

The Life of Birds

Instructor's
Manual



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BIOLOGY

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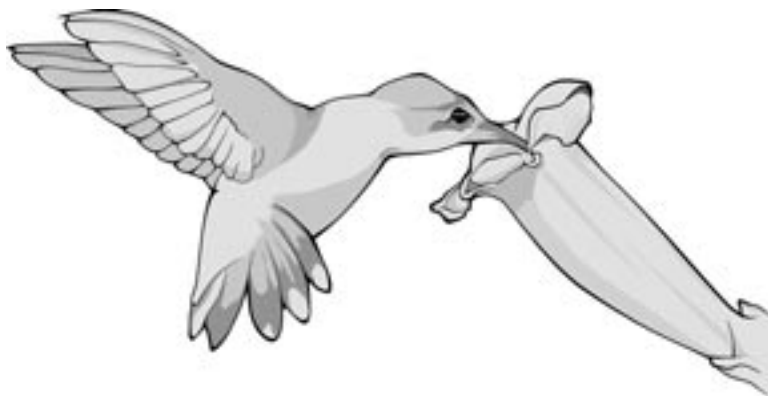


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Student Learning Objectives

Upon viewing the video and completing the enclosed activities, students will be able to do the following:

- List some of the key characteristics common to most birds.
- Describe some of the ways the avian body is designed for flight.
- Differentiate between contour feathers and down feathers. State the general structure and function of each.
- Explain that many birds possess an oil gland near the base of the tail to help make feathers waterproof.
- Understand that the bones of birds tend to be thin and hollow, providing a lightweight skeleton for flight.
- Describe the fact birds are endothermic animals, enabling them to remain active even in cold temperatures.
- Briefly describe the function of some portions of the digestive system of birds including the role of the crop, gizzard, and intestine.
- Explain that bird embryos develop inside amniotic eggs incubated by the parent(s). List a couple of advantages of the amniotic egg in the process of reproduction.
- Understand that the first birds evolved from reptiles over 200 million years ago.
- Cite that the earliest bird fossil known to possess feathers was Archaeopteryx which is thought to have lived about 150 million years ago.
- Know that scientists have cataloged numerous different orders of birds based on various different characteristics.
- Cite some examples of bird behavior including courtship behavior and migratory behavior.

Assessment

Preliminary Assessment (p. 14-15):

The Preliminary Assessment is an assessment tool designed to gain an understanding of students' preexisting knowledge. It can also be used as a benchmark upon which to assess student progress based on the objectives stated on the previous pages.

Post Assessment (p. 16-17):

The Post Assessment can be utilized as an assessment tool following student completion of the program and student activities. The results of the Post Assessment can be compared against the results of the Preliminary Assessment to assess student progress.

Video Review (p. 18):

The Video Review can be used as an assessment tool or as a student activity. There are two sections. The first part contains questions displayed during the program. The second part consists of a ten-question video assessment to be answered at the end of the video.



Introducing the Program

Birds are some of the most remarkable and entertaining vertebrate animals. It's hard to go through the day without seeing birds no matter where you live. Before showing the video program, ask students to name some of the different types of birds that live in the community. Next, ask them to name some of the various types of birds that live on their continent. Last, ask them to list some examples of bird species that live on other continents. Tell students that birds have been extremely successful inhabiting most parts of the globe, even the coldest regions. There are about 9,000 known different species of birds.

Next, ask students to write down some of the major differences between birds and animals in other vertebrate groups such as reptiles or fish. Call on students to share their answers. On the board list some of the defining characteristics of birds.

One of the most remarkable characteristics of most birds is their ability to fly. Explain to students that the avian body is uniquely designed for flight. Ask students how the bodies of birds are uniquely designed for flight. Discuss some of the external features such as wings and feathers that enable birds to fly. Tell students to pay close attention to the video to learn more about how the avian body is uniquely designed for the amazing process of flight.

Program Viewing Suggestions

The student master "Video Review" (p. 19) is provided for distribution to students. You may choose to have your students complete this master while viewing the program or do so upon its conclusion.

The program is approximately 20 minutes in length and includes a ten-question video assessment. Answers are not provided to the Video Assessment in the video, but are included in this guide on page 13. You may choose to grade student assessments as an assessment tool or to review the answers in class.

The video is content-rich with numerous vocabulary words. For this reason you may want to periodically stop the video to review and discuss new terminology and concepts.

