Comparative Vertebrate Anatomy

Presented by BIOBUGS:

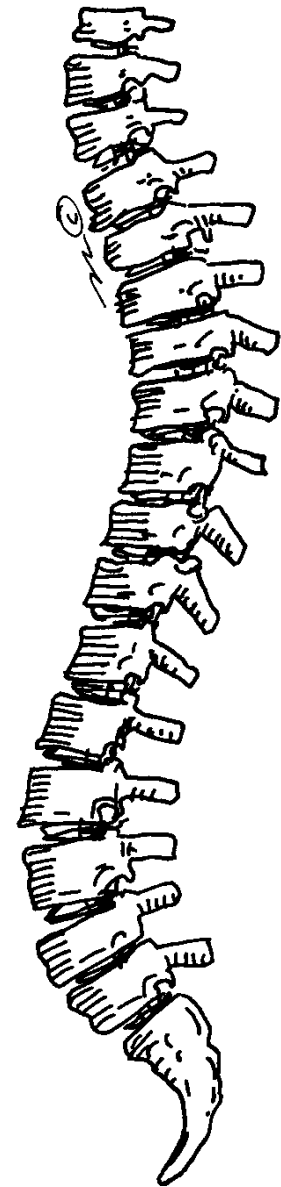Biology Inquiry and Outreach

with

Boston University Graduate Students

In association with LERNet and

The BU Biology Teaching Laboratory

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Your Name _____   Date:_____

Station 1: Skulls Tell Stories #1

In front of you are skulls from 3 mammals that have adapted to different ways of surviving in different environments. Based on the labeled mammal skull to the right, fill out the chart on the next page, describing the relative sizes and shapes of each of the labeled features. Judge each feature based on its size relative to the rest of the skull, not its absolute size.

In the last two columns of the chart, make a hypothesis about which of the five senses is strongest in each animal, and another hypothesis about what the animal eats and it's place in the food chain. Be prepared to defend your reasoning.

NASAL PASSAGE

ORBIT

INCISORS

CANINES

PREMOLARS

MOLARS

AUDITORY BULLA
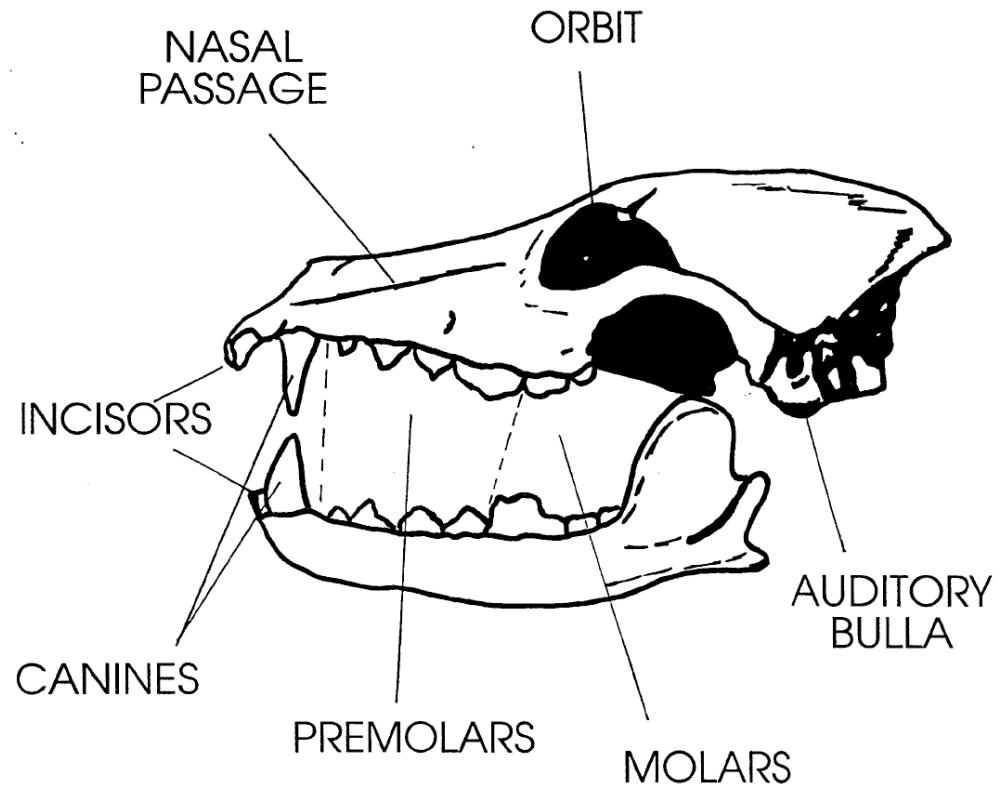
Station 2: Skulls Tell Stories #2

In front of you are skulls from 2 mammals that have adapted to different ways of surviving in different environments. Based on the labeled mammal skull to the right, fill out the chart on the next page, describing the relative sizes and shapes of each of the labeled features. Judge each feature based on its size relative to the rest of the skull, not its absolute size.

