

ZOOLOGY PRACTICAL

According to the syllabus of Berhampur University

ZOOL-P-304

Identification and Comments on Animals of Ecological Adaptation and Evolutionary Importance

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Study Tip: For animals of ecological adaptation, the emphasis is on the body structures and physiological processes that help an animal survive in its habitat. For animals of evolutionary importance, the emphasis is on diagnostic characters, evolutionary relationships and evidence for understanding animal evolution.

PART I. ANIMALS OF ECOLOGICAL ADAPTATION

1. Rohu (*Labeo rohita*)



Taxonomy

- Kingdom: Animalia
- Phylum: Chordata
- Subphylum: Vertebrata
- Class: Actinopterygii
- Order: Cypriniformes
- Family: Cyprinidae

- Genus: *Labeo*
- Species: *rohita*

Identification

1. Freshwater bony fish with a streamlined, laterally compressed body.
2. Body covered with scales and mucus; gills and paired and unpaired fins are present.

Morphological and Physiological Adaptations

3. The streamlined body reduces resistance during swimming.
4. Gills extract dissolved oxygen from water.
5. Fins provide propulsion, steering and stability.
6. The swim bladder regulates buoyancy.
7. The lateral line detects water movements and vibrations.
8. Scales and mucus protect the body and reduce friction.

Ecological Significance

9. Adapted to freshwater rivers, ponds and reservoirs.
10. Its feeding habits allow it to exploit a range of aquatic food resources.
11. Swimming and sensory adaptations assist in finding food and avoiding predators.

2. Mudskipper (*Periophthalmus* sp.)



Taxonomy

- Kingdom: Animalia
- Phylum: Chordata
- Subphylum: Vertebrata
- Class: Actinopterygii
- Order: Gobiiformes

- Family: Oxudercidae
- Genus: Periophthalmus

Identification

1. Amphibious fish with prominent, elevated eyes.
2. Strong pectoral fins support movement over moist mud.
3. Commonly found in mangrove and intertidal habitats.

Morphological and Physiological Adaptations

4. Strong pectoral fins facilitate movement over mud.
5. Moist skin and the buccopharyngeal lining enable aerial gas exchange.
6. Elevated eyes provide vision above the water surface.
7. Behavioural and physiological mechanisms help maintain moisture during exposure to air.
8. Burrowing provides shelter and helps avoid environmental extremes.