Video Script: The Life of Birds

1. If there is one group of naturally occurring vertebrate animals that you are probably familiar with, it's birds.
2. Birds are all around us.
3. Whether you live in the city,...
4. ...in the suburbs...
5. ...or in a rural area, you can see many different kinds of birds.
6. So, what exactly are birds and what makes them unique?
7. What are some of their characteristics,...
8. ...and what features enable them to fly?
9. During the next few minutes we are going to answer these questions and,...
10. ...others as we explore the life of birds.
- 11. Graphic Transition – Key Characteristics of Birds**
12. What is the first thing you visualize when you think about birds?
13. Most likely you envision an animal with feathers and wings that can fly.
14. These are key characteristics common to most birds.
15. Birds are one of only four groups of animals that have mastered the amazing ability to fly.
16. A bird's entire body is adapted for flight.
17. And while not all birds fly, they do all share several common characteristics.
18. Most birds have a body plan consisting of a head, neck, trunk, and tail.
19. Their bodies are relatively spindly shaped and light.
20. Birds possess two pairs of limbs
21. The forelimbs are wings used for flying.
22. Wings are slightly curved from front to back, and they are thicker in the front. This shape helps produce lift during flight.
- 23. You Compare!** Look at this goose. What is the role of its hind limbs compared to its forelimbs?
24. The forelimbs are used for flying, but the hind limbs are adapted for both walking and swimming.
25. The hind limbs of birds are designed for walking or swimming, perching, and even catching prey, depending on the particular species.
26. This peacock possesses many beautifully colored feathers. What exactly are feathers?
27. Feathers are lightweight, flexible, durable structures that cover the bodies of birds.
28. Believe it or not, feathers are thought to have evolved from reptilian scales, that protect and insulate the bird's body, and create the shape necessary to generate lift for flight.
29. Feathers are constantly being lost and replaced with new ones.
30. In some cases feathers also play a role in attracting mates.
31. Quite often males and females in the same species have different colored feathers.
32. Most often the male is brighter than the female, as is the case with cardinals.
33. While there are several different types of feathers, we will discuss two main types: contour feathers and down feathers.

Video Script: The Life of Birds

34. Contour feathers have a stiff main shaft with many side branches called barbs.
35. Each barb possesses interlocking barbules that cling to each other and make the feather strong.
36. When birds preen themselves they are actually “zipping” together barbs that have become separated.
37. Down feathers are different types of feathers that cover the bodies of young birds, such as these chicks.
38. Down feathers have short shafts with tufts of long, fluffy barbs.
39. These types of feathers are also found at the base of contour feathers in adult birds and help to insulate the body.
40. An oil gland near the base of the tail helps to make feathers waterproof.
41. Many birds use their beaks or bills to take oil from the gland and spread it over their feathers to help repel water.
42. A characteristic common to most birds is a strong, lightweight skeleton.
43. The bones of birds tend to be thin and hollow. Such hollow bones are said to be ossified.
44. Many bones are fused, or joined together making the skeleton stronger per volume thus reducing overall weight.
45. Attached to the skeleton are powerful muscles. Muscles in the breast are particularly thick and strong enabling birds to powerfully flap their wings.
- 46. Graphic Transition—Structures and Processes in Birds**
47. One of the special characteristics of birds is their ability to maintain a relatively constant body temperature. Endothermic animals, such as birds and mammals have this ability.
48. In other words, regardless of the outside temperature, the internal core body temperature remains constant.
49. Because birds are endotherms, they can remain very active in a very cold environment, unlike reptiles and amphibians.
50. The activity of flying and the process of maintaining a constant body temperature require large quantities of energy.
51. To meet their energy needs birds must eat and efficiently process lots of food.
52. A hummingbird, for example, needs to eat five times its body weight each day.
53. Imagine eating five times your body weight every day!
54. When birds eat, food passes from the mouth to an enlarged part of the esophagus called the crop.
55. Here food is stored and softened.
56. Food then passes to the gizzard where it is ground up into a pulp.
57. The gizzard is a muscular organ that often contains small stones used to break food into pieces.
58. From the gizzard food then travels to the intestine where nutrients are absorbed.
59. The excretory system of birds is designed to conserve water from body wastes.
60. So, urine is excreted in a non-watery, pasty form.
61. Birds don’t have a urinary bladder to store liquid water, that’s a modification that helps reduce weight for flight.

