SI Biology - Full Discipline Demo

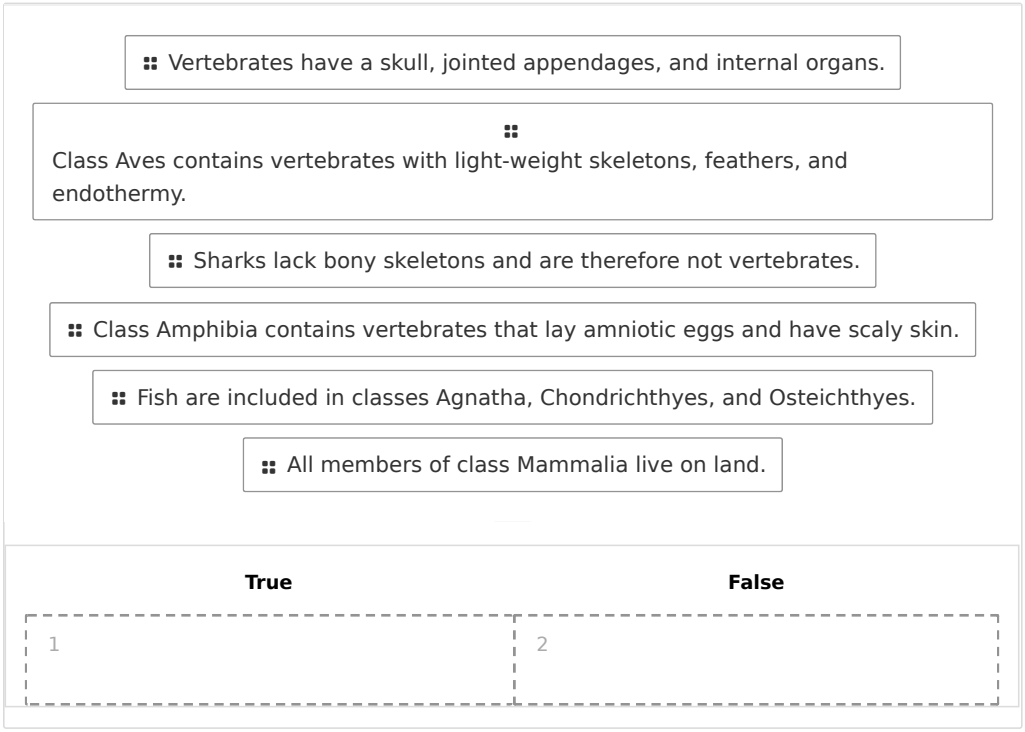
Vertebrates - Digital

Final Report - Answer Guide

Institution	Science Interactive University
Session	SI Biology - Full Discipline Demo
Course	SI Biology - Full Discipline Demo
Instructor	Sales SI Demo

Test Your Knowledge

Identify each statement as true or false.



Correct answers:

1 Vertebrates have a skull, jointed appendages, and internal organs.

Class Aves contains vertebrates with light-weight skeletons, feathers, and endothermy.

