

Unit B: Anatomy and Physiology of Poultry

Lesson 2: Skeletal Structure of Poultry

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Identify the bones of the leg.
2. Identify the bones of the wing.
3. Identify the bones of the spine and pelvis.
4. Identify the physiology and anatomy of the beak.

Recommended Teaching Time: 2 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed for use with this lesson plan.
- http://en.wikipedia.org/wiki/Bird_anatomy

List of Equipment, Tools, Supplies, and Facilities

Writing surface

PowerPoint Projector

PowerPoint Slides

Transparency Master copies

Copies of Student Worksheet

Poultry skeleton or individual bones (option but strongly suggested)

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide # 2):

caudal vertebrae	ischium	scapula
cervical vertebrae	keel	skull
digits	lower mandible	sternum
femur	pelvis	synsacrum
fibula	phalanges	tarsus
furcula	pubis	thoracic vertebrae
hallux	pygostyle	tibia
humerus	radius	ulna
illium	rhamphotheca	upper mandible
	ribs	

Interest Approach: Use an interest approach that will prepare the students for the lesson.

Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Hold up a bone from a mammal and from a bird. Pass the bones around the class and have the students compare and contrast them. Ask them questions like, “Do they weigh the same?” “Is their color similar?” “Do they perform the same jobs for both animals?” Use the answers from these questions as well as the comparing and contrasting to lead into a discussion of Objective 1.

Summary of Content and Teaching Strategies

Objective 1: Identify the bones of the leg.

(PowerPoint Slide #3)

- I. The many bones of poultry provide structure to the body and allow for attachment of muscles.
 - A. Avian bones are hollow which allows them to fly.
 1. Even though most chickens, ducks, geese, and turkeys can't fly, their bones are still hollow.

(PowerPoint Slide #4)

- B. Leg bones
 1. Beginning at the body, the **femur** is the first leg bone.
 2. The **fibula** is a much-reduced bone of the lower leg, while the **tibia** is the next major bone.

(PowerPoint Slide #5)

3. Next, is the elongate **tarsus**.
 - a. This structure is homologous to the metatarsals and tarsals in the mammalian foot.
 - b. However, in birds, these bones have been fused together to form what is essentially a third leg bone.
 4. Birds run or walk only on their **digits** (they are technically digitigrade), each consisting of jointed **phalanges**.
 - a. The hind-facing digit is the first digit or **hallux**.

(PowerPoint Slide #6) This slide shows a bird leg with the bones from this objective identified. Pass around the bones discussed in this objective (if any are available). Alternately, use TM: B2-1 and identify where the bones are in the skeleton. Pass out WS: B2-1 and have the students label the bones discussed in this objective.

Objective 2: Identify the bones of the wing.

(PowerPoint Slide #7)

- II. Wing bones
 - A. The first wing bone is the **humerus**.

(PowerPoint Slide #8)

1. Many of the muscles involved in flight are attached to this bone, but it does not hold any flight feathers.
 2. The **radius** and **ulna** comprise the forearm, and the secondary flight feathers attach to the **ulna** so take a look at that bone carefully, the area for attachment of the feathers should be obvious.
 3. The remaining parts of the wing skeleton are made up by the homologues of the bones in your hand, and primarily those bones in the middle finger or third digit.
 4. These bones support the primary flight feathers.

(PowerPoint Slide #9) This slide shows a drawing of a bird wing. Pass around the bones discussed in this objective (if any are available). Alternately, use TM: B2-1 and identify where the bones are in the skeleton. Continue to use WS: B2-1 to label the bones found in this objective.

Objective 3: Identify the bones of the spine and pelvis.

(PowerPoint Slide #10)

III. The bones of the spine provide support for the bones of the ribs and pelvis.

A. Skull and Vertebrae bones

1. The **skull** includes the nasals, maxilla and premaxilla which comprise the “**upper mandible**”, a term we shall use to simplify the material.
2. These structures, along with the **lower mandible** comprise the bill.

(PowerPoint Slide #11) This slide shows a diagram of a bird's head. Note the upper and lower mandibles, or jaws. The other terms on the picture are not necessary to know but provide more identification of the bird's skull.