Video Script: The Life of Birds

62. Birds have a four-chambered heart, high blood pressure, and a rapid heartbeat. The heart of this chickadee, for example, beats 1000 times a minute compared to the 70 to 80 beats per minute of the human heart!
63. These circulatory features enable body cells to receive large amounts of oxygen and carry out a high metabolic rate.
64. Air passes through the lungs and a system of air sacs that extend throughout the body...
65. ...even to the hollow spaces inside bones!
66. In the lungs oxygen comes in contact with the bloodstream.
67. Birds possess a well-developed nervous system with a large brain that has the ability to control the complex muscular movements of flight.
68. While most birds have a poorly developed sense of smell and taste,...
69. ...many have a well-developed sense of sight, hearing, and balance.
70. A hawk, for example, can hear and see a mouse scurrying in a field from a great distance in the sky.
- 71. Graphic Transition – Bird Life Cycles**
72. At one time or another perhaps you have heard birds singing in the spring, seen birds building a nest, or seen them settling on a nest full of eggs.
- 73. You Decide!**
What is the purpose of all these activities?
74. All these things are tied to producing young.
75. Birds reproduce via internal fertilization, and produce amniotic eggs.
76. The eggs produced by chickens are examples of amniotic eggs.
77. Eggs are laid at a relatively early stage in development, thus eliminating the need to carry heavy eggs in flight.
78. Eggs contain various materials including albumin and yolk that provide nourishment to the developing embryo.
79. To mature eggs need to be incubated – kept at a constant, warm temperature while the embryo inside develops.
80. Birds do this by sitting on the nest to keep the eggs warm for many days to months.
81. Most baby birds depend on their parents for food.
82. During the early stages of development parents spend a large part of their time gathering food for their young.
83. Many young birds grow rapidly and quickly develop the ability to live on their own within a period of weeks.
84. Other species of young birds, however, may spend much longer periods of time with their parents.
- 85. Graphic Transition – Evolution and Diversity of Birds**
86. Scientists estimate that birds began to evolve from reptiles about 225 million years ago.
87. In Texas in the mid 1980's a birdlike vertebrate fossil was found called Protoavis.

Video Script: The Life of Birds

88. This small bird possessed both reptilian and birdlike features and is thought to be an intermediary bridge between reptiles and birds.
89. The earliest bird fossil known to possess feathers is Archaeopteryx, which scientists think lived 150 million years ago. It is the oldest known bird.
90. During the next several million years birds evolved into a vast diverse group.
91. Birds today still possess many reptilian features including the presence of scales on their legs and skin.
92. Throughout the world birds live high in trees, on the ground, and they even swim underwater.
93. There are nearly 9,000 known bird species.
94. Scientists have cataloged the many species into orders. Some examples of the larger orders with which you may be familiar include Passeriformes the songbirds making up over half of all bird species.
95. Piciformes include birds such as toucans and woodpeckers.
96. Charadriiformes include auks, gulls, plovers, sandpipers, and terns.
97. The order, Falconiformes, includes birds such as eagles, falcons, hawks, and vultures.
98. And the order, Anseriformes, includes ducks, geese, and swans.
99. These are just a few examples of the wide array of bird orders.
- 100. Graphic Transition – Importance and Behavior of Birds**
101. Birds carry out many vital ecological roles.
102. Some, such as hummingbirds are important pollinators.
103. After consuming fruits, birds help disperse intact seeds through their feces.
104. Birds also occupy key roles in different parts of the food chain.
105. While many are strict herbivores,
106. ...some eat other animals.
107. This falcon for example is eating a pigeon,
108. ...and these gannets consume fish from the sea.
109. In turn, birds are often preyed upon by other animals such as mammals and snakes.
110. For thousands of years birds have served as an important source of food for humans.
111. We commonly eat birds such as turkey and chicken. We also eat eggs and cook with them.
112. Bird watching is a very popular hobby throughout the world.
113. One of the most fascinating characteristics of birds that interest enthusiasts is bird behavior.
114. Birds exhibit a wide and varied range of behaviors, many of which are odd and fascinating.
- 115. You Observe!** Describe this bird behavior.
116. This male peacock is displaying his colorful feathers.
117. It is an example of courtship behavior.
118. Some of the most interesting kinds of behaviors relate to courtship.
119. Most courtship behaviors have evolved to enable birds to locate and select mates.
120. These male frigate birds for example, inflate a balloon-like throat pouch and sound a loud cry to attract females.

Video Script: The Life of Birds

121. Many birds exhibit courtship displays to continually bond them throughout the breeding and nesting process.
122. Nesting behaviors, including the building and maintenance of the nest, are other examples of bird behavior.
123. While many birds remain in the same place year-round, others make annual migrations in the spring and fall to places where it is more favorable for them to survive.
124. In the Northern hemisphere birds tend to migrate south in the fall and then migrate north in the spring.
125. These incredible birds called red knots migrate amazing distances – thousands of kilometers every spring and fall between the southern tip of South America and the Arctic.
126. It's amazing that these small birds make such a great journey in just a couple of weeks without losing their way!

