STUDENT HANDOUT

GRADES 6–12

SCIENCE LAB

EXPLORING BIRD SKELETON EVOLUTION

BIRD BODIES ARE ADAPTED TO DIFFERENT FEEDING NICHES

New York State Museum

The New York State Museum is a program
of The University of the State of New York
The State Education Department
Office of Cultural Education

STUDENT HANDOUT

GRADES 6–12

Name: Date Completed:

Class: Lab Minutes: Teacher:

SCIENCE LAB

EXPLORING BIRD SKELETON EVOLUTION

BIRD BODIES ARE ADAPTED TO DIFFERENT FEEDING NICHES

BACKGROUND

In this portion of the lab we are going to examine the ways that bird morphology (body shape) is adapted to different feeding niches. We will measure wing and leg bones from species with different foraging behaviors. We will interpret the results in the context of convergent evolution, which is the process where multiple species independently evolve similar traits although they are not closely related on the phylogenetic tree.

LAB PROCEDURE

- **STEP 1 –** In groups of 3 to 4 students, select your first bird to measure. Write the species name and common name on the data sheet.
- **STEP 2 –** Using Figures 1 and 2, identify the femur, tibiotarsus, tarsometatarsus, and the longest toe bone.
- **STEP 3 –** Measure each of these four leg bones (in millimeters) and enter the data on your sheet. Add the measurements together to get the total length of the leg.
- **STEP 4 –** Next, find the humerus, ulna, carpometacarpus, and phalanx 1 of the second digit.
- **STEP 5 –** Measure each wing bone, just as you did in step 3 for the legs. Then add each measurement together, and enter all data into the data sheet.
- **STEP 6 –** Trade places with another team and measure a different bird, repeating all previous steps.
- **STEP 7 –** After your group has measured the bird specimens, enter your information in the class data sheet.
- **STEP 8 –** Using the pooled class data, create a graph with total leg-bone length on the y-axis and total wing-bone length on the x-axis.
- **STEP 9 –** After all data points have been plotted, draw a trend line that passes through the origin of the plot (0, 0). Bird species that fall well above the line have relatively long wings, and birds that fall well below this line have relatively long legs.

NYS Museum
New York State Museum

The New York State Museum is a program of The University of the State of New York
The State Education Department
Office of Cultural Education

