

Reading Text 1: The Evolution of Flightless Birds

A ratite is any of a diverse group of large, flightless birds of the infraclass Palaeognathae. The name "ratite" refers to their flat sternum that is distinct from the typical sternum of flighted birds because it lacks the keel. Flightless birds are birds that have evolved the inability to fly. They include penguins, kiwis, ostriches, and emus. Certain domestic birds, such as the chicken and duck, are also unable to fly for extended periods of time. The tallest and heaviest flightless bird is the ostrich. Extinct species such as the Phorusrhacidae was also a flightless bird. Like the ostrich and emu, these birds developed specific body shapes, large heads, long necks, and legs.

After the mass extinction of non-avian dinosaurs, the loss of flight evolved within the ratite lineage. The sudden disappearance of certain species offered opportunities for Palaeognathae to distribute and take up new environments. Due to environmental and ecological factors, these animals developed new body types and flightlessness to adapt. During the Miocene period, rainforests dried into partially arid deserts. These animals had to travel long distances to find food that was low-lying vegetation.

Therefore, flightlessness and gigantism are correlated, and this is most evident in regions such as islands with fewer predators and competition. Nevertheless, ratites usually reside in regions with a variety of mammals. Not all flightless birds have gigantism, such as the New Zealand kiwi. This may be due to their evolution from a flying bird or due to competitive exclusion. Once a flightless bird arrived in a region, the herbivore or omnivore niche was used, forcing other birds - such as the kiwi - to remain small. Where no other flightless birds were present, they may have been excluded by other herbivorous mammals.

It was initially believed that ratites originated after the separation of the Gondwana supercontinent. However, in 1974, Joel Cracraft suggested that ratites derived from a flighted ancestor and developed flightlessness over time. New Zealand boasts the greatest number of flightless bird species. This is due to the fact that until human habitation one thousand years ago, no large land predators existed in New Zealand.

Notable differences between flightless and flying birds lie in the size of the wing bones. In flightless birds, the wing bones are much smaller and generally, the keel that anchors muscles for wing movement on the breastbone are absent. The pectoral apparatus in ratites used to give power to flight is reduced and the pelvic girdle is wider and stronger for running. Primitive characteristics for flight, such as the fusion of wing elements, an alula on the wing and a cerebellar structure are still present in flightless birds.

It is interesting to note that some varieties of flightless island birds are related to the flying ones and that flightlessness coincides with body size and mass. The amount of energy needed for flight increases according to the size of the bird's body. With the reduction of the pectoral muscles that demand a great deal of energy, the metabolic energy rate of flightless birds reduced, and they were able to conserve energy. For example, in kiwis, research indicates a notable correlation between the pectoral muscle mass and a low basal rate. However, flightless penguins show an intermediate basal rate as they have stronger pectoral muscles for diving and hunting

Apart from New Zealand moas, the wing structure is still present in flightless birds. This is due to the fact that wings are necessary for balance and act as a parachute apparatus to slow the bird down. An example of this is in the ostrich that can run up to fifty kilometres per hour. Wings are also used to attract a mate, as can be seen in rheas and ostriches. Larger birds are generally more successful in reproduction and a bigger male size indicates protective abilities to the female. These birds use the wings in courtship and to maintain body size in reproduction. Flightless birds are monogamous as they need a reliable mate for high parental involvement. The male flightless birds protect the baby birds between 85 and 92 days while the female birds' feed. The males can survive up to one week without eating and survive off fat storage. Emus can fast up to 56 days.

