

DARWIN 2009
Exploration is Never Extinct

Feathered Families

Lesson Plan
grades 4-7



REGENERATIVE MEDICINE
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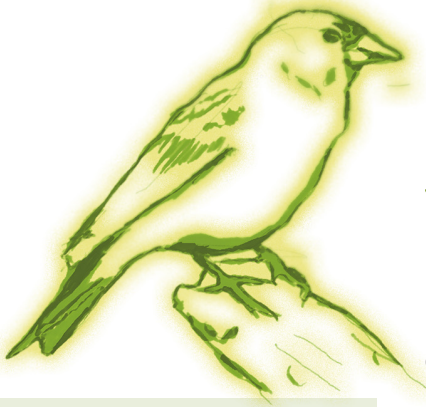
Darwin 2009: A Pittsburgh Partnership



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Introduction

Feathered Families

DARWIN 2009
EXPLORATION IS NEVER EXTINCT

This lesson plan was developed as part of the "Darwin 2009: Exploration is Never Extinct" initiative in Pittsburgh. Darwin2009 includes a suite of lesson plans, multimedia, on-line resources and art. Find all information on-line at: www.sepa.duq.edu/darwin.

This lesson plan was originally developed for the National Aviary in Pittsburgh, PA.

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NATIONAL AVIARY

Goals

1. To introduce the concepts of relatedness, species/speciation, adaptation, environmental niches, and taxonomy.
2. To utilize bird facts and information to demonstrate the relatedness of various bird species and groups.
3. To introduce the concept of environmental conservation through letter writing.

Learning Objectives

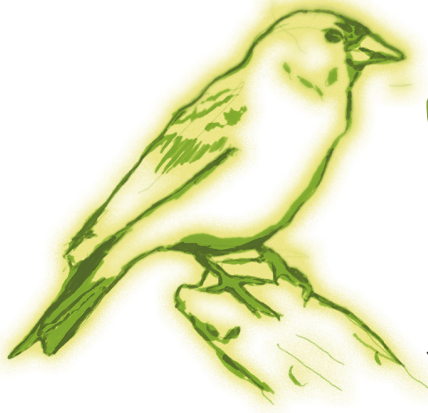
1. The student will be able to define the terms "species," "speciation," "adaptation," "environmental niche," and "taxonomy" and understand how they are related.
2. The student will be able to give examples of species of birds and orders of birds.
3. The student will be able to use "Bubble Maps" and Double Bubble Maps" to compare and contrast between two bird species or orders of birds.
4. The student will be able to participate in the conservation process by writing a letter to a congressman, expressing the importance of protecting wildlife.

Materials, Resources, and Preparation

1. Educator should read the Teacher Pages provided in this packet.
2. "Bubble Map" and "Double Bubble Map" templates for comparing and contrasting birds are provided at the end of the lesson plan.
3. Preparations should be made for the class to have access to the internet and other research materials like encyclopedias or bird field guides to gather information about birds of prey.
4. Pencils/Pen and paper are needed to complete the conservation letter writing portion of the lesson.

A few things your students should already know:

1. What an organism is.
2. That a bird is an animal, but they have very unique characteristics to make them different from other groups such as mammals, etc.



Teacher Pages

Feathered Families

Vocabulary

1. **Species**- A group of organisms (plants or animals) that are capable of breeding with other members of the same group but are unable to produce fertile offspring with other organisms.
2. **Speciation**- The process through which a new species arises. This can happen through various natural phenomena, including: mutation, migration, genetic drift, and natural selection.
3. **Natural Selection**- The process by which favorable traits are determined by environmental conditions. Eventually those with the favorable trait will have a higher rate of reproduction and survival.
4. **Adaptation**- The alteration in an organism's behavior or body resulting from natural selection. This change occurs over an extended period of time. Adaptations are tailored to the organism's environmental niche.
5. **Environmental Niche**- The unique position of a species in the biosphere.
6. **Taxonomy**- The science of naming, organizing, and classifying living organisms based on relatedness.