127. Graphic Transition – Video Review

128. During the past few minutes we have explored some of the fascinating features of birds.
129. We began by highlighting the key characteristics which enable them to fly, including feathers, wings, and a lightweight skeleton.
130. Some of the internal structures and processes were highlighted.
131. The major features of the digestive and respiratory system were explained.
132. We briefly explored the important aspects of the nervous system.
133. Next, the common stages of the bird life cycle were investigated including the development of the embryo in an amniotic egg.
134. We briefly discussed the origin of birds, and highlighted some of the major orders of birds.
135. We talked about why birds are important.
136. And, finally we investigated some of the fascinating features of bird behavior.

137. Graphic Transition – Video Assessment

Fill in the correct word to complete the sentence.

1. In birds the forelimbs form structures called _____.
2. The bodies of birds are covered with _____.
3. _____ feathers cover the bodies of young birds.
4. The bones of birds tend to be thin and _____.
5. Birds are _____, meaning they maintain a constant body temperature.
6. The muscular digestive organ called the _____, often contains small stones.
7. The embryos of birds develop in _____.
8. _____ is the earliest known bird, dating back 150 million years.
9. Birds are thought to have evolved from _____.
10. _____ behaviors enable birds to locate and select mates.

Answer Key to Student Assessments

Preliminary Assessment (p. 15-16)

1. d - wings
2. a - flight
3. c - feathers
4. a - down
5. b - endotherms
6. b - gizzard
7. d - beak
8. c - incubation
9. b - amniotic egg
10. a - Archaeopteryx
11. a - reptiles
12. d - 9,000
13. c - pollination
14. d - courtship behavior
15. a - migration
16. Birds are endothermic vertebrate animals that are covered with feathers. Most can fly. Birds reproduce via internal fertilization and lay eggs.
17. The following are some features that help birds in the process of flight: feathers, wings, lightweight skeleton with air spaces, strong breast muscles, and the laying of eggs reducing weight in flight.
18. Endothermic means the animal maintains a relatively constant body temperature. This is advantageous because it enables organisms to remain active even in cold temperatures.
19. Birds evolved from reptiles. The first fossil evidence of a bird possessing feathers is Archaeopteryx dating back 150 million years.
20. Migration, courtship and nesting are examples of various types of bird behavior.

Video Review (p. 19)

1. The hind limbs are adapted for both walking and swimming, but the forelimbs are used for flying.
2. Birds singing in the spring, building nests, and settling on a nest of eggs, are all tied to producing young.
3. This male peacock is displaying his colorful feathers which is an example of courtship behavior.

Video Assessment (p. 19)

1. wings
2. feathers
3. down
4. hollow
5. endothermic
6. gizzard
7. amniotic eggs
8. Archaeopteryx
9. reptiles
10. courtship

Post Assessment (p. 17-18)

1. c - pollination
2. a - Archaeopteryx
3. d - beak
4. a - migration
5. d - 9,000
6. b - amniotic egg
7. b - endotherms
8. a - flight
9. b - gizzard
10. a - down
11. d - courtship behavior
12. d - wings
13. c - incubation
14. a - reptiles
15. c - feathers
16. Birds evolved from reptiles. The first fossil evidence of a bird possessing feathers is Archaeopteryx dating back 150 million years.
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19. Migration, courtship and nesting are examples of various categories of bird behavior.
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Life of Birds Vocabulary (p. 20)

1. e - gizzard
2. j - reptiles
3. o - migration
4. f - crop
5. l - falconiformes
6. c - down feathers
7. k - passeriformes
8. d - endothermic
9. n - nesting behavior
10. i - archaeopteryx
11. h - incubation
12. m - courtship behavior
13. b - contour feathers
14. g - amniotic egg
15. a - wings

Answer Key to Student Activities

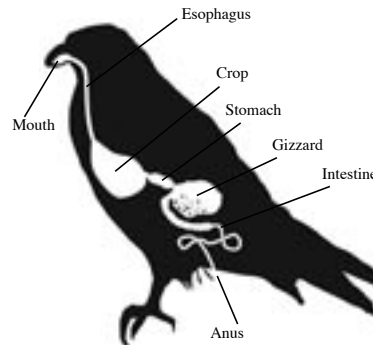
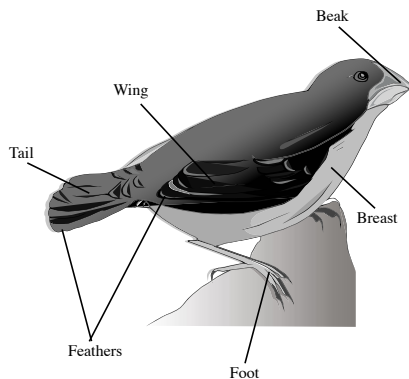
Major Order of Birds (p. 21)