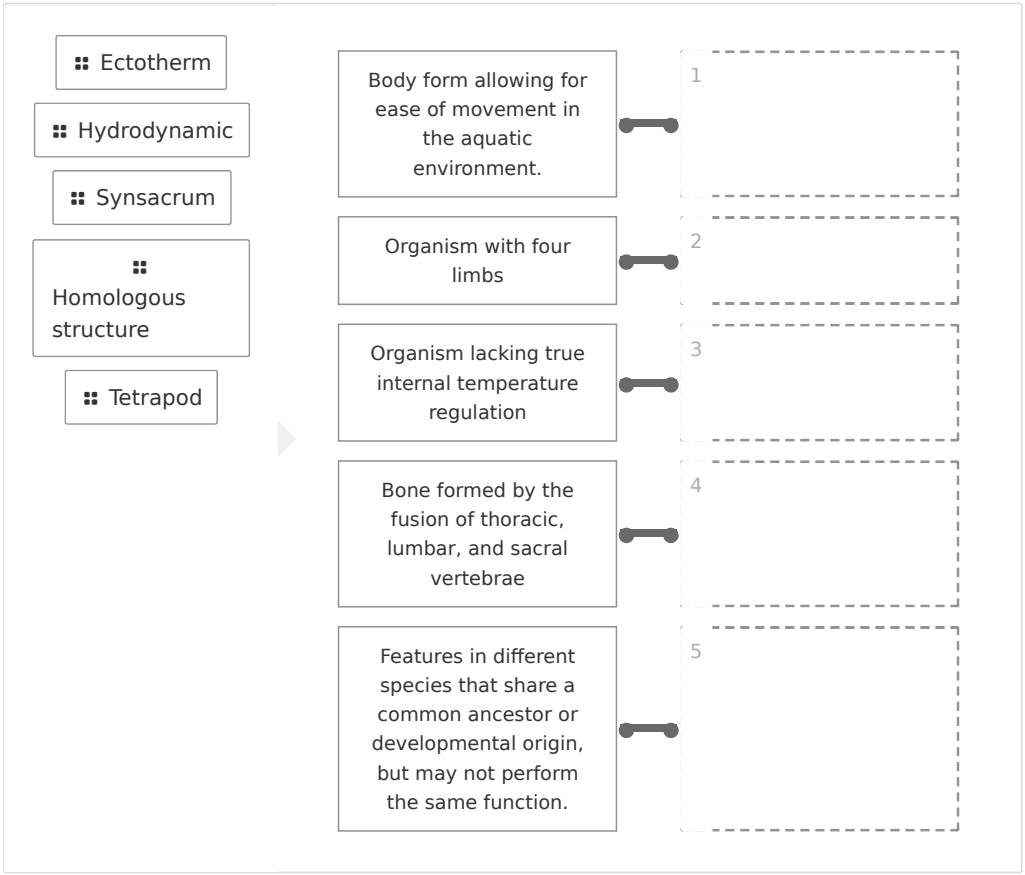
Fish are included in classes Agnatha, Chondrichthyes, and Osteichthyes.

2 Sharks lack bony skeletons and are therefore not vertebrates.

Class Amphibia contains vertebrates that lay amniotic eggs and have scaly skin.

All members of class Mammalia live on land.

Match each term with the best description.



Correct answers:

1 Hydrodynamic 2 Tetrapod 3 Ectotherm 4 Synsacrum

5 Homologous structure

Exploration

The skeletons of vertebrates may be composed of either cartilage or bone.

- True ✔
- False

In Osteichthyes, the pectoral and pelvic girdles are attached to the ____.

- anal fin
- skull ✔
- vertebral column
- hemal spines

The eggs of amphibians require moist or wet incubation environments.

- True ✔
- False

Reptiles lay ____ eggs that are protected by a shell and contain sufficient nutrients to produce well-developed hatchlings.

- gelatinous
- endothermic
- amniotic ✔
- pectoral

The ____ supports the tail feathers of birds.

- keel
- synsacrum
- furcula
- pygostyle ✔

The position and size of the phalanges and metacarpal/metatarsal bones do not vary in mammals.

- True
- False ✔

_____ structures have a similar function but evolved independently without sharing a common ancestor.

- [x] Analogous
- [ ] Homologous
- [ ] Synonymous
- [ ] Interspecific

Exercise 1

What are the defining characteristics of subphylum Vertebrata? Which of these characteristics were present on the skeleton diagrams used in this exercise? Reference Photo 1 and Data Table 1 in your answer.

Subphylum Vertebrata is characterized by organisms that possess:

1. a vertebral column
2. a skull
3. jointed appendages
4. internal organs
5. an endoskeleton

All defining features were observed on the shaded skeletons in Photo 1 and the associated structures in Data Table 1 except for internal organs.