At this station you will need to use dissecting microscopes to make your observations on the tiny skulls. Take turns so that everyone gets a chance to look at both skulls. Focus the microscope using the large focus knob. Be gentle with both the microscopes and the skulls!

In the last two columns of the chart on the next page, make a hypothesis about which of the five senses is strongest in each animal, and another hypothesis about what the animal eats and it's place in the food chain. Be prepared to defend your reasoning.

BONUS - Make all of these observations on your own skull. Make hypotheses for *Homo sapien's* best sense, and where we *used* to fit into the food web. Include these observations in the table on the next page.

Skulls Tell Stories Worksheet

Skull No.	Incisors (Short, Long)	Canines (Present, Absent)	Premolars & Molars (Flat & Broad, Sharp& Pointy or In Between)	Orbit Relative Size (small, medium, large)	Orbit Position (forward, side)	Nasal Passage Relative Length (short, medium, long)	Auditory Bullae Relative Size (small, medium, large)	Best Senses (Sight, Smell, Hearing)	Place in Food Web (Herbivore, Omnivore, Carnivore)
1									
2									
3									
4									
5									
***** Your Skull *****									

Station 3: First in Flight: Birds vs. Bats

Compare the arm bones in the pigeon and bat skeletons to the bones in the human arm to the right. Both the pigeon and the bat have adapted their arm bones to flight but in different ways.

1.   Which bones probably support most of the wing muscles and flight surfaces in the pigeon?

_____

2.   Which bones probably support most of the wing muscles and flight surfaces in the bat?

_____

3.   Based on your evidence, do you think that bat wings and bird wings are closely related? In other words, did they get their wings from the same ancestor?

_____

4.   Based on your evidence, do you think that the bat radius+ulna and the bird radius+ulna are closely related? Did they get their arm bones from the same ancestor?

_____

Clavicle _____

Scapula _____

Humerus

Ulna

Radius

_____Carpals

_____Metacarpals

_____Phalanges

5.   Make the following observations on the pigeon skeleton and enter them as 1 (present) or 0 (absent) on your Homology Data Table (last sheet in packet): Vertebrae, calcified bone, dorsal process, 4 limbs, beak, shell
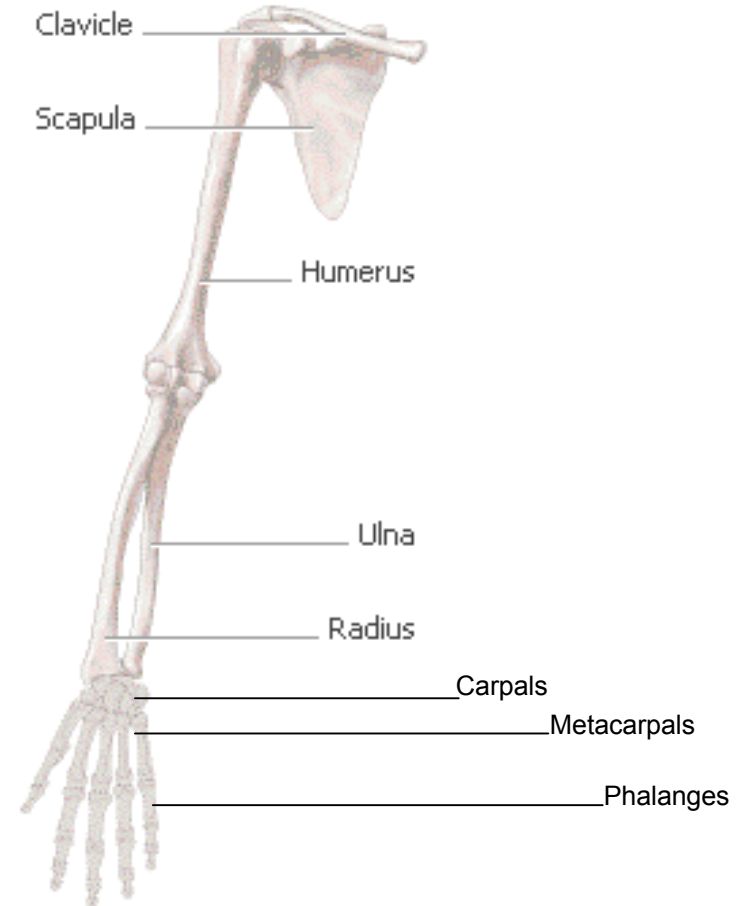
Station 4: Fusion Power