Bird Order	Number of Species	Key Characteristics	Examples
Passeriformes	5276	Perching feet, dependent young, well-developed vocal organs	robins, sparrows, starlings, crows, warblers
Apodiformes	428	small bodies, short legs, rapid wing beat	hummingbirds, swifts
Piciformes	383	sharp, chisel-like bills used for breaking down wood, grasping feet	woodpeckers, toucans
Psittaciformes	340	well-developed vocal cords; large, powerful bills used to crush seeds	parrots, cockatoos
Charadriiformes	331	long, slender legs; thin, probing bills	gulls, sandpipers, terns, plovers, auks
Columbiformes	303	round, stout bodies; perching feet	pigeons, doves
Falconiformes	288	Keen vision; sharp, pointed beaks; carnivorous	hawks, vultures, eagles
Galliformes	268	usually limited flying ability; rounded bodies	chickens, pheasants
Gruiformes	209	live in marshes; stilt-like legs, various body shapes	cranes, bitterns
Anseriformes	150	Broad bills; webbed feet	geese, ducks, swans
Strigiformes	146	talons; nocturnal; birds of prey	barn owl, screech owl
Ciconiiformes	114	large bodies with long legs	storks, herons
Procellariiformes	104	ability to fly for long periods of time; bills are tube-shaped	albatrosses, petrels

Speciation (p. 23-25)

- About 950 kilometers
- The Pacific Ocean acts as a huge geographic barrier.
- Birds could possibly fly. Other animals and plants could float on a land raft or logs, or swim.
- The original ancestor of the finches was a South American finch that arrived at the Galapagos Islands from the mainland.
- There are 13 different species of finches.
- The interacting components of variation, competition, and adaptation promote adaptive radiation. When niches in an environment are free, new species exploit the niches.
- The Large Ground Finch has a big blunt beak that is rather short. The Warbler Finch has a small pointed beak. The Woodpecker Finch has a larger, sharp beak.
- The Large Ground Finch eats seeds, and spends its time on the ground. The Warbler Finch eats insects in trees. The Woodpecker Finch uses sharp sticks as tools to dig into tree branches and eats bug larva it finds inside.
- The 13 species of Galapagos finches are a good example of adaptive radiation because each of the 13 distinct species evolved from the same ancestor, and now occupy different niches.

Bird Anatomy (p. 22)



- The presence of wings and feathers help birds achieve flight.
- The heron has long, thin legs, a long pointed bill, and is tall compared to the songbird.
- Food enters the body through the mouth. It then proceeds down the esophagus. It may be stored for a period of time in the crop. From the crop, it then proceeds to the stomach and gizzard where extensive digestion occurs. Nutrients are absorbed in the intestine before waste exits the body through the anus.
- Birds have a crop and a gizzard which is not found in humans. The role of the gizzard is to grind up bits of food into smaller pieces. Some birds have tiny stones in the gizzard that aid in the process of breaking up tough bits of food such as seeds.
- The forelimbs of birds are modified into wings whereas a lizard has legs. Birds tend to walk on two legs whereas lizards walk on four similar legs. Birds are covered with feathers whereas lizards are covered with scales. Birds possess beaks or bills, whereas lizards have teeth.

Preliminary Assessment

Name: _____

Directions: Circle the best answer for each of the following:

- The forelimbs in birds are called:
 - flippers
 - talons
 - beaks
 - wings
- The entire body plan of most birds is designed for the process of:
 - flight
 - swimming
 - running
 - digging
- What lightweight, flexible structures cover the bodies of birds and aid in the process of flight?
 - skin
 - scales
 - feathers
 - hair
- What types of feathers consisting of short shafts and long, fluffy barbs cover the bodies of young birds?
 - down
 - contour
 - streamline
 - barbed
- Birds can remain active in cold temperatures due to the fact they are:
 - poikilothermic
 - endotherms
 - cold-blooded
 - ectotherms
- What muscular digestive organ in birds often contains small stones used to break food into pieces?
 - kidney
 - gizzard
 - intestine
 - liver
- What characteristic is not designed to help birds fly?
 - wings
 - hollow bones
 - feathers
 - beak
- Eggs are kept at a relatively constant temperature by the parent(s) in the process of:
 - fertilization
 - egg laying
 - incubation
 - courtship
- Materials such as albumin and yolk provide nourishment to the developing bird embryo inside the:
 - placenta
 - amniotic egg
 - uterus
 - crop
- The earliest bird fossil known to possess feathers is:
 - Archaeopteryx
 - Pterodactyl
 - Stegosaurus
 - Brontosaurus
- Birds most likely evolved from the following animals:
 - reptiles
 - amphibians
 - fish
 - mammals
- About how many known bird species are there?
 - 2,000
 - 900
 - 20,000
 - 9,000
- Some birds, such as hummingbirds, move pollen from one plant to another in the process of:
 - asexual reproduction
 - mutation
 - pollination
 - propagation
- What type of behavior helps birds locate and select mates?
 - defensive behavior
 - migratory behavior
 - aggression
 - courtship behavior
- Geese traveling in the spring and fall to a place better suited to their survival is an example of the following behavior:
 - migration
 - courtship
 - nesting
 - indiscriminate