(PowerPoint Slide #12)

3. The vertebral column includes the **cervical vertebrae** of the neck region, **thoracic vertebrae** of the mid-body, **synsacrum** the fused sacral vertebrae, **caudal vertebrae** of the proximal part of the tail, and finally the **pygostyle** consisting of the fusion of the distal caudal vertebrae.

(PowerPoint Slide #13) This slide shows two orientations of a bird's neck and back. The vertebrae can be seen from the side in the picture on the left. The picture on the right gives a much better view of the thoracic vertebrae as well as some other parts which are hard to identify from a side view of the bird.

(PowerPoint Slide #14)

B. Pelvic Girdle

1. The **pelvis** (**illium**, **ischium** and **pubis**) of birds is enlarged and fused to the **synsacrum**, to provide points of attachment for upper leg muscles.

(PowerPoint Slide #15)

C. Thoracic Region: (Rib cage)

1. This part of the avian skeleton has become fused, strengthened, and expanded for attachment and operation of the all-important flight muscles.
2. The **ribs** are braced against one another to provide structure to chest and give protection to the lungs and air sacs.
3. The **sternum**, with its expanded **keel**, is the main point of origin for the major flight muscles.
4. The **furcula** (wishbone) and **scapula** aid in bracing and supporting the wing. These bones have homologues in the mammalian shoulder girdle.

(PowerPoint Slide #16) This slide provides a close up side view of a bird's thoracic region. Ask the students to identify any other bones they may see on this view that are not identified. Pass around the bones discussed in this objective (if any are available). Alternately, use TM: B2-1 and identify where the bones are in the skeleton. TM: B2-2 is a top view of the back of a bird that shows the exact placement of the vertebrae. Continue to use WS: B2-1 to label the bones found in this objective.

Objective 4: Identify the physiology and anatomy of the beak.

(PowerPoint Slide #17)

- IV. Beaks of birds vary widely among species.
- The jaw is made of bone, typically hollow or porous to conserve weight for flying.
 - The outside surface of the beak is covered by a thin horny sheath of keratin called the **rhamphotheca**.
 - Between the hard outer layer and the bone is a vascular layer containing blood vessels and nerve endings.
 - The rhamphotheca can include a knob, which is found above the beak of some domesticated Chinese geese.

View PowerPoint slide #18. As a class, compare the shape and size of the beaks of these species. Hold a discussion about what these beaks would do for the bird in terms of eating.

Review/Summary: Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used to determine which objectives need to be reviewed or re-taught with a different approach. Questions on **PowerPoint Slide #19** can also be used.

Application: Split the class into four groups. Assign each group a species of poultry: turkey, duck, goose, or chicken. Have each group find a diagram of the skeleton of their species. Provide them with a large piece of paper and have them draw the skeleton in a larger size. Once they have drawn their poster sized bird skeleton, have them present it to the class and discuss the unique feature of their species' skeleton. As an extension on this activity, have the students make a comparison between the bones of the human and bird skeleton.

Evaluation: Evaluation should focus on student achievement of this lesson's objectives. A sample written test is attached.

Answers to Sample Test:

Part One: Matching

1. A
2. A
3. A
4. A
5. D
6. A
7. B
8. E
9. B
10. C
11. D
12. B
13. D
14. E
15. D
16. C
17. A
18. D
19. B

Part Two: True or False

1. T
2. F
3. T
4. T

Test**Unit B Lesson 2: Skeletal Structure of Poultry****Part One: Matching**

Instructions: Match the bone in Column A with the correct area of the body in which it can be found in Column B. An example has been done for you.

