Beyond the Pond

Trace how tetrapod body systems and life cycles changed

ZOO.8.1 "Understand the evolution of tetrapods and the development of the structure and function of body systems and life cycles."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline a structural change that aided movement on land, circle each breathing structure, and write 1 beside frog egg and tadpole details and 2 beside lizard egg and hatchling details.

From Shallows to Dry Ground

1. Picture a shallow Devonian floodplain, where water levels rise and fall. Some fish relatives of early tetrapods already had lungs for breathing air and strong, bony fins for pushing through weedy shallows. Across many generations, descendants evolved limbs with digits, supported by bones related to those in earlier fins. These limbs could brace a body in shallow water and later help it move on land. Stronger connections between the spine and hips helped carry weight outside water. Tetrapods did not appear because a fish decided to walk; inherited variations spread when they helped animals survive and reproduce.

2. A pond can still reveal an ancient challenge: breathing and growing in two environments. A frog begins as an egg without a protective shell in water; its tadpole uses gills to take oxygen from water. During metamorphosis, legs develop, the tail shrinks, and lungs become useful for breathing air. An adult frog can also absorb oxygen through its moist skin. These stages let frogs use different resources as young and adults, but their eggs and permeable skin keep them closely tied to damp places. Modern frogs are not the ancestors of reptiles; both belong to branching tetrapod lineages.

3. One branch of ancient tetrapods gave rise to amniotes, including reptiles, birds, and mammals. In an amniotic egg, a fluid-filled membrane surrounds the embryo, while other membranes help exchange gases and store waste. Many reptiles lay such eggs on land with leathery shells that limit water loss while allowing gas exchange. A lizard that hatches from such an egg has lungs and legs, rather than passing through a gilled tadpole stage. Skin covered in scales also reduces water loss compared with a frog's moist skin. Together, these traits allowed some tetrapod lineages to reproduce farther from ponds.

2 ANSWER WITH EVIDENCE

Use the passage

1. How were the bony fins of early tetrapod relatives and later limbs with digits connected in structure and function?

2. Why does having lungs not, by itself, mean that a tetrapod can live far from water? Use evidence from two parts of the passage.

3. How do an amniotic egg and scaly skin work together to let a lizard reproduce farther from a pond than a frog?

4. Why is a modern frog not a step on a straight evolutionary path toward a lizard? Give one life-cycle difference as evidence.

3 YOUR TURN

Your own words

Imagine a tetrapod population on a rocky coast where tide pools dry for two months each year. In five sentences, propose one inherited movement trait and one inherited reproductive trait that could spread over generations, explain how each would help, and name one remaining limitation or cost.

Beyond the Pond

PART 1 · READ AND MARK

Underline a structural change that aided movement on land, circle each breathing structure, and write 1 beside frog egg and tadpole details and 2 beside lizard egg and hatchling details. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How were the bony fins of early tetrapod relatives and later limbs with digits connected in structure and function?	**Limbs had bones related to those in the earlier bony fins. Fins helped push through shallow water, while limbs could brace the body there and later aid movement on land.**
2	Why does having lungs not, by itself, mean that a tetrapod can live far from water? Use evidence from two parts of the passage.	**Fish relatives of early tetrapods already had lungs, yet used fins in shallow water. Adult frogs have lungs but remain tied to damp places because their eggs lack protective shells and their skin is permeable.**
3	How do an amniotic egg and scaly skin work together to let a lizard reproduce farther from a pond than a frog?	**The amniotic egg's membranes support development away from open water, and its leathery shell limits water loss. Scaly skin reduces water loss, while a frog's unshelled eggs and moist skin keep it tied to damp places.**
4	Why is a modern frog not a step on a straight evolutionary path toward a lizard? Give one life-cycle difference as evidence.	**Frogs and lizards belong to branching tetrapod lineages, so modern frogs are not lizard ancestors. Frogs have aquatic, gilled tadpoles, while lizards hatched from amniotic eggs have lungs and legs.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

On this coast, individuals with stronger connections between their hips and spines might cross exposed rock to reach other pools. If they survived and reproduced more often, that inherited trait could spread over generations. Eggs with protective membranes and leathery shells could develop on damp ground when pools dried. If more young survived, this inherited egg trait could also become common. The eggs would still need to exchange gases and could dry out if the ground became too hot and dry.

Accept other plausible inherited traits if students connect structure to movement or reproduction and explain how a trait could spread across generations. A limitation must be biologically reasonable, not a claim that an individual changes its traits because it needs to.