In front of you are skeletons from a salamander, a frog, and a pigeon. Examine the salamander skeleton and compare it to the figure of a generalized vertebrate to the right. All tetrapods (vertebrates with four limbs) have two sets of bones called girdles that support the vertebrae and ribs and allow attachment of the walking limbs. The front set is called the pectoral girdle (" shoulder bones") and the rear set is called the pelvic girdle (" hip bones"). Find the pectoral girdle and pelvic girdle on the salamander skeleton.
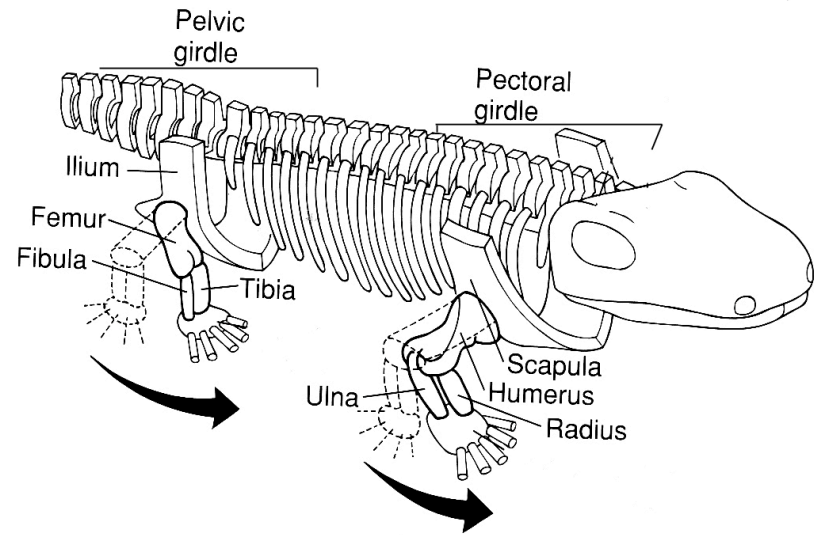
1.   Compare the pelvic girdle in the salamander to the pelvic girdle in the frog. Which one has more bones?

_____

2.   Compare the pectoral girdle in the salamander to the pectoral girdle in the pigeon. Which one has more bones?

_____

3.   The flat bone in the center of the frog's pelvic girdle is called the <u>urostyle</u>, and the flat bone in the center of the pigeon's pectoral girdle is called the <u>keel</u>. Both are formed by the fusion of several bones into a single, large, flat bone that serves a common purpose in both animals. What is this purpose? (hint: think about specialized forms of locomotion in both animals, and all that tasty meat in chicken breasts and frog legs…yummm)

4.   Make the following observations on the salamander skeleton and enter them as 1 (present) or 0 (absent) on your on your Homology Data Table (last sheet in packet): Vertebrae, calcified bone, dorsal process, 4 limbs, beak, shell

Station 5: Turtle and Fish Skeletons

You may have seen each of these animals as pets or at a zoo. Take this opportunity to look at how many similarities they share in their skeletal anatomy, and also how many differences they have!

1.   Make the following observations on the perch skeleton and enter them as 1 (present) or 0 (absent) on your on your Homology Data Table (last sheet in packet): Vertebrae, calcified bone, dorsal process, 4 limbs, beak, shell

2.   Make the following observations on the turtle skeleton and enter them as 1 (present) or 0 (absent) on your on your Homology Data Table (last sheet in packet): Vertebrae, calcified bone, dorsal process, 4 limbs, beak, shell

3.   Why do you think you haven't seen a shark skeleton yet?

Station 6: Cat Skeleton

Compare this skeleton to the others at other stations.
How are the bodies of cats specialized for their predatory habits?

1. Make the following observations on the cat skeleton and enter them as 1(present) or 0 (absent) on your on your Homology Data Table (last page of packet): Vertebrae, calcified bone, dorsal process, 4 limbs, beak, shell

Take a moment to finish writing answers to questions that you haven't finished. Grab a graduate student and ask for help if you're stuck!

Dissection Worksheet

Your Assigned Structure:_____

Record measurements, notes, and drawings of the shape and <u>relative</u> size of your structure in each dissected animal. If you have extra time, use it to complete your Homology Data Table (last sheet of packet) for all of the characters that you have not been able to finish with skeletons.

Dogfish (Shark)	Perch
Salamander	Turtle
Pigeon	Cat

Homology Data Table

1 = Present, 0 = Absent

	1. Vertebrae	2. Calcified bone	3. Four walking limbs	4. Egg with amniotic membrane	5. Pronounced large intestine	6. Skin Covering (describe)	7. Pronounced dorsal process on vertebrae	8. Egg with mineralized shell	9. Lower Jaw Bones fused into beak -no teeth	10. Keeled breastbone	11. Diaphragm	12. Thoracic vertebrae fused into shell
Dogfish *Squalus acanthias*				0								
Perch *Perca flavescens*				0								
Salamander *Necturus maculosus*				0								
Turtle *Trachemys scripta*				1								
Pigeon *Columba livia*				1								
Cat *Felis domesticus*				1								

Vertebrate Phylogenetic Hypothesis

(Draw the phylogenetic tree that your class creates here)