

## **Lab Structure and Goals**

The lab is organized around the different vertebrate groups-jawless fish, cartilaginous fish, bony fish, amphibians, turtles, lizards/snakes, birds, and mammals. At the specific tables covering each of the vertebrate groups, you will find representative examples of vertebrate groups. Additional material that describes and illustrates the skeletal anatomy of each group and, where applicable, locomotor adaptations of that group, will be available at the tables.

Goals:

1. For each vertebrate group, examine the skeletal material and be able to locate the structures associated with each group.
2. Examine the skeletal material, specimens, and live animals associated with the following types of locomotion: swimming, terrestrial locomotion, fossorial (digging), locomotion without limbs, and flight. Compare the skeletons and specimens of each different group, paying attention to the anatomy of the pectoral and pelvic girdles, limbs, and external coverings. Pay particular attention to the differentiation of the vertebral column.

### **I. Petromyzontoidea – Lamprey**

Examine the sagittal and cross-sections of the lamprey and identify:

1. **Notochord**
2. **Myomeres**

### **II. Chondrichthyes – Cartilaginous fish/Sharks**

Examine the preserved skeletons of the shark and identify:

Observe the skull and skeleton and be able to identify and know names of:

1. The **mandibular arch**
2. The **hyoid arch**
3. The **branchial arches**
4. **Vertebral column**
5. The **trunk**
6. **Caudal** vertebrae
7. **Pectoral girdle** and **fin**
8. **Pelvic girdle** and **fin**

### **III. Osteichthyes – Bony fish**

#### **Anatomy**

Examine the perch skeleton and identify how the:

1. **Skulls** are compressed laterally

There are many bones in the skull, including the:

2. **Frontal**
3. **Parietal**
4. **Premaxilla** in front
5. **Maxilla** of the upper jaw
7. **Angular** bone of the lower jaw (mandible)
8. The **operculum**
9. **Vertebral column**:
10. Observe the **bony trunk**

6. **Dentary** bone of the lower jaw (mandible)

11. Bony **caudal vertebrae**

Branching off of each vertebra observe:

12. The **neural spine**

13. Ribs are attached to each **trunk vertebrae**

Observe:

14. The **pectoral girdle and fin**

15. **Pelvic girdle and fin**

### **Locomotion**

Read section in textbook

## **IV. Amphibia – Anura and Caudata**

### **Anatomy – Caudata**

Examine the skeleton of Necturus and identify:

1. The **skull**

2. The **vertebral column**:

3. Differentiated into the **cervical vertebrae**,

4. The **trunk vertebrae**,

5. The **sacral vertebrae**,

6. The **caudal vertebrae**.

7. The **ribs**

8. The **sternum** (hard to see)

9. **Pectoral girdle**

10. The **forelimb**:

11. The **humerus**,

12. The **radius**,

13. The **ulna**.

14. **Pelvic girdle**

15. The **hindlimb**:

16. The **femur**,

17. The **tibia**,

18. The **fibula**.

### **Anatomy – Anura**

Examine the skeleton of the frog and identify:

1. The **skull**. Note the large jaws and the small braincase. The brain is enclosed by several bones including:

2. The **fronto-parietals**.

3. The upper jaw consists of the small **premaxillaries** in front,

4. The large **maxillaries**.

5. The **lower jaw or mandible** consists of two bones. Amphibians, like fish, have a complete roof to the mouth, which is an unmodified palate.

6. The **vertebral column** is differentiated into:

7. The **cervical vertebrae**,

8. The **trunk vertebra**,

16. The **forelimb** includes:

17. The **humerus**,

18. The **radio-ulna**,

9. The **sacral vertebrae**,
10. The **urostyle**
11. Observe the **transverse processes**.
12. Observe the **sternum**.
13. The **pectoral girdle** includes:
14. The **supra scapula**
15. The **scapula**.
19. The **carpals**
20. The **pelvic girdle** includes:
21. The **ilium**,
22. The **ischium**.
23. The **hindlimb** includes:
24. The **femur**,
25. The **tibiofibula**,
26. The **tarsals**.

## **V. Skull Architecture of Amniotes**

There are many bones associated with the skull, but for the purpose of our introductory vertebrate zoology course, we will focus on just a handful:

1. The **temporal fenestrae** are anatomical features of the skulls of several types of amniotes, characterized by bilaterally symmetrical holes (fenestrae) in the temporal bone.

Depending on the lineage of a given animal, two, one, or no pairs of temporal fenestrae may be present, above or below:

2. The **postorbital**,
3. The **squamosal bones**.

There are three types of amniote skull found in extant (living) vertebrates, classified by the number and location of their fenestra:

- **Diapsid**- two temporal arches, two fenestrae. (Aves and Lepidosauria-Squamata)
- **Anapsid**- no temporal arch, no fenestrae. (Testudinata)
- **Synapsid**- a single temporal arch, a single fenestra. (Mammalia)

## **Cervical Region of the Vertebral Column in Tetrapods**

The cervical region of the vertebral column varies across tetrapods. Amphibians have a single cervical vertebra, allowing for little head movement. Reptiles have increased numbers of cervical vertebrae (usually 7) and increased flexibility of the heads. Birds have a variable number of cervical vertebrae (as many as 25 in swans).

Mammals usually have 7 cervical vertebrae.

In reptiles, birds, and mammals, the first two cervical vertebrae are modified and called the 1) **atlas** and 2) **axis**. The atlas is the first cervical vertebra, is ring-like, and provides a 'cradle' in which the skull can 'rock' (as when nodding 'yes'). The axis is the second cervical vertebra.

## **VI. Testudinata – Turtles**

Examine the skeleton of the turtle and identify:

1. The **ANAPSID skull**.

The brain is enclosed by several bones including:

2. The **frontal**
3. The **parietal**

The upper jaw consists of:

4. The **premaxilla** in front
5. The **maxilla**

The lower jaw or mandible consists of two bones:

6. The **dentary**
7. The **angular**

The turtle shows development of the bones providing a partial secondary palate.

8. The **vertebral column** is differentiated into:
9. The **cervical**,
10. The **dorsal or trunk**,
11. The **sacral**,
12. The **caudal** vertebrae.

13. The **ribs** of the turtle are fused with the **carapace**

14. The **pectoral girdle** includes:

15. The **scapula**,
16. The **coracoid** (procoracoid)

17. The **forelimb** includes:

18. The **humerus**,
19. The **radius**,
20. The **ulna**,
21. The **carpals**

22. The **pelvic girdle** includes:

23. The **hindlimb** which includes:
24. The **femur**,
25. The **tibia**,
26. The **fibula**,
27. The **tarsals**.