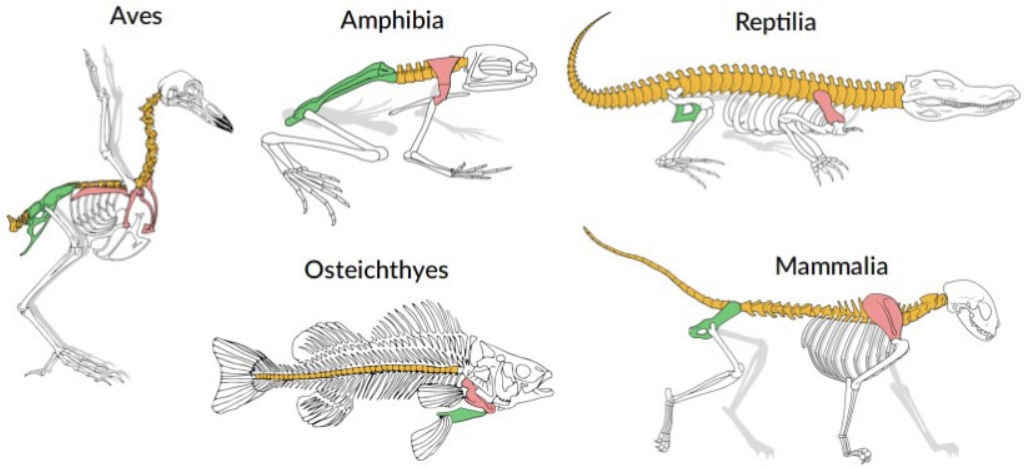
Describe two skeletal adaptations present in the skeleton diagram that allow fish to swim efficiently.

Answers should include two of the following: hemal and neural vertebral spines allow for a hydrodynamic body form; lengthened vertebral column allows for increased muscle attachments; pectoral, dorsal, and caudal fins for propelling, turning, and stabilizing the body.

Explain two skeletal adaptations that facilitate reptiles walking on land that were visible in the skeleton diagram of the alligator.

Answers should any two of the following: heavy, ossified skeletons that support large body sizes; a rib cage that supports the internal organs; limbs that attach to the bottom of the body allowing for more efficient movement.

Photo 1: Shaded Vertebrate Skeletons
(SAMPLE ANSWER BELOW)



Data Table 1: Vertebrate Skeletons
(SAMPLE ANSWER BELOW)

Bone	Family	Description
Neural and hemal vertebral spines	Osteichthyes	Extend the vertebral column vertically for ease of movement in the water.
Urostyle	Amphibia	Provides a strong, shock absorbing pelvic basket to withstand the forces of jumping.
Rib cage	Reptilia, Aves, Mammalia	Forms a bony basket to support internal organs.
Keel	Aves	Extension of the sternum for flight muscle attachment.
Synsacrum	Aves	Fused thoracic, lumbar, and sacral vertebrae to accommodate bipedal locomotion.
Opposable thumb	Mammalia	Wide saddle joint at base of thumb for strong muscle attachment to make grasping possible.
Vertebrae	Osteichthyes, Amphibia, Reptilia, Aves, Mammalia	Form the vertebral column that protects the central nervous system and supports the internal skeleton.

Exercise 2

What are the functions of each of the fins labeled in Photo 2?

Pectoral fins aid in lifting; pelvic fins assist in moving up and down, turning sharply, and stopping; the dorsal fin stabilizes the body to keep it upright; and the caudal fin propels the fish forward.

Describe the location and the function of the liver in the perch. Reference Photo 3 in your answer.

The liver is positioned on the anterior end of the coelomic cavity and surrounds most of the other internal organs of the perch as labeled in Photo 3. The liver is a vital organ that detoxifies blood, synthesizes proteins, and secretes digestive enzymes.

List two internal organs observed during the dissection of the perch that facilitate living under water. Describe the function of each structure.

- Gills
- Swim Bladder

Gills are the respiratory organs of all fish, providing oxygen to the bloodstream. The swim bladder is a gas-filled organ that assists the perch in maintaining buoyancy in the water.