SCIENCE LAB

EXPLORING BIRD SKELETON EVOLUTION

STUDENT HANDOUT

GRADES 6–12

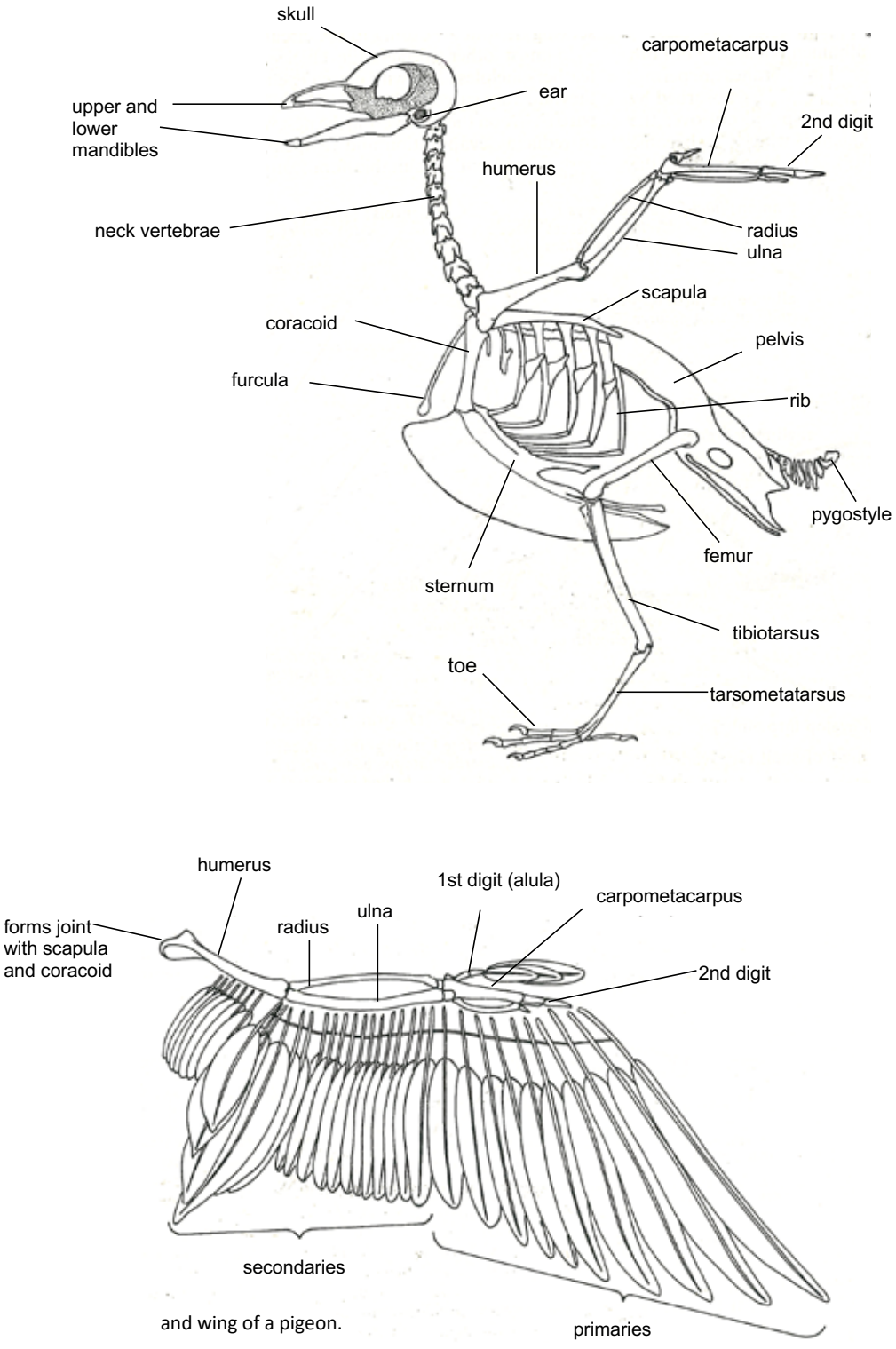

Figure 1. Skeleton and wing of a pigeon.

New York State Museum

The New York State Museum is a program of The University of the State of New York
The State Education Department
Office of Cultural Education

SCIENCE LAB

EXPLORING BIRD SKELETON EVOLUTION

STUDENT HANDOUT

GRADES 6–12

Figure 2. Two views of the wing bones (upper in each photo) and leg bones (lower) of a grouse.

New York State Museum

The New York State Museum is a program of The University of the State of New York
The State Education Department
Office of Cultural Education

SCIENCE LAB

EXPLORING BIRD SKELETON EVOLUTION

STUDENT HANDOUT

GRADES 6–12

DATA SHEET

Student Names:

SKELETON 1

Species Name: Common Name:

Wing

Enter the length of each wing bone (in mm) in the table below and calculate the total length.

Humerus	Ulna	Carpometacarpus	2nd Digit Phalanx 1	Wing Total Length

Leg

Enter the length of each leg bone (in mm) in the table below and calculate the total length.

Femur	Tibiotarsus	Tarsometatarsus	Longest Toe (Pedal Phalanx)	Leg Total Length

SKELETON 2

Species Name: Common Name:

Wing

Enter the length of each wing bone (in mm) in the table below and calculate the total length.

Humerus	Ulna	Carpometacarpus	2nd Digit Phalanx 1	Wing Total Length

Leg

Enter the length of each leg bone (in mm) in the table below and calculate the total length.

Femur	Tibiotarsus	Tarsometatarsus	Longest Toe (Pedal Phalanx)	Leg Total Length

SKELETON 3

Species Name: Common Name:

Wing

Enter the length of each wing bone (in mm) in the table below and calculate the total length.

Humerus	Ulna	Carpometacarpus	2nd Digit Phalanx 1	Wing Total Length

Leg

Enter the length of each leg bone (in mm) in the table below and calculate the total length.

Femur	Tibiotarsus	Tarsometatarsus	Longest Toe (Pedal Phalanx)	Leg Total Length

New York State Museum

The New York State Museum is a program of The University of the State of New York
The State Education Department
Office of Cultural Education

SCIENCE LAB

EXPLORING BIRD SKELETON EVOLUTION

STUDENT HANDOUT

GRADES 6–12

DATA SHEET

DISCUSSION QUESTIONS

- Which bird species is found furthest below the line in your class graph? Describe the feeding behavior of this species.

- Why are the Common Nighthawk and Caspian Tern found well above the line?

- According to the phylogeny in Figure 3, about how long ago did the Caspian Tern and Common Nighthawk diverge from their common ancestor?

- Describe how convergent evolution has produced similar skeletal proportions in these two distantly related birds.

- What is it about the diets and feeding behaviors of the two hawk species that might explain the difference in the relative length of their wings?

