Exercise 4:
Animal Adaptations

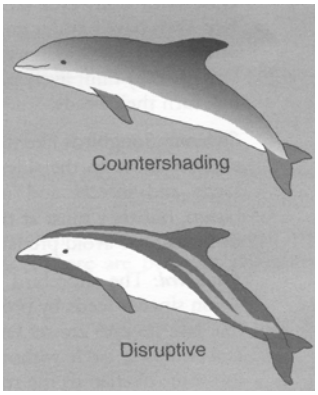
Introduction

There are approximately 1.5 million species of organisms that have been described and named today. But, some scientists estimate that we may have as many as 30 million species on Earth, thus leaving the majority of the Earth's biodiversity still to be discovered. There is tremendous diversity among the world's species, and species live nearly everywhere, from the Arctic to the bottom of the sea. You can deduce a lot about where and how an animal lives just by looking at it. Thick fur, for example, probably means an animal is exposed to cold temperatures for at least part of the year. Body shape, coloration, forelimb structure, jaw or beak shape – are all physical features that can be adaptations by helping an animal survive, feed, move or reproduce in its environment.

You will learn about these features in three ways today in lab. First, you will watch a PBS film entitled, "Triumph of Nature: The Four Billion Year War", that emphasizes the struggle to survive since the beginning of life, approximately four billion years ago. This film highlights the major radiations of life forms, and some important features of each group that allowed them to persist through time. Next, your TA will show you a slide show that will highlight different features of organisms that can be considered adaptive, or in some way improve an individual's ability to survive and reproduce. Finally, you will visit the Conner Museum where you will focus on vertebrate (backbone) species. As you visit the museum today, keep in mind that animals will have physical features that provide a "fit" with their habitat. Several of these features will be adaptations.

Types of Adaptations
A. Coloration

1. **Cryptic Coloration**: coloration designed to hide the animal



a. Camouflage: coloration that matches the background where the animal is usually found (e.g., pepper moths).

b. Counter-shading: An animal can be visible because of the shadow it casts against a background. To counteract this, animals are often darker on top with a lighter underside so their shadow is less apparent.

c. Disruptive Coloration: bright stripes and

contrasting colors tend to break up the general outline into apparently unrelated parts. This makes it more difficult to pick out an individual animal (e.g., zebras).

2. **Warning Coloration**: Poisonous or distasteful animals are often brightly colored so that predators will be able to identify them easily (and leave them alone; e.g., poison dart frogs, newts).

3. Epigamic Coloration: coloration used to attract a mate. The colors are usually bright and distinctive, helping animals to identify their own species and advertise their vigor to potential mates (e.g., many bird species have brightly colored males).

Coloration tends to be darker in humid climates and lighter in arid climates. Why might this be advantageous?

B. Specialized Methods for Obtaining Food

Animals have developed distinct morphological (structural) characteristics which enable them to acquire specific types of food (…think about Darwin's finches). For example, the number, size, shapes and location of teeth in the mouth of mammals differs according to the type of food they eat. The beaks of birds are highly specialized for food gathering and provide easy to see examples of the great diversity of diets found among species. Examples of these can be seen in display cases in room 126.

C. Visual Adaptations

Eye position reveals much about a bird's lifestyle. For example:

Owls: With both eyes facing forward from a relatively flat face, owls have a better range of binocular vision than any other bird. Binocular sight is vital to hawks and owls because they hunt living prey, and depth perception is extremely important so that they know how far away the prey are and the speed at which they are moving. To see the side or rear, they must turn their heads.

Sparrows: Songbirds like the white-crowned sparrow have eyes set more to the sides of their heads. They feed on seeds and insects and need some forward binocular vision, but they must also be able to see far to the side (i.e., peripheral vision) to avoid predators.

Shorebirds: The shorebirds have less of a need for forward binocular vision. They feed, often underwater, by probing into the mud with a flexible bill. Their eyes are set far to the rear, enabling them to see in a complete circle without moving the head and providing some overlap of vision to the rear.

Do you see any examples of these visual adaptations in mammals?

D. Limb Adaptations

The wing of a bird is a modified forelimb that functions as an airfoil. Other limb adaptations can be seen in the hallway display between room 135 and 138.

E. Adaptations for Flight

In addition to wings, birds have other special features that are important for flight. Their bones are hollow and light in weight. Feathers provide insulation and act as airfoils. They also contour and smooth the body to decrease wind resistance. Note the skeletal adaptations in the swan skeleton in the hallway exhibit between room 135 and 138. Note the large breastbone for attachment of the flight muscles.

F. Body Shape

Animals that live or hunt in burrows often have an elongated shape and short legs to enable them to move readily through small openings. Flying birds and many swimming organisms have streamlined body shapes. This decreases resistance as the body moves through the air or water.