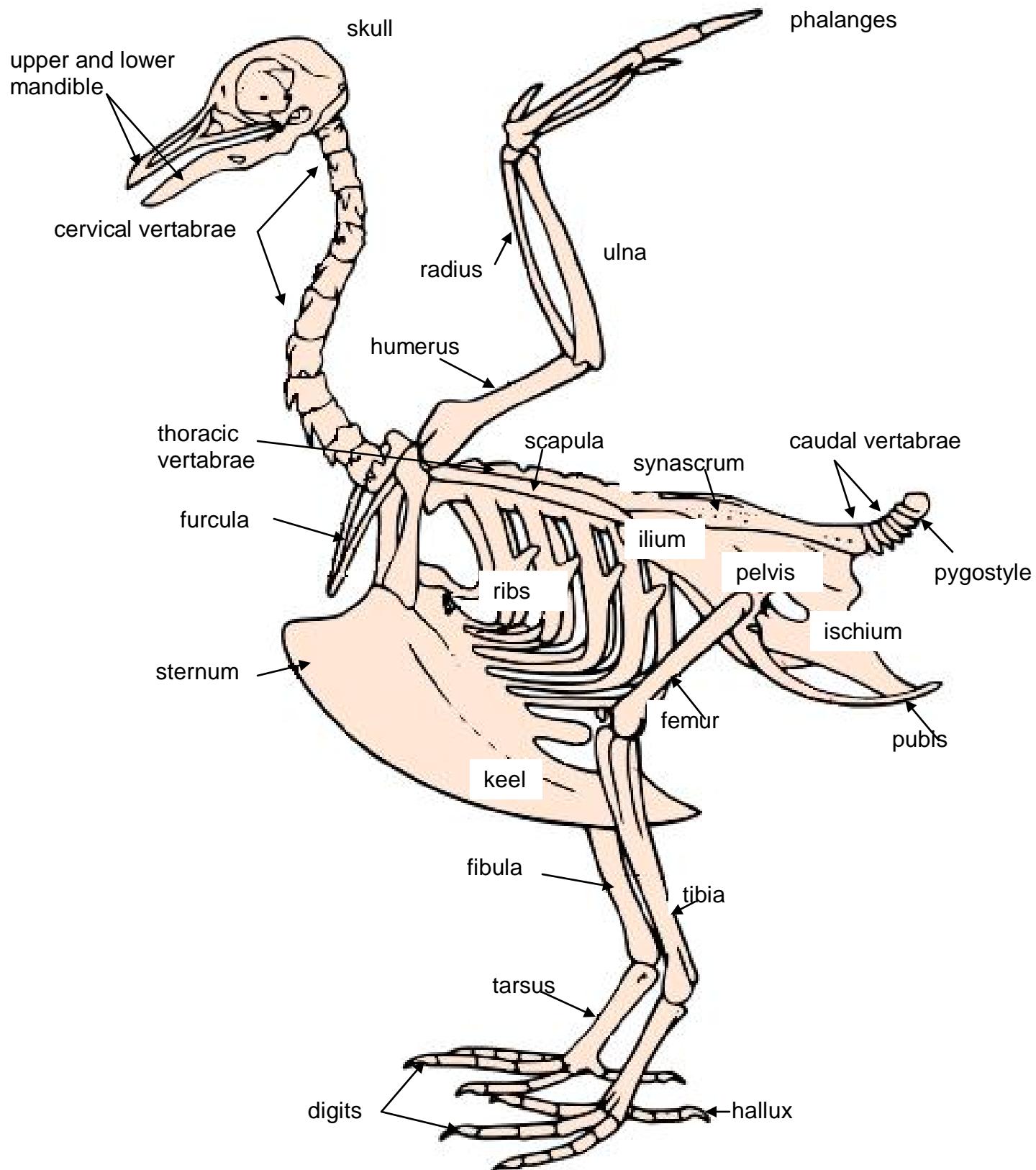
Column A	Column B
<u>A</u> 1. tibia	A. Leg/feet
___ 2. digits	B. Wing
___ 3. femur	C. Pelvis
___ 4. fibula	D. Spine/chest area
___ 5. furcula	E. Head
___ 6. hallux	
___ 7. humerus	
___ 8. mandible	
___ 9. phalanges	
___ 10. pubis	
___ 11. pygostyle	
___ 12. radius	
___ 13. scapula	
___ 14. skull	
___ 15. sternum	
___ 16. synsacrum	
___ 17. tarsus	
___ 18. vertebrae	
___ 19. ulna	