NYS New York State Museum

The New York State Museum is a program of The University of the State of New York
The State Education Department
Office of Cultural Education

SCIENCE LAB

EXPLORING BIRD SKELETON EVOLUTION

STUDENT HANDOUT

GRADES 6–12

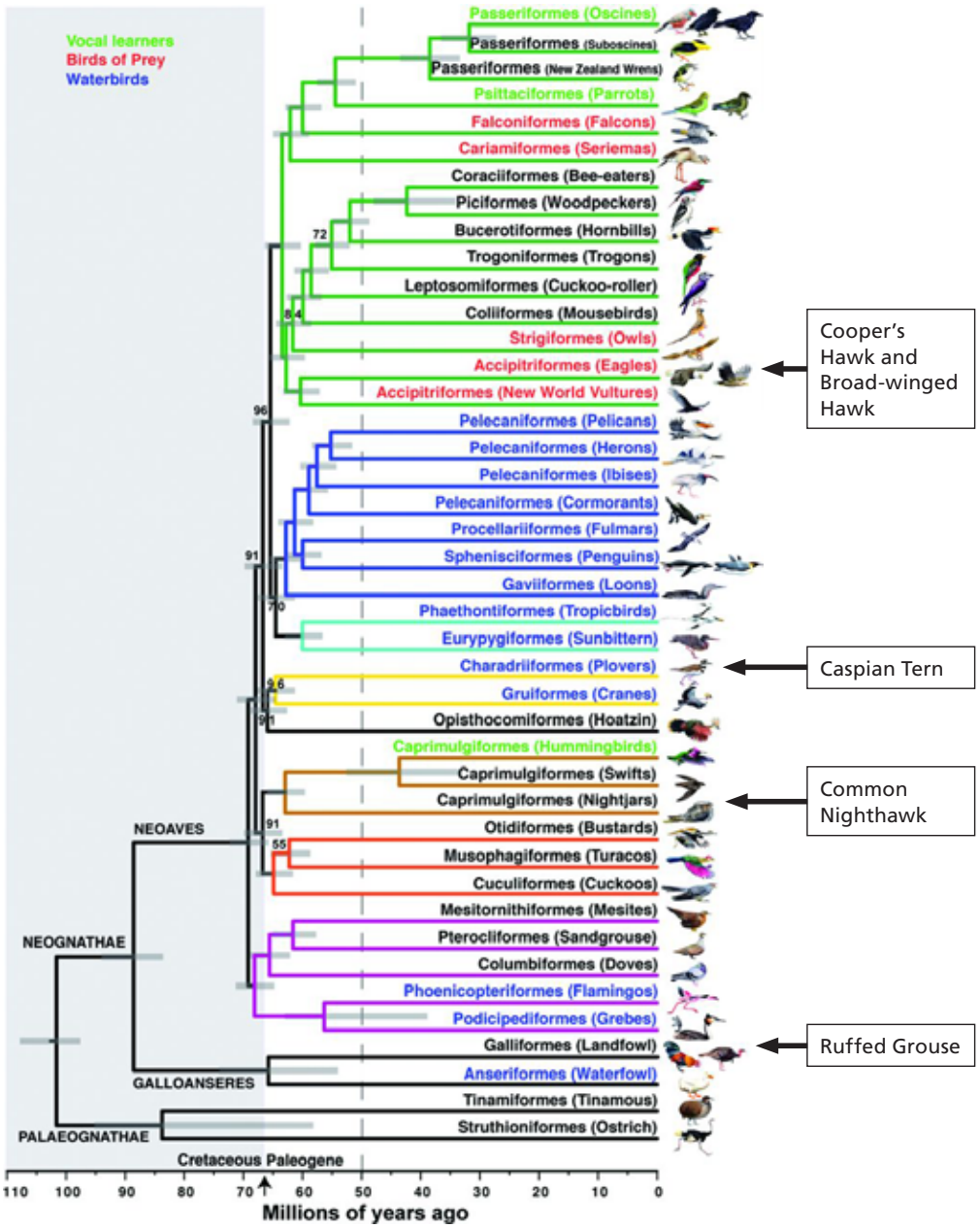

Figure 3. A phylogeny of major bird lineages based on whole-genome DNA sequences. The K-Pg boundary is denoted by the small vertical arrow in the timeline. All orders of birds were in place by 50 Ma, denoted by the dashed line. (From E. D. Jarvis et al., "Whole-genome analyses resolve early branches in the tree of life of modern birds," Science 346 (December 2014): 1320-1331.

New York State Museum

The New York State Museum is a program of The University of the State of New York
The State Education Department
Office of Cultural Education

WINTER 2021

Museum Director
Mark A. Schaming

Curator of Ornithology
Dr. Jeremy J. Kirchman

Exhibition Planner
Carrie Ross

Museum Educators
James Jenkins & Hattie Langsford

Museum Editor
Jessica Fisher Neidl

Graphic Designer
Christopher Havens

Cover Photo
Terns, left to right: Caspian Tern juvenile and adult, Royal Tern adults in winter and summer plumage, Black Tern adult in summer, adult molting to winter plumage (in flight), and juvenile.

Reproduction of original watercolor by
Louis Agassiz Fuertes (NYSM H-1977.74.29)

NYS Museum
New York State Museum

The New York State Museum | Cultural Education Center | 222 Madison Avenue | Albany, New York 12230