Overview

There is great diversity found among living organisms on earth. In order to better understand the relatedness of organisms, scientists use taxonomy to group and organize related species. A system of classification puts all living things into a kingdom, phylum, class, order, family, genus, and species based on relatedness. A kingdom is the broadest classification group, such as Animalia, the Animal Kingdom. A species is the most specific group, such as, *Aptenodytes forsteri*, commonly known as the Emperor Penguin. A species is defined as a group of organisms (plants or animals) that are capable of breeding with other members of the same group but are unable to produce fertile offspring with other organisms.

One way of remembering the various classification levels in the taxonomic system is the mnemonic device: **King Phillip Cuts Open Five Green Snakes**. The beginning letter of each word in the above sentence represents a taxonomic level: Kingdom, Phylum, Class, Order, Family, Genus, Species.

In the case of birds, there are several characteristics that taxonomists uses to classify them into the class of Aves. All birds are classified as follows:

Kingdom: *Animalia*

Phylum: *Cordata*

Sub-Phylum: *Vertebrata*

For a more specific bird, such as the Sharp-Shinned Hawk, the classification would be:

Kingdom: *Animalia*
Phylum: *Cordata*
Sub-Phylum: *Vertebrata*
Class: *Aves*
Order: *Falconiformes*
Family: *Accipitridae*
Genus: *Accipiter*
Species: *striatus*

All birds have feathers, lay eggs, have wings, have hollow bones, have beaks, and are warm blooded. All of the birds in the order *Falconiformes*, a more specific classification, have a hooked beak, strong feet (talons) and legs, and long broad wings for soaring. They are meat eaters, have very good eyesight, and their juvenile birds look different than the adults. These shared characteristics are what make them all *Falconiformes*.

The process of speciation can easily be seen in the various species of birds of prey found in different habitats and niches around the world. While all of these birds share the characteristics of the order *Falconiformes*, each species possess unique **adaptations** that better suit them to their individual environmental niches. Adaptations are unique features that the species have gained over time that help them survive in their particular environment. For example, the environmental niche of the American Bald Eagle contains a large population of fish, so this eagle has developed rough talon skin. The increased roughness of their feet allows these eagles to better catch the slippery fish that make up their diet. Another example of adaptation brought about by environmental pressures are the “eye spots” of the pearl spotted owlet. In order to ward off attacks from the natural predators in its niche, the pearl spotted owlet developed a unique plumage pattern. Because predators often attack from behind and rarely attack when they can see the face of their prey, the owlet uses these “eye spots” to fool predators into thinking they are looking at the front of the owl. This can help prevent attacks from some of the owlets’ predators, thereby increasing its chances of survival.

The adaptations of these animals that have arisen from the pressures of their environmental niches support Charles Darwin’s principle of evolution. Darwin refers to these environmental pressures as **natural selection**. Natural selection acts upon birds and all other organisms, determining which individuals are most fit - which ones have the most suited physical characteristics, like particularly rough skin on the feet. Over generations, the most fit organisms reproduce more and their favorable traits became more common in the species, therefore becoming adaptations. Over time, adaptations accumulate and the species evolves!



Ostrich



Emperor Penguin



Great Horned Owl

Bird Taxonomic Groups

(Order - *example species*)

