Built to Fly

Trace how feathers, body structures, and internal systems support flight.

ZOO.9.7 "Explain the importance of the evolution of flight and feathers, including the morphological and physiological adaptations needed to sustain flight."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline two details showing how the roles of feathers changed over evolutionary time, circle two body structures that support flight, and number the steps connecting breathing to muscle-powered flight.

How Flight Took Shape

1. Imagine a small dinosaur running through a fern-filled floodplain. Fossils show that feathers appeared in some dinosaurs before birds could fly. Early feathers could help retain heat, signal to other animals, or protect eggs. Over many generations, some feathered lineages evolved forelimbs that functioned as wings. Long, stiff flight feathers made a broad surface that pushes air downward as the wings beat, helping lift the animal. Feathers with uneven vanes, wider on one side of the shaft, can resist twisting during flight. Flight did not appear in a single leap, and scientists still debate how the first sustained fliers took off.

2. A wing alone cannot keep an animal airborne. In many flying birds, a large breastbone has a keel where powerful chest muscles attach. These muscles drive wingbeats; the wings are modified forelimbs, and the feathers form an adjustable airfoil. Some bones have air-filled spaces that reduce mass without simply making the skeleton fragile. A streamlined body reduces drag as the bird moves through air. Together, muscle power, a useful wing shape, and a relatively light body help produce enough lift and thrust for controlled flight. A bird missing strong flight muscles might glide briefly but could not sustain flapping flight.

3. Flight demands energy because flight muscles contract repeatedly and rapidly. Birds have a four-chambered heart that delivers oxygen-rich blood to these muscles. Air sacs help move air through the lungs so gas exchange remains efficient across the breathing cycle. Oxygen supports cellular respiration, which releases usable energy from food for muscle contraction. This supply system helps a bird keep flying rather than merely launch into the air. Powered flight lets birds reach food beyond ground obstacles, escape some predators, and travel between distant habitats. Those benefits can increase survival and reproduction, which helps explain why flight-related adaptations persisted in many bird lineages.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why do feathers on dinosaurs that could not fly challenge the idea that feathers evolved only for flight? Explain one early role and one later role.

2. How do the uneven vanes of flight feathers and the shape of a wing work together to support flight?

3. Why would a bird with wings and flight feathers still struggle to sustain flapping flight if it lacked strong chest muscles or a keel?

4. How do the heart, air sacs, and lungs help a bird keep flying long enough to travel between distant habitats?

3 YOUR TURN

Your own words

Imagine an ancestral ground-dwelling bird population on an island where insects gather on high cliff ledges and predators hunt on the ground. In one paragraph, explain how feathers, at least two body structures, and one internal process could make powered flight possible, then explain two survival advantages flight would offer there.

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PART 1 · READ AND MARK

Underline two details showing how the roles of feathers changed over evolutionary time, circle two body structures that support flight, and number the steps connecting breathing to muscle-powered flight. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why do feathers on dinosaurs that could not fly challenge the idea that feathers evolved only for flight? Explain one early role and one later role.	**Feathers existed before flight and could retain heat, signal, or protect eggs. Later, flight feathers formed surfaces that helped produce lift.**
2	How do the uneven vanes of flight feathers and the shape of a wing work together to support flight?	**Uneven vanes help feathers resist twisting, while feathers on the wing form a broad, adjustable airfoil that helps produce lift.**
3	Why would a bird with wings and flight feathers still struggle to sustain flapping flight if it lacked strong chest muscles or a keel?	**Strong chest muscles drive repeated wingbeats, and the keel provides a place for them to attach. Wings and feathers alone cannot power sustained flapping.**
4	How do the heart, air sacs, and lungs help a bird keep flying long enough to travel between distant habitats?	**Air sacs move air through the lungs for efficient gas exchange. The heart delivers oxygen-rich blood to flight muscles, where oxygen supports the release of energy needed for repeated wingbeats.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

In this island population, feathers that once helped retain heat could eventually form stiff flight surfaces on the forelimbs. Broad wings would push air downward, while a keeled breastbone would anchor strong muscles for repeated wingbeats. Air sacs would support airflow through the lungs, supplying oxygen needed to release energy from food. Birds able to fly could reach insects on cliff ledges that ground birds miss. They could also escape ground predators by taking off and landing above them.

Accept other accurate feather roles, flight structures, and oxygen-delivery processes if the student explains how they contribute to powered flight. The two advantages must relate to the island scenario.