Photo 2: External Anatomy of the Perch
(SAMPLE ANSWER BELOW)

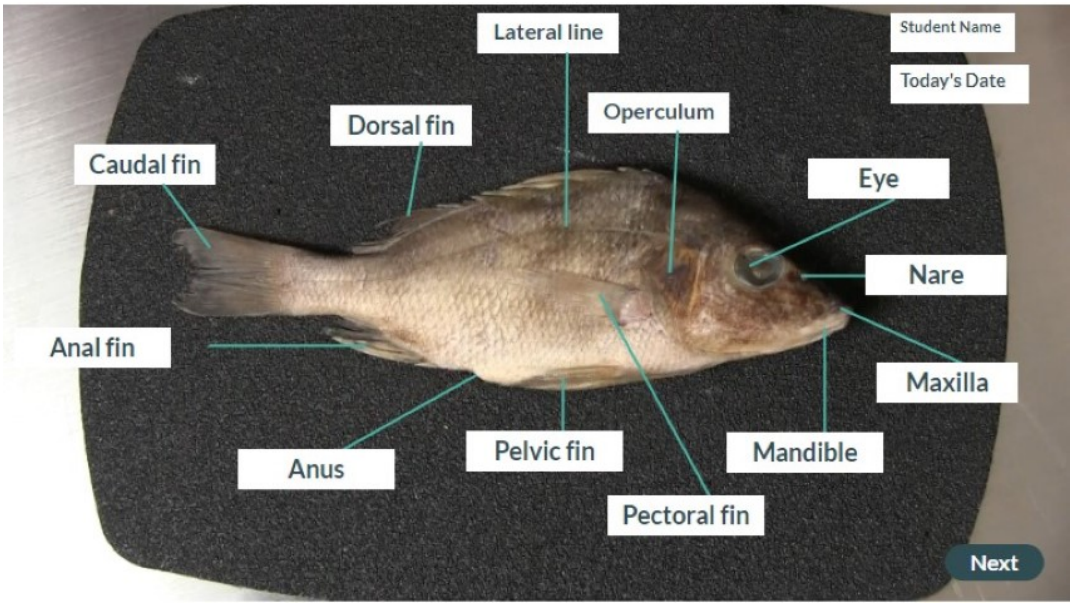
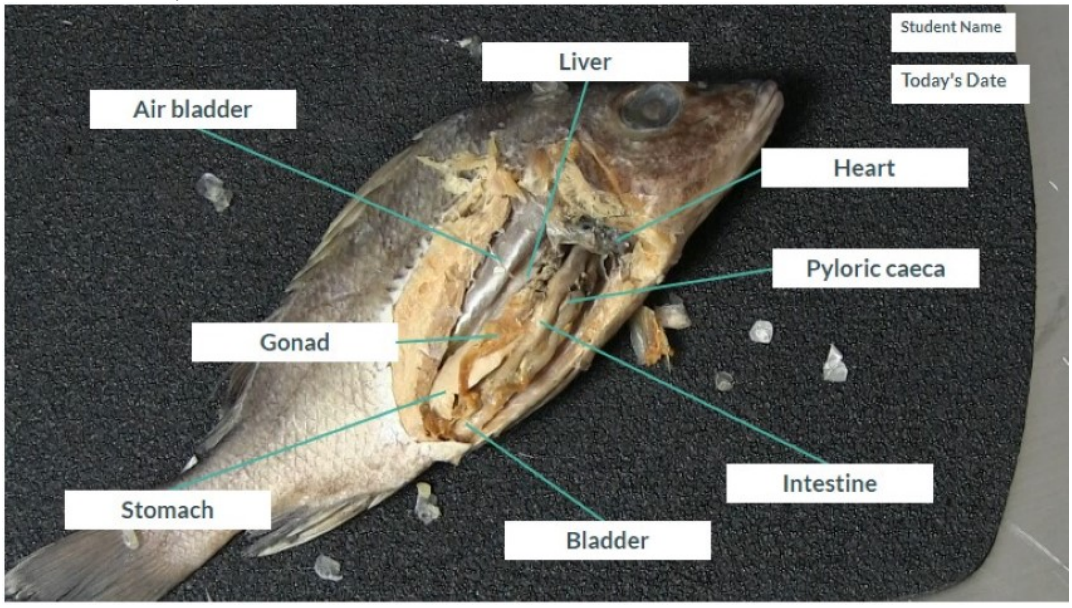


Photo 3: Internal Anatomy of the Perch
(SAMPLE ANSWER BELOW)



Exercise 3

Describe the jointed appendages labeled in Photo 4 and their functions.