Post Assessment

Name: _____

Directions: Circle the best answer for each of the following:

- Some birds, such as hummingbirds, move pollen from one plant to another in the process of:
 - asexual reproduction
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 - pollination
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 - talons
 - beaks
 - wings
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 - fertilization
 - egg laying
 - incubation
 - courtship
- Birds most likely evolved from the following animals:
 - reptiles
 - amphibians
 - fish
 - mammals
- What lightweight, flexible structures cover the bodies of birds and aid in the process of flight?
 - skin
 - scales
 - feathers
 - hair

Post Assessment

Name: _____

Directions: Answer the following using complete sentences

16. From what organisms did birds evolve?

17. What does it mean when we say birds are endothermic? How is endothermy advantageous?

18. What makes a bird a bird?

19. Describe an example of a bird behavior.

20. Describe two bird features that help them in the process of flight.

Video Review

Name: _____

Directions: Answer these questions as you watch the video:

1. You Compare!

Look at this goose. What is the role of its hind limbs compared to its forelimbs?

2. You Decide!

What is the purpose of all these activities?

3. You Observe!

Describe this bird behavior.

Video Assessment

Directions: After you watch the video, fill in the blank to complete the sentence.

1. In birds, the forelimbs form structures called _____.
2. The bodies of birds are covered with _____.
3. _____ feathers cover the bodies of young birds.
4. The bones of birds tend to be thin and _____.
5. Birds are _____, meaning they maintain a constant body temperature.
6. The muscular digestive organ called the _____, often contains small stones.
7. The embryos of birds develop in _____.
8. _____ is the earliest known bird, dating back 150 million years.
9. Birds are thought to have evolved from _____.
10. _____ behaviors enable birds to locate and select mates.

The Life of Birds Vocabulary

Name: _____

Directions: Unscramble the vocabulary words in the first column. Match the words to the definitions in the second column.

____ 1) zdgriza _____

____ 2) tsierpel _____

____ 3) irmtiaogn _____

____ 4) ocpr _____

____ 5) lnoeaimcrofsf _____

____ 6) wdno etesarhf _____

____ 7) iesrsosaefmpr _____

____ 8) enretmihdco _____

____ 9) entsgni ihraobve _____

____ 10) rhyptaeeaoxr _____

____ 11) nuainctiob _____

____ 12) hrcsotiup hiaorveb _____

____ 13) otuconr etesarhf _____

____ 14) ionatmic geg _____

____ 15) giswn _____

a. The forelimbs in birds that are adapted for flight in most birds.

b. Structures that possess a stiff main shaft with many side branches called barbs.

c. Structures that have short shafts with tufts of long, fluffy barbs; cover the bodies of young birds.

d. A characteristic of birds and mammals whereby they maintain a relatively constant internal core body temperature.

e. A muscular organ in the avian digestive tract that often contains small stones used to break food into pieces.

f. An enlarged part of the esophagus where food is temporarily stored before progressing in the digestive tract.

g. Hard, multilayered structure within which the bird embryo develops.

h. A process in which one or both parents keep eggs at a consistent temperature to ensure the embryos develop properly.

i. The earliest bird fossil known to possess feathers.

j. Vertebrate group from which birds are thought to have evolved.

k. Order of birds that includes songbirds; makes up over half of all bird species.

l. A bird order that includes eagles, falcons, hawks, and vultures.

m. Enables birds to locate and select mates.

n. Behavior related to the building and maintenance of the nest.

o. The regular movement (often seasonal) of birds to locations where it is more favorable for them to survive.