Tinamiformes - *Tinamous*

Rheiformes - *Rheas*

Struthioniformes - *Ostrich*

Casuariiformes - *Cassowaries*

Dinornithiformes - *Kiwis*

Podicipediformes - *Grebes*

Sphenisciformes - *Penguins*

Procellariiformes - *Tube-nosed Seabirds*

Pelecaniformes - *Pelicans and relatives*

Anseriformes - *Waterfowl*

Phoenicopteriformes - *Flamingos*

Ciconiiformes - *Herons, Storks, New World Vultures and relatives*

Falconiformes - *Diurnal Birds of Prey*

Galliformes - *Fowl-like Birds*

Gruiformes - *Cranes, Rails and relatives*

Charadriiformes - *Shorebirds, Gulls and relatives*

Gaviiformes - *Loons*

Columbiformes - *Pigeons and Doves*

Psittaciformes - *Parrots*

Coliiformes - *Mousebirds*

Musophagiformes - *Turacos*

Cuculiformes - *Cuckoos*

Strigiformes - *Owls*

Caprimulgiformes - *Nightjars and relatives*

Apodiformes - *Swifts and Hummingbirds*

Trogoniformes - *Trogons*

Coraciiformes - *Rollers, Kingfishers and relatives*

Piciformes - *Woodpeckers, Toucans and relatives*

Passeriformes - *Perching Birds*

** It is under discussion by geneticists whether or not owls are considered a separate order from the Falconiformes.*

Birds of Prey

Listed below are the various species of *Falconiformes*, birds of prey. Listed under each bird are characteristics that are unique to that species. These characteristics can be used to complete the bubble or double bubble maps. Keep in mind that all of the following birds share the characteristics of birds of prey, listed on page 4.

1. Stellar Sea Eagle

- Native to Russia, North Korea, and Japan
- One of the largest birds of prey, weighing 15-20 lbs.
- Diet consists of fish, crabs, shellfish, and smaller birds
- Females are usually larger than males
- Near threatened species

2. Bald Eagle

- Native to Canada, Alaska, U.S., and Northern Mexico
- Another large bird of prey, weighing 7-15 lbs.
- Wingspan of 6-8 feet
- Diet consists of fish, small animals (turtles, rodents, snakes, etc.), and smaller birds
- National bird of the U.S.
- Has special rough feet to help grab onto slippery fish
- Threatened species

3. African Pygmy Falcon

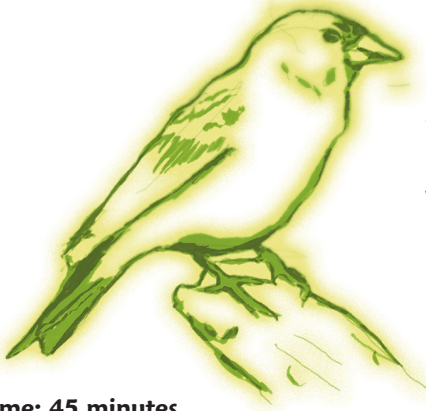
- Native to North-Eastern Africa and South-Western Africa
- One of the smallest birds of prey, weighing only 1.9-2.6 oz.
- Diet consists of small lizards and rodents
- Will often “take over” the nests of white-browed sparrow weavers
- Lives in dry areas with sparse vegetation
- Not threatened species

4. Pearl-spotted Owlet

- Native to Southern Africa
- Another small bird of prey, weighing only 2.4-5.2 oz.
- Diet consists of rodents, insects, frogs, and small birds
- Females larger than males
- Has “eye spots” on the back of its head to ward off predators
- Has specialized “silent” feathers to keep quiet while hunting in the dark
- Not threatened species

5. Spectacled Owl

- Native to Central to South America, Mexico to Argentina
- Weighs 15.9-31.8 oz.
- Diet consists of rodents, bats, crabs, and insects
- Has white plumage around the eyes that resembles eye glasses or “spectacles”
- Lives in rainforest habitats
- Has specialized “silent” feathers to keep quiet while hunting in the dark
- Not threatened species



Introductory Activity

Feathered Families

Lecture

Time: 45 minutes

Materials:

- Teacher Pages (for reference)
- 1 bubble map per student. Template on page 10.
- 1 double bubble map per student. Template on page 12.

1. Start a discussion with students about birds. Ask students questions like,
 - What kinds of birds do you know?
 - What do they look like?
 - What do they eat?
 - Do you know what makes a bird a bird?
2. The definition of a species can be given here and explained using individual bird examples.

“A species is defined as a group of organisms (plants or animals) that are capable of breeding with other members of the same group but are unable to produce offspring with other organisms.”
3. Explain to students that all of their examples are (likely) species of birds, but they are all birds. “Birds” is a grouping of organisms with certain characteristics. Describe the bird class and contextualize it in modern taxonomy. (See Teacher Pages 3 and 4.) The class birds can be further divided into groups called orders. Orders are a way of placing birds with similar characteristics into smaller groups than the class. Terms like “pigeons or “eagles” refer to the grouping “species,” which is a smaller grouping inside of orders. *Falconiformes*, for example, is the order that includes the species hawks, eagles, falcons and more. Explain the characteristics of this order (page 4).
4. Use the students’ examples and place a few of these birds into their respective order.