Questions

1. The word extended in paragraph A is closest in meaning to:

- A. Large
- B. Lengthy
- C. Enlarged
- D. Strong

2. Which of the following can be inferred from paragraph B about the evolution of ratites?

- A. Ratites evolved during the Miocene period as they originally lived in rainforests
- B. Non-avian dinosaurs were the ancestors of current ratite species
- C. Ratites evolved physical characteristics and behaviour to adapt to rainforest environments
- D. Ratites evolved physical characteristics and behaviour to adapt to new environments, such as desert areas with low-laying vegetation

3. In paragraph C, why does the author mention the kiwi?

- A. The kiwi is an exception as it is a flightless bird that does not exhibit gigantism
- B. The kiwi is an exception because it is the only flightless bird to be found in New Zealand
- C. The kiwi is an exception as it is found only in New Zealand and nowhere else in the world
- D. The kiwi is exceptional as it is not categorised as an herbivore or omnivore

4. According to paragraph D, why are there many flightless bird species in New Zealand?

- A. Because of New Zealand's isolation from other land areas, flightless birds evolved more successfully in this region
- B. Many flightless bird species evolved in this region from their flighted ancestors that arrived generations before
- C. Flightless bird species evolved on New Zealand as it broke from the larger, supercontinent
- D. Due to a lack of animals of prey, flightless birds survived and were still present when humans arrived

5. The word lineage in paragraph B is closest in meaning to:

- A. Descendant
- B. Descent
- C. Ancestor
- D. Parents

6. The word exclusion in paragraph C is closest in meaning to:

- A. Rejection
- B. Refusal
- C. Loneliness
- D. Isolation

7. According to paragraph E, all of the following statements are true about flying or flightless birds, EXCEPT:

- A. Flying birds have larger wing bones and a keel on the breastbone
- B. The size of the pelvic girdle in flightless birds is broader
- C. Flightless birds have wider and longer wing bones
- D. Flightless birds also have some primitive traits for flights

8. The word fusion in paragraph E is closest in meaning to:

- A. Connection
- B. Mixture
- C. Coherence
- D. Harmony

9. Paragraph G supports which of the following statements about the size and wings of flightless male birds:

- A. The size and wings of the flightless male bird are used for the search of vegetation and water
- B. The male flightless birds use their size and wings in protection of their young
- C. Flightless male birds use their size and wings to compete against other flightless males
- D. The size and wings of flightless male birds are used to attract new mates and ensure body size in offspring

10. The word apparatus in paragraph G is closest in meaning to:

- A. Strategy
- B. Equipment
- C. Machine
- D. Means

11. Which of the sentences below best expresses the essential information in the following sentence? **With the reduction of the pectoral muscles that demand a great deal of energy, the metabolic energy rate of flightless birds reduced, and they were able to conserve energy.**

- A. Ratites are better able to conserve energy due to a lower basal rate as the pectoral muscles are small with less demand for energy
- B. Flighted birds are better able to conserve energy due to a higher basal rate as the pectoral muscles are small with less demand for energy
- C. Ratites are better able to conserve energy due to a higher basal rate as the pectoral muscles are large with less demand for energy
- D. Flightless birds are better able to use energy due to a higher basal rate as the pectoral muscles are large with a greater demand for energy

12. Which of the following is true, according to the passage? (Make sure to read the WHOLE PASSAGE)

- A. Ratites evolved with the separation of the supercontinent, Gondwana
- B. Ratites evolved from a flighted ancestor through adaptation to new environments
- C. Both theories – the separation of the supercontinent Gondwana and evolution from the flighted ancestor – may explain the current existence of ratites
- D. Ratites did not evolve from a flighted ancestor but are a separate species

Do the following statements agree with the claims of the writer in the reading passage? Select TRUE, FALSE, or NOT GIVEN based on each statement.

- TRUE if the statement agrees with the views of the writer
- FALSE if the statement contradicts the views of the writer
- NOT GIVEN if it is impossible to say what the writer thinks about this

- 13. Flightless birds usually have multiple partners
- 14. Male flightless birds will incubate eggs until they hatch
- 15. Birds that can fly have similar wing structure as flightless birds
- 16. Small birds are less successful in reproduction
- 17. During incubation, eggs are turned about ten times a day
- 18. Generally speaking, female flightless birds will protect male flightless birds