Major Orders of Birds

Background:

Today, birds are the most successful of all terrestrial vertebrates. In the class Aves there are 28 orders, 166 families, and about 9,000 species. Birds are an extremely interesting class of animals due to the fact they vary tremendously from each other, possessing fascinating body forms, colors, and behaviors.



Activity:

In this activity you will become familiar with some of the major orders of birds. Below is a chart listing 13 of the major bird orders. Using your knowledge of birds and other reference materials, complete the information on the chart. After completing the chart, each member of the class will be assigned one avian order. One at a time they will state the characteristics of their assigned order. The rest of the class will try to figure out the order they are describing.

Bird Order	Number of Species	Key Characteristics	Examples
Passeriformes			
Apodiformes			
Piciformes			
Psittaciformes			
Charadriiformes			
Columbiformes			
Falconiformes			
Galliformes			
Gruiformes			
Anseriformes			
Strigiformes			
Ciconiiformes			
Procellariiformes			

Bird Anatomy

Name: _____

Directions: On this page are two diagrams: an exterior view of a songbird, and a simple internal diagram of the digestive tract in a bird. Using your knowledge of birds and other reference materials, identify and label the features on the diagrams. On the back of the paper describe the function of each structure. On the external diagram, identify the following: beak, breast, foot, tail, feathers, and wing. On the internal diagram of the digestive system identify the following: esophagus, mouth, crop, stomach, gizzard, intestine, and anus.

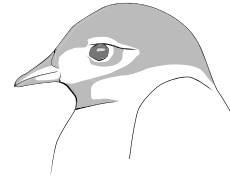


Questions:

1. What external structures enable birds to fly?
2. How do the external features of a heron differ from this songbird?
3. Describe the path of food in the avian digestive tract.
4. What digestive structures do birds have that humans do not possess? What is the role of tiny stones in the gizzard of some birds?
5. Compare the external features of a bird to that of a reptile such as a lizard.

Speciation

Name: _____



Background:

There are millions of species of living things on planet Earth. Remarkably, the existing living species on Earth today represent a fraction of the number of species which inhabited the planet at one time. Scientists estimate there are tens of millions of extinct species that once thrived on Earth. How have so many different species of living things evolved? There is not a single, simple answer to this question.

Darwin's theory of natural selection serves as the foundational theory upon which our modern understanding of how species change has been formulated. Overproduction, competition, variation, and adaptation are the basic components of the theory of natural selection. Over time, interacting factors can result in the formation of an entirely new species.

Speciation is the evolution of one or more new species from a single existing species. One of the most important factors promoting speciation is isolation. Isolation is anything which prevents groups within a species from breeding. Geographic isolation occurs when a population is divided by a natural barrier such as an ocean, a mountain range, a desert, or any other natural obstruction. The Galapagos Islands are an excellent example of an area that is geographically isolated - separated by about 950 kilometers of ocean from the South American continent. In this activity you will explore a very important group of birds in the Galapagos as we take a look at one of the more well known examples of speciation.

Materials: world atlas, worksheet titled "Darwin's Finches", pencil

Directions:

1. Locate the Galapagos Islands using a world atlas.
2. Measure the distance of the Galapagos Islands to the mainland of South America. Record your answer here:
 - a.
3. Describe the type of geographic barrier that exists between the Galapagos Islands and the continent of South America. Record your answer below:
 - b.
4. Some of the older islands in the Galapagos are about 5 million years old; they formed as a result of volcanic activity. Describe how animals and plants could possibly have arrived at the newly formed islands over this time period. Record your response here:
 - c.
5. One of the organisms that is thought to have arrived is one or more finches from South America. It is thought that the 13 different species of finches which exist in the Galapagos speciated from a single type of finch that arrived from the continent. Study the diagram illustrating what scientists believe is the evolutionary relationship of the finches.

Speciation

Name: _____

6. Answer the following questions:

d. What is the original ancestor of the finches?

e. How many species of finches are there?

7. The finches in the Galapagos provide an excellent example of the process of adaptive radiation. Adaptive radiation is the process by which a species evolves into a number of different species, with each occupying a new environment or niche. Answer the following questions:

8. On page 25 are three different diagrams illustrating the head and bill structures of three different species of finches. Each different species is labeled.