Activity

1. As a class, have the students complete a “Bubble Map” on the order Falconiformes. Falconiformes are more commonly known as “birds of prey.” (Template on page 10. Answer key included in page 12.)

Be sure that the “Bubble Map” includes the following characteristics: a hooked beak, strong feet (talons) and legs, long broad wings for soaring, meat eater, juvenile birds look different than adults, and very good eye sight.
2. For a more advanced lesson, have the students complete a double bubble map that compares and contrasts the order Falconiformes with the order, Anseriformes (Waterfowl). Characteristics that are shared between the orders should be placed in the circles with lines going to both orders. (Template on page 11. Answer on pages 12.)
 - Shared characteristics can include:

1. has feathers	4. warm blooded
2. wings	5. lays eggs
3. hollow bones	6. has a beak
 - Characteristics specific to each order are placed in the circles with lines connecting them to their respective order.

Note:

- All of these characteristics are what make a bird a bird.



Activity

Feathered Families

Set Up

Time: 30-60 minutes

Materials:

- 1 double bubble map per student.
Template on page 12.

Break the class into groups of 4-5 students. Use the list provided on page 5 of the Teacher Pages to assign each group a particular bird of prey.

Activity

1. Have the students use research materials like the internet, encyclopedias, or field guides to find various facts about their assigned birds of prey. Encourage the students to research specific characteristics of each bird. To guide students in their research, ask questions such as:
 - Where does this bird live?
 - What does it eat?
 - How big is the bird?
 - What color pattern is it?
2. After each group has completed their research, have them partner up with another student group that has been assigned a different bird of prey.
3. Have the students complete a double bubble map that compares and contrasts the two birds they researched. Remember that shared characteristics go in the middle circles, while characteristics unique to one bird go in the circles on the side.
4. Some suggested pairs of birds for the double bubble map are:
 - Pearl Spotted Owlet vs. Spectacled Owl (answer key on page 13)
 - Stellar Sea Eagle vs. Bald Eagle
 - African Pygmy Owl vs. Pearl Spotted Owlet
5. Any birds of prey can be used to complete the double bubble map. Remember to place characteristics which categorize birds of prey, like “a sharp hooked beak” or “strong feet and legs,” into the shared circles, or also characteristics that are shared between the species like “eats small birds,” while keeping characteristics of the individual species to the outside circles.



Post-Activity

Feathered Families

Time: 30 minutes

Materials:

- pencils/Pens
- paper
- address of your district congressperson, and/or conservation organization

Reflection

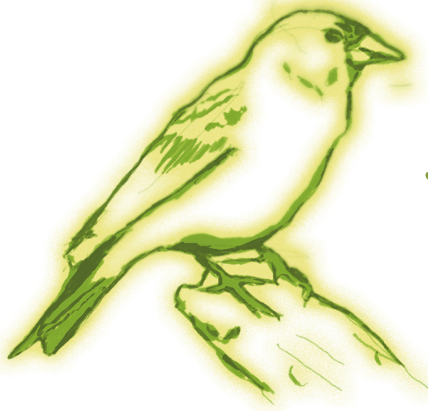
1. Explain the idea that the characteristics written in the middle circles of the double bubble map show the commonalities between the species of birds of prey. These commonalities are what make the birds closely related to one another and make up the *Falconiformes* order.
2. Taxonomy, or the science of grouping and categorizing living things, is based upon placing organisms with similar characteristics in the same group. The similarities are both morphological (has bones, is feathered), evolutionary and genetic.
3. It is also important to explain the idea that the characteristics contained in the circles on the outer edges (which are connected to only one species) show how each species is separate and distinct from the other species.
4. These circles contain each species' special adaptations. These adaptations have developed in each particular species to fit the environmental niche that the species occupies. Adaptations are unique features that the species has gained over time that helps them survive in their particular environment.
5. Be sure to explain that the appearance of special adaptations, like the eye spots of pearl spotted owlets and the rough feet of the bald eagles, are from the environmental pressures of each species' unique environmental niche. Encourage students to present, based on their research, how the bird's environment explains its unique characteristics.