The forelimbs, hindlimbs, and tail are jointed appendages labeled in Photo 4. The both pairs of limbs function for mobility and to support the body. The rat has a **digitigrade** foot used for jumping and running. The forelimbs of the rat are also used to hold food and move it into the mouth. The tail of the rat provides stability and support when the animal is moving.

What structures in the rat are analogous to the lateral line system of the perch dissected in Exercise 2? Explain the definition of analogous structures in your answer.

The ears of the rat are analogous to the lateral line system of the perch. Analogous structures are those that perform a similar function but do not share a common ancestor. The ears of the rat are

used for hearing by funneling sound waves to receptor cells in the head. The lateral line system of the fish is used for detecting pressure waves and sounds underwater.

What are the differences between the circulatory and respiratory organs of the rat and perch? How are these differences related to the environments where these vertebrates occur?

The rat has a four-chambered hear and a pair of lungs located in the thoracic cavity compared to the two-chambered heart and gills, located under the opercula, of the perch. Lungs are necessary for respiration in terrestrial environments, whereas gills are required for breathing underwater.

Photo 4: External Anatomy of the Rat
(SAMPLE ANSWER BELOW)

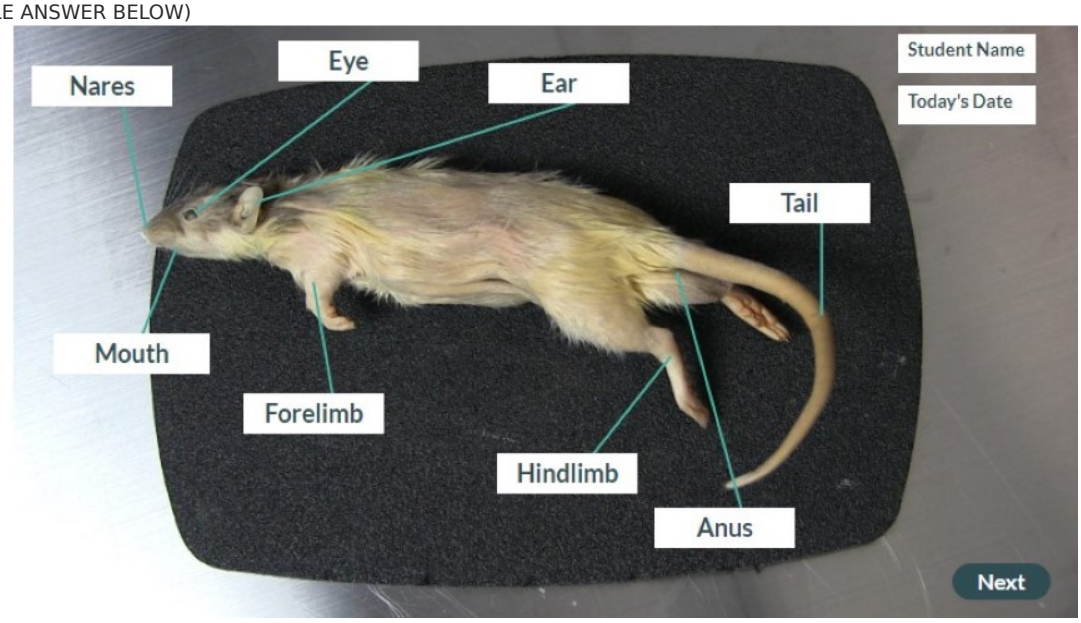
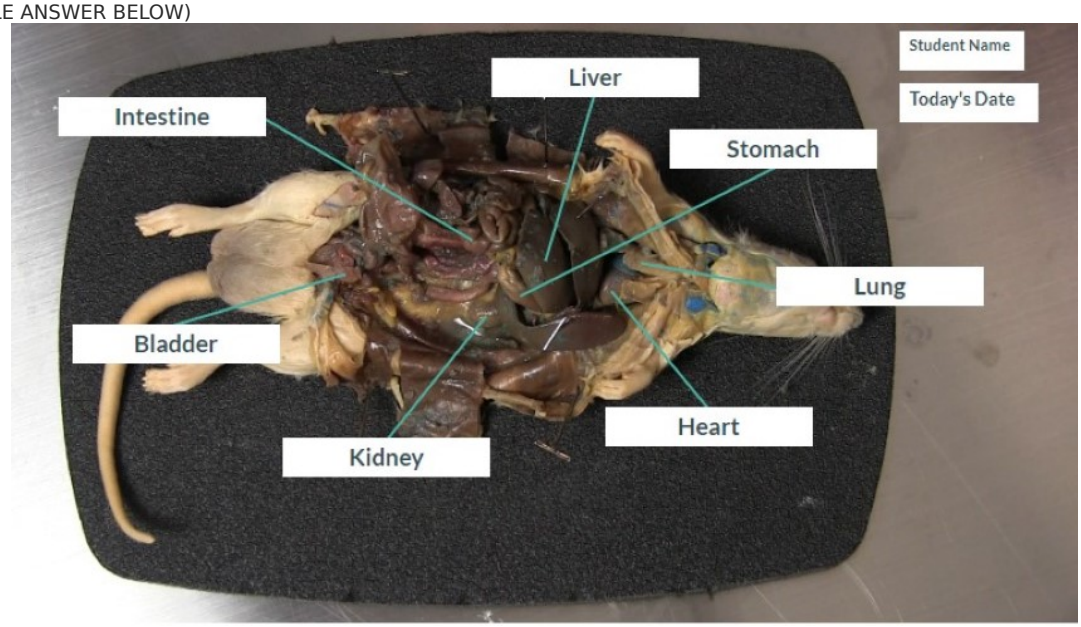