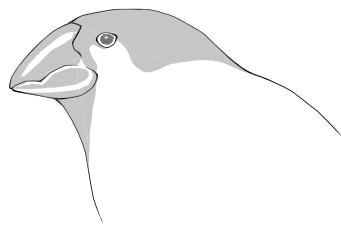
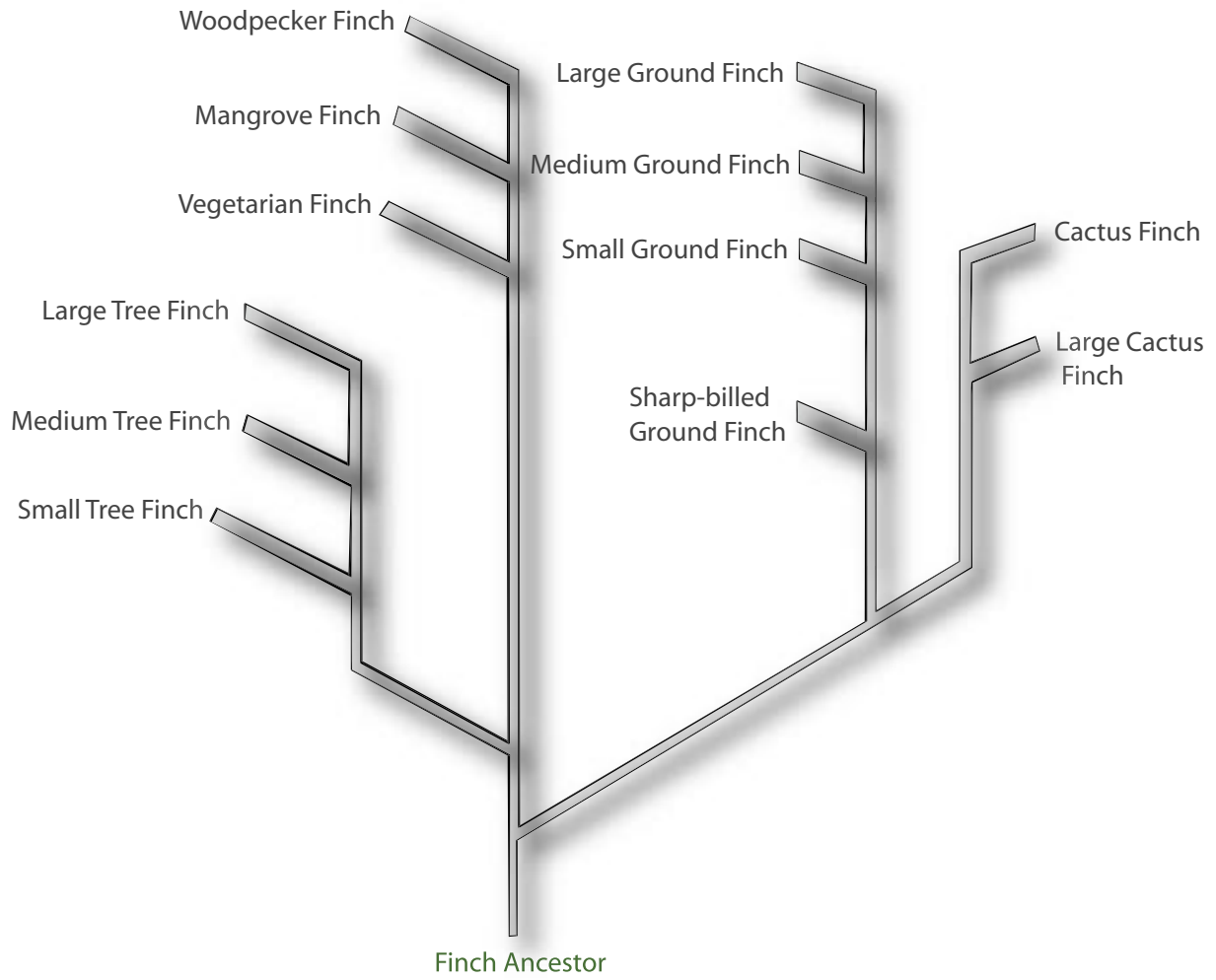
g. Describe how the beak structures of each bird differs.

h. Describe the type of food each bird feeds on, and describe the type of environment in which it spends most of its time.

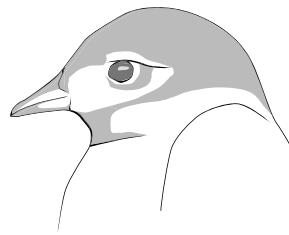
i. Explain why the Galapagos finches are a good example of adaptive radiation.

Speciation

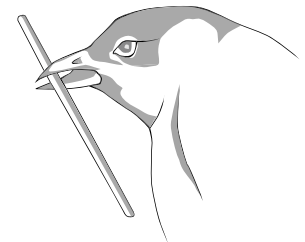
Name: _____



Large Ground Finch



Warbler Finch



Woodpecker Finch