Activity

1. After reviewing the "Double Bubble Maps, it is important to inform students about the "endangered species" status of many birds of prey.
2. Provide students with the address of a congressperson or conservation organization. (See the materials list at the top-left of this page.) Have students write a letter to the congressperson/organization that tells them what they have learned about birds of prey and the influence of the environment on adaptations, and gives them their opinion on habitat destruction/conservation.

Discussion

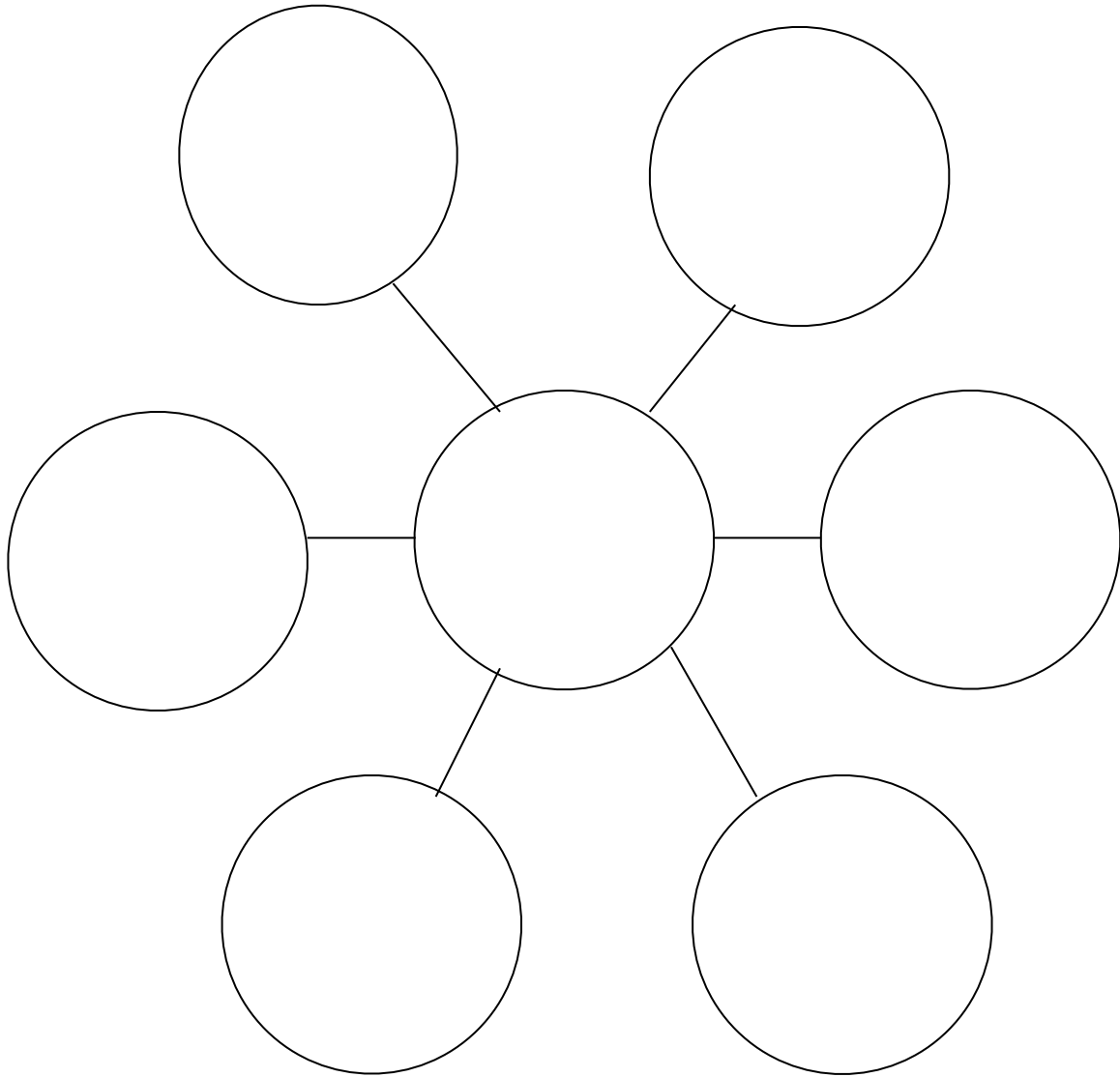
As a wrap-up activity, have a class discussion about what students can do in their daily lives that can help protect endangered animals' habitats.