G. Adaptations for Maintaining Body Temperature

Birds and mammals that live in cold climates tend to have heavy coats of fur or feathers for insulation. Animals living in cold climates tend to have a smaller surface area (through which heat is lost) in relation to their volume (where heat is generated) than similar animals living in warm climates. This is accomplished two ways:
1. Body size tends to be larger in colder climates, smaller in warmer climates.
2. Ears, tails and other extensions of the body tend to be shorter in cooler climates, longer in warmer climates

H. Dimorphism

This means "two-forms." Within the same species, more than one form may appear and be distinct from another. This may be due to **sexual dimorphism:** differences between male and female by color, specialized structures, or size. There may be distinct coloration differences between juveniles and adults, showing **age dimorphism**. There may also be **seasonal dimorphism**: (e.g., winter to summer). These differences are most often in coloration (e.g., snowshoe hares are white in the winter to match snow and brownish in summer to match woodland habitats), but may also be structural such as antlers on deer.

Assignment 1

Name_____

As you observe the mounted specimens in the museum, think about how each animal is adapted to survive and successfully reproduce in its environment. Use the concepts described above to characterize some of these adaptations for each animal listed below. Group answers are fine but each student must fill out and hand in the assignment.

1. Common name: Loon ------Location: Room 135
Habitat: northern lakes and ponds, some species in salt water bays
Special Adaptations:

2. Common name: Pelican ------Location: Room 135
Habitat: lakes and shallow lagoons, ocean shores and bays depending on species
Special Adaptations:

3. Common name: Cormorant ------Location: Room 135
Habitat: Open water from ponds to ocean, some species only on ocean shores
Special Adaptations:

4. Common name: Great Blue Heron------Location: Room 135
Habitat: lakes and streams with quiet shallow water
Special Adaptations:

5. Common name: Trumpeter Swan------Location: Room 135
Habitat: wooded ponds and rivers
Special Adaptations:

6. Common name: Mallard and Pintail Ducks------Location: Room 135
Habitat: almost any wet habitat
Special Adaptations:

7 Common name: Hooded Merganser ------Location: Room 135
Habitat: small wooded ponds
Special Adaptations:

8. Common name: Turkey Vulture ------Location: Room 135
Habitat: many habitats, most of U.S.
Special Adaptations:

9. Common name: Hawks and Eagles ------Location: Room 135
Habitat: many habitats-open country to seashore
Special Adaptations:

10. Common name: Ptarmigans -Location: Room 135,126 case D
Habitat: tundra or mountains
Special Adaptations: White Tailed Ptarmigan - seasonal dimorphism

11 Common name: Owl ------Location: Room 135
Habitat: most species roost in trees
Special Adaptations:

12. Common name: Piliated Woodpecker ------Location: Room 135
Habitat: mature forests
Special Adaptations:

13. Common name: Rabbits ------Location: Room 138
Habitat: all habitats, many species
Special Adaptations:

14. Common name: Porcupine ------Location: Room 138
Habitat: forested areas
Special Adaptations:

15. Common name: Skunk ------Location: Room 138
Habitat: open country to mixed woods, most of U.S.
Special Adaptations:

16. Common name: Moose ------Location: Large showcase, hall exhibit
Habitat: Forests with lakes and swamps
Special Adaptations:

17. Common name: Deer ------Location: Large showcase, hall exhibit
Habitat: Many habitats with brushy areas
Special Adaptations:

18. Common name: Otter --Location: Room 138 (River otter, Sea otter)
Habitat: sea otter-kelp beds, rocky ocean shores river otter-along streams and lakes
Special Adaptations:

19. Common name: Badger ------Location: Room 138
Habitat: Open grasslands
Special Adaptations:

20. Common name: Beaver ------Location: Room 138
Habitat: streams and lakes with trees on banks
Special Adaptations:

Assignment 2

1. Read about sexual dimorphism in the display in room 135. If bright coloration attracts mates, why do you suppose all birds aren't brightly colored?

Describe two other cases of sexual dimorphism that you observe in the museum. How do the two forms differ?

1.

2.

2. Look at the Bighorn Sheep on display in room 135. Read about their head-butting behavior during mating season and the structural adaptations that are associated with this behavior. Now look at the mountain goats in the glass cases nearby (don't miss the large specimen in the case on the end). These animals inhabit mountainous areas as well (though at higher altitudes). Based on your observations of the mountain goat, would you expect head butting behavior from these animals as well? Why or why not?

3. Observe and read about the caribou and moose in the hall display. Based on what you observe and read, what adaptations do these animals share? How are they different? Why?

4. Read about the diversity of bill adaptations in birds in room 126 and about hindleg adaptations in the opposite display case. As you can see, the range of just these structural adaptations is enormous. And since every aspect of an animal's life is adaptive, the overall diversity of adaptations is truly immense. Why does so much diversity exist?