Photo 5: Internal Anatomy of the Rat

(SAMPLE ANSWER BELOW)



Competency Review

All members of subphylum Vertebrata possess a vertebral column, skull, and internal organs.

- True ✔
- False

Most fish and reptiles are considered _____ because they lack true internal temperature regulation.

- ectotherms ✔
- endotherms
- warm-blooded
- viviparous

Class _____ contains tetrapods with moist, glandular skin that lay eggs in water.

- Osteichthyes
- Amphibia ✔
- Reptilia
- Aves

Terrestrial, walking reptiles possess a(n) _____ that protects the internal organs.

- amniotic egg
- patagium
- rib cage ✔
- urostyle

Flight muscles attach to the _____ of the bird skeleton.

- keel ✔
- pygostyle
- synsacrum
- zygomatic arch

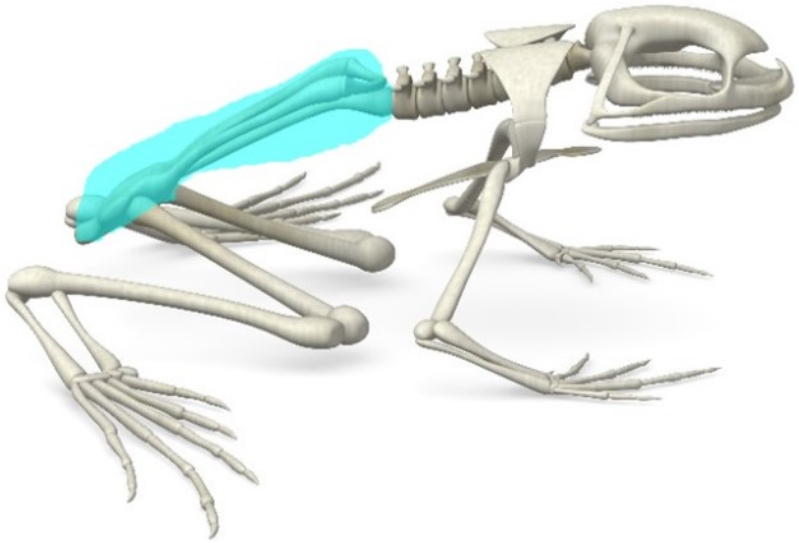
Skull morphology is associated with _____ in mammals.