Part Two: True or False

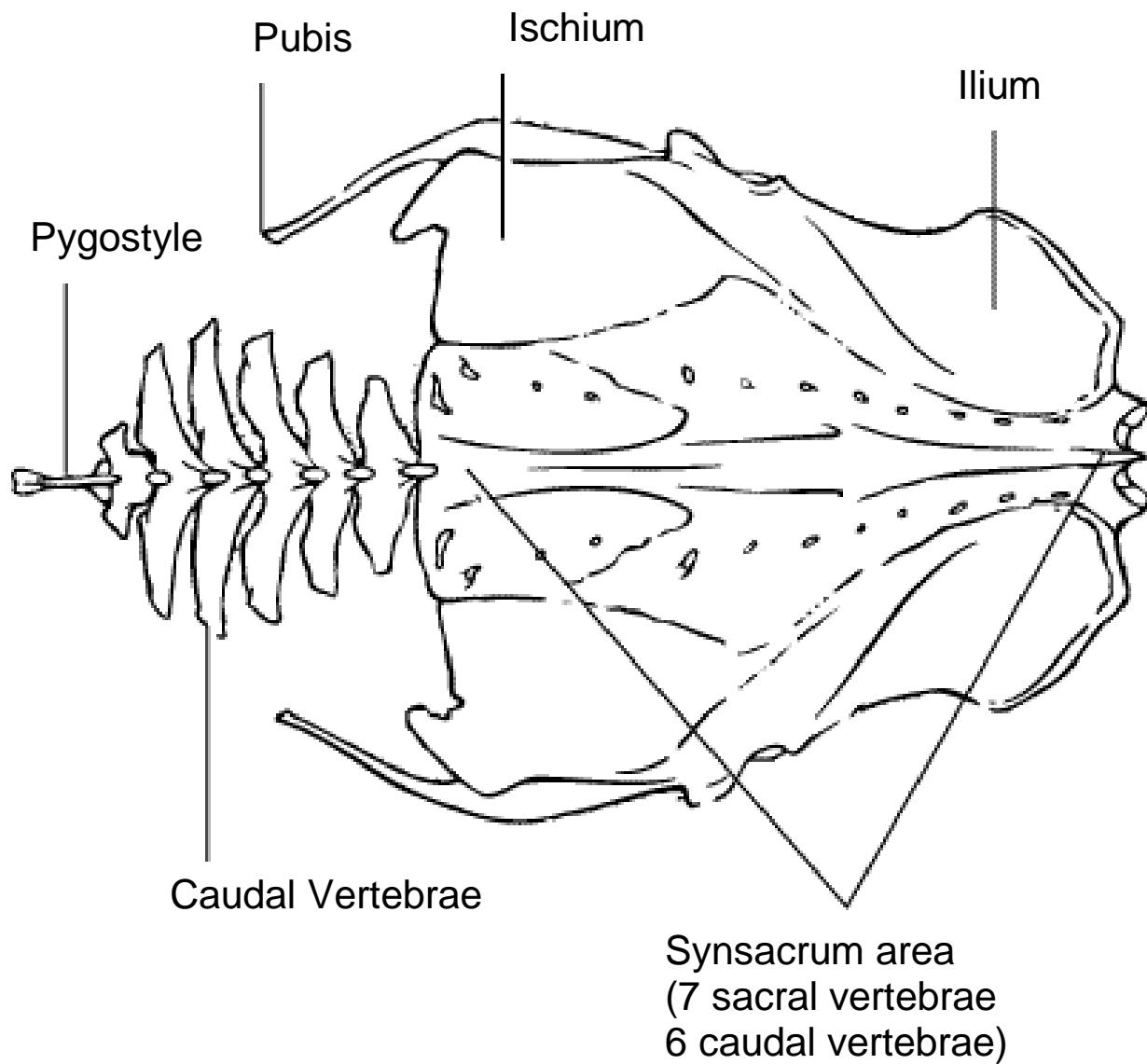
Instructions. If the statement is True write a T in the blank. If the statement is false write an F in the blank.

- ___ 20. Avian bones are hollow to allow for less weight in flight.
- ___ 21. The beak of birds is all bone and has no nerves or blood flow.
- ___ 22. Even though domesticated turkeys, ducks, chickens, and geese can't fly their bones are still hollow.
- ___ 23. Bones serve as a point of attachment for muscles in the bird.

Poultry Skeletal System



Top View of Bird Spine



Labeling a Poultry Skeleton

