why genetic variation within a species is important, and (3) how understanding heredity could help scientists protect Zoefishus deepus from extinction.

Answer Key: Zoe Dives Deep: Secrets of Heredity

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Before starting, project an image of a coral reef and ask students which fish traits they think are inherited. This anchors Zoe's mission visually and activates prior knowledge for Q1 and Q2.

1. Zoe dives down to a coral reef on her first mission. She spots a clownfish with bright orange stripes. Circle the correct answer: Is the clownfish's orange color an inherited trait or an acquired trait?

Answer: Q1: An inherited trait is passed from parents to offspring through genes. A clownfish is born with orange stripes because of information in its DNA — it did not learn or earn this color.

Answer: The orange color is an INHERITED trait.

2. Zoe writes in her dive log: 'The clownfish has fins, orange stripes, and a scar from a rock.' True or False: The scar is an inherited trait.

Answer: Q2: Inherited traits come from genes passed down by parents. A scar is caused by an injury after birth — it is not coded in DNA and cannot be passed to offspring. Answer: FALSE. The scar is an acquired trait, not an inherited trait.

3. Zoe finds a rare find: a sea turtle nest with 3 eggs. All three hatchlings have the same shell pattern as their mother. Fill in the blank: The hatchlings got their shell pattern from their mother's _____, which carried the instructions inside her DNA.

Answer: Q3: Traits are passed from parent to offspring through genes. Genes are segments of DNA that carry coded instructions for building traits like shell patterns. Answer: The blank is filled with GENES. 'The hatchlings got their shell pattern from their mother's GENES, which carried the instructions inside her DNA.'

4. Zoe discovers a unique item: a journal left by a past explorer. It lists two clownfish parents. Parent A has one copy of the orange-stripe gene (Oo). Parent B also has one copy (Oo). Zoe knows that O (orange stripes) is dominant and o (no stripes) is recessive. What are the four possible gene combinations their offspring could inherit? List all four.

Answer: Q4: Set up a Punnett square using Parent A (Oo) and Parent B (Oo). Cross the alleles: O from A × O from B = OO. O from A × o from B = Oo. o from A × O from B = oO. o from A × o from B = oo. Answer: The four possible combinations are OO, Oo, oO, and oo. Three combinations (OO, Oo, oO) produce offspring WITH orange stripes. One combination (oo) produces offspring WITHOUT orange stripes.

5. Zoe observes two anglerfish near a hidden treasure chest on the seafloor. Anglerfish A grew its glowing lure because of its genes. Anglerfish B lost part of its fin in a net. Explain: Which of these traits could be passed to offspring, and why?

Answer: Q5: Only traits coded in DNA can be passed to offspring. The glowing lure is an inherited trait — it is built by genes that Anglerfish A will pass through reproduction. The damaged fin is an acquired trait caused by an outside injury. It changed the body but did NOT change the DNA.

Answer: Only the glowing lure trait can be passed to offspring, because it is coded in the anglerfish's genes. The fin injury cannot be inherited because it did not change the DNA.

6. Zoe opens the hidden treasure chest and finds a special object: a glass vial holding DNA from an unknown deep-sea fish. She observes the fish has large eyes (dominant trait, E) and no scales (recessive trait, ss). The fish's genotype for eye size is Ee and for scales is Ss. Zoe hypothesizes that this fish could pass on

recessive traits to offspring even though they are not visible. Is Zoe's hypothesis correct? Explain using the words genotype, phenotype, and recessive.

Answer: Q6: Genotype = the actual gene combination an organism carries (like Ee or Ss). Phenotype = the visible trait that shows (like large eyes). A recessive trait is hidden when paired with a dominant allele but is still present in the genotype. For eye size: genotype is Ee — the fish shows large eyes (dominant phenotype) but carries the e allele. It CAN pass the recessive e to offspring. For scales: genotype is Ss — the fish shows scales (dominant phenotype) but carries the recessive s allele. It CAN pass s to offspring. Answer: Yes, Zoe's hypothesis is correct. The fish carries recessive alleles in its genotype that do not show in its phenotype. These hidden alleles can be passed to offspring, who may then display the recessive trait if they inherit two copies.

7. Zoe uses the special object — the DNA vial — to compare the mystery fish's genes to two known species. She finds the mystery fish shares 12 out of 20 genes with Species X and 18 out of 20 genes with Species Y. Zoe hypothesizes the mystery fish is more closely related to Species Y. Which biological concept best supports her hypothesis, and what does shared DNA reveal about heredity across generations?

Answer: Q7: The concept that supports Zoe's hypothesis is common ancestry (also called shared ancestry or evolutionary relatedness). Organisms that share more DNA sequences are more closely related because they inherited those gene sequences from a common ancestor more recently. Species Y shares 18/20 genes with the mystery fish — that is 90% similarity. Species X shares 12/20 — that is 60% similarity. The higher the percentage of shared DNA, the more recently two species diverged from a common ancestor. Answer: The concept is common ancestry. Shared DNA reveals that traits — and the genes that code for them — are passed down through generations. Species with more shared DNA inherited more of the same genes from a recent common ancestor, making them more closely related. Zoe's hypothesis is supported: the mystery fish is more closely related to Species Y.

8. Zoe has completed her mission. She discovered that the mystery fish in the hidden treasure chest is a newly found species — now named Zoefishus deepus in her honor. Scientists want to protect this species. Zoe writes a report explaining why inherited traits matter for species survival. Using what you learned today, write 3 to 4 sentences explaining: (1) how traits are passed to offspring, (2) why genetic variation within a species is important, and (3) how understanding heredity could help scientists protect Zoefishus deepus from extinction.

Answer: Q8 — Model Answer: (1) Traits are passed from parents to offspring through genes, which are segments of DNA. Each parent contributes one allele for each trait, and the combination of alleles determines what traits the offspring inherit. (2) Genetic variation — differences in alleles within a species — is important because it means some individuals may carry traits that help them survive changes in their environment, such as warmer water or new predators. Without variation, a single disease or change could wipe out the entire species. (3) By studying the heredity of Zoefishus deepus, scientists can identify which individuals carry rare or protective alleles. They can then set up breeding programs that preserve genetic diversity, giving the species the best chance of adapting and surviving in the deep ocean. Answer: Full credit requires all three components — genes carry trait instructions to offspring; variation increases survival odds across a changing environment; heredity data guides conservation breeding to protect Zoefishus deepus. Narrative closure: Zoe's mission is complete — her discovery of the hidden treasure chest and the DNA vial led to the naming of a new species, and her science knowledge will help protect it for future generations.