- locomotion
- reproduction
- viviparity
- diet ✔

The fins of sharks and whales are examples of homologous structure.

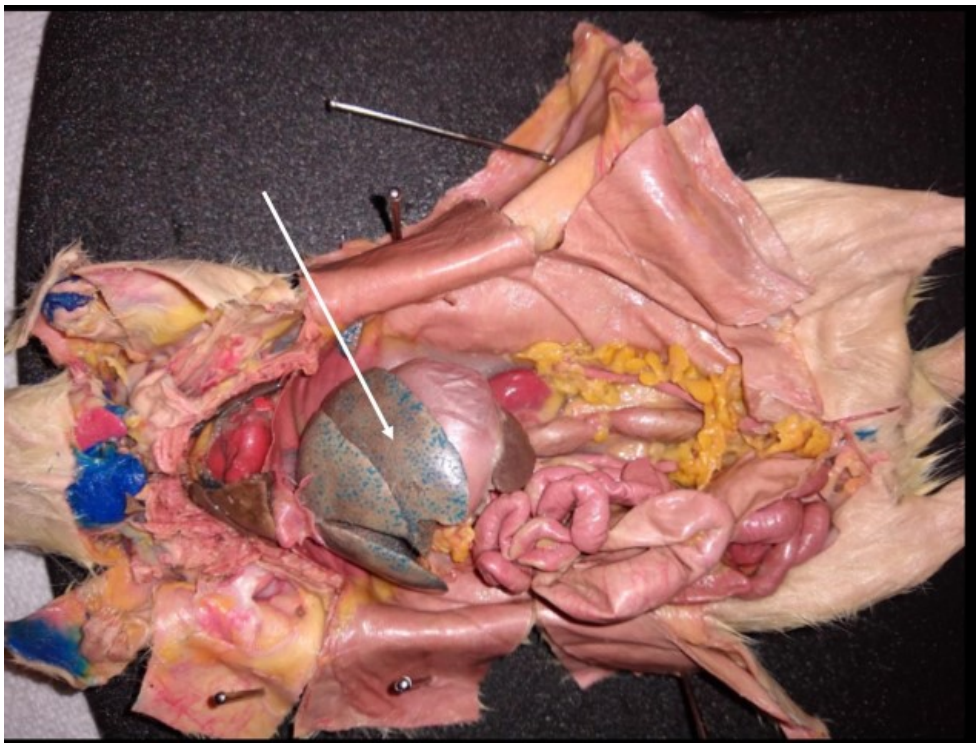
- True
- False ✔

The _____ is highlighted on the frog skeleton diagram below.



- pectoral girdle
- pelvic girdle ✔
- vertebral column
- skull

The _____ of the rat is indicated by the arrow in the image below.



- heart
- lung
- liver ✔
- kidney

The _____ of the perch functions to propel the fish forward.

- operculum
- anal fin
- dorsal fin
- caudal fin ✔

Extension Questions

Several bird species have lost the ability to fly. Apply your knowledge of comparative vertebrate anatomy to predict how the skeletal structure of a flighted bird differs from that of a flightless species that moves solely by walking/running.

(SAMPLE ANSWER BELOW)

The flightless species would be expected to have relatively thicker/heavier bone structure to support a strictly terrestrial/walking environment. The pelvic girdle of flightless birds should allow greater range of motion and also contain the largest muscle mass compared to flying birds which should have more articulation and muscle mass in the pectoral girdle. Bones of the wings may be reduced in size for the flightless species. The keel should be reduced or absent in the flightless species since it is no longer needed for flight muscle attachment.