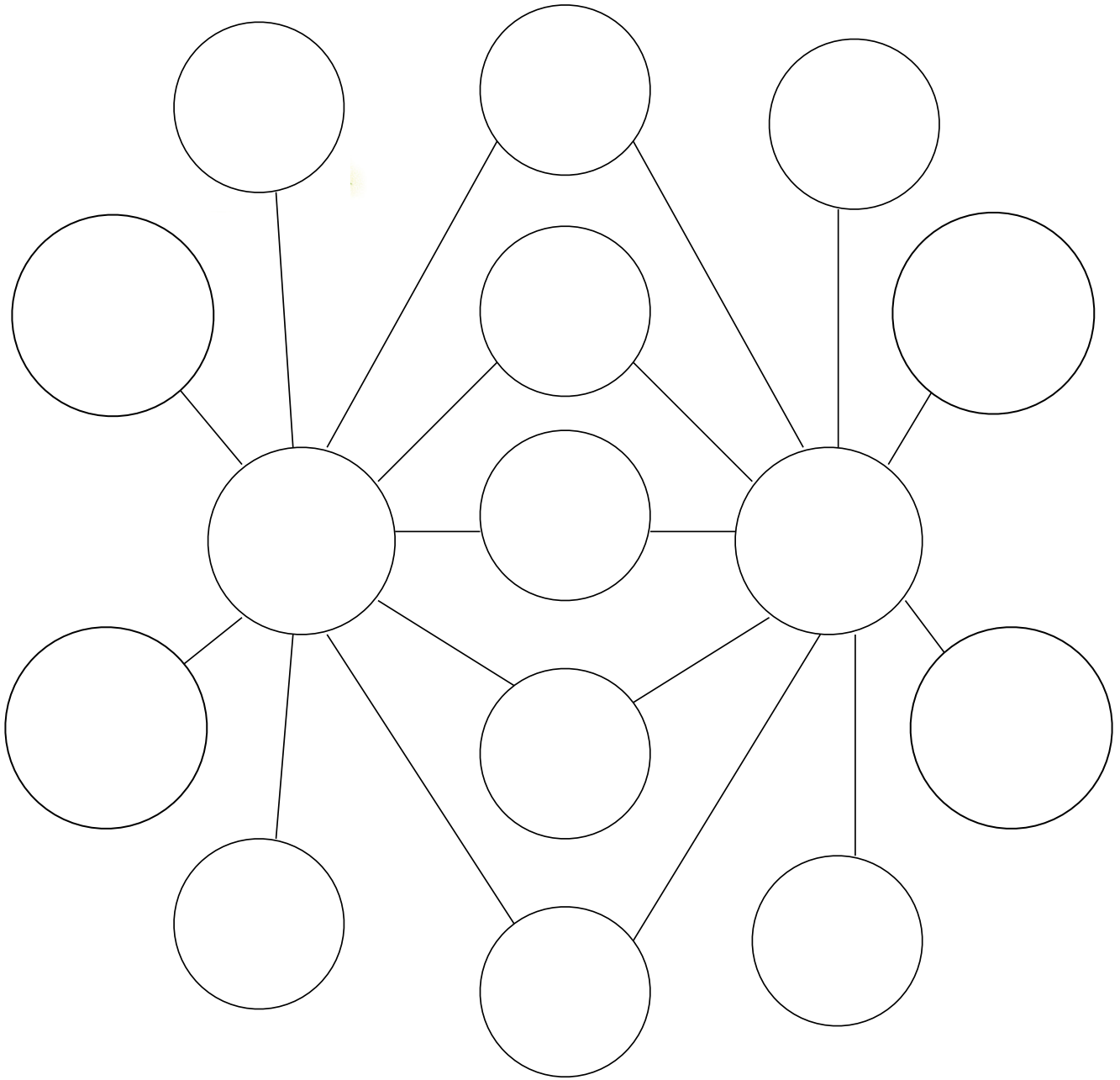
Appendix

Feathered Families

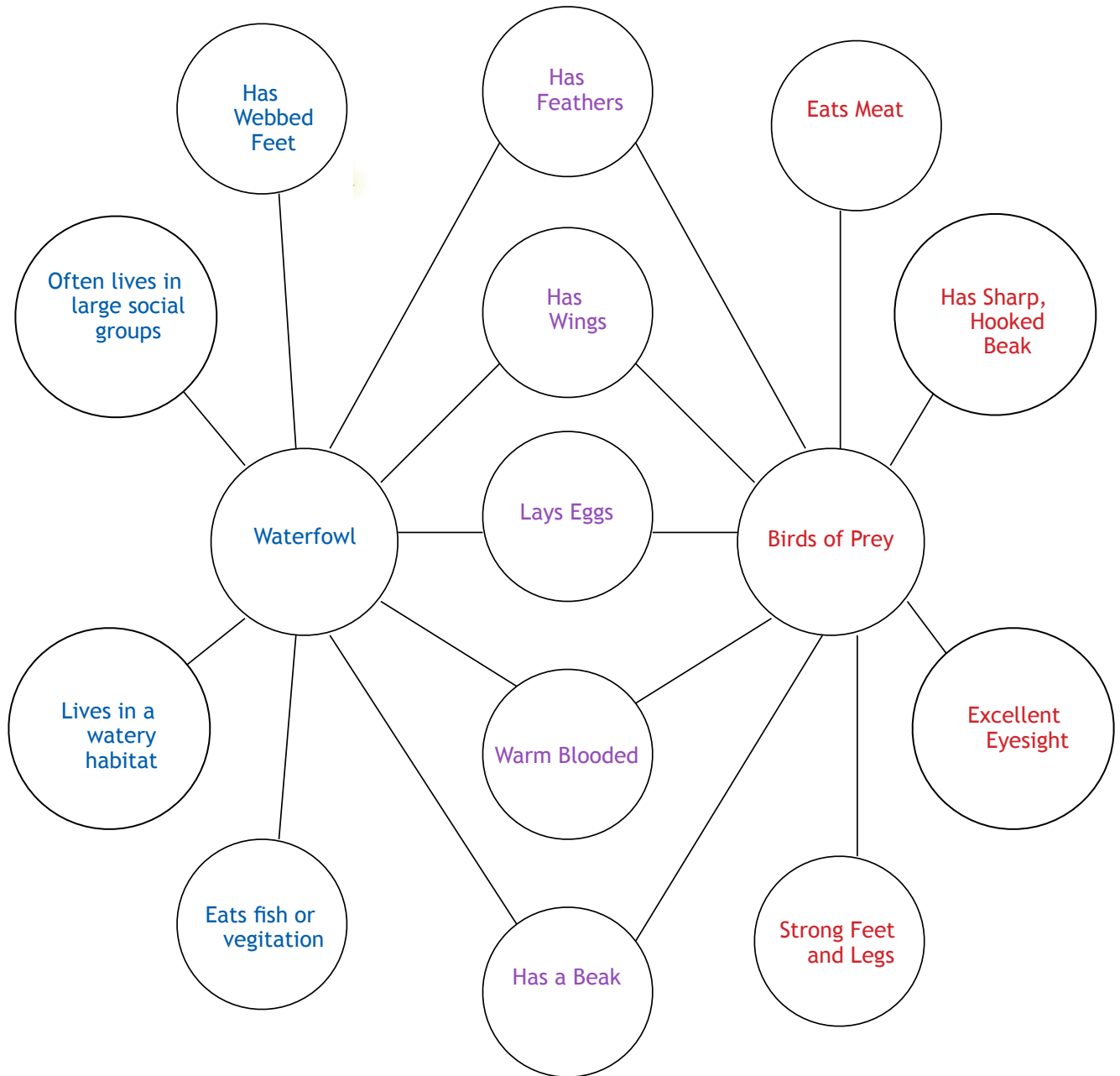
Bubble
Map



Double Bubble Map



Double Bubble Map



Double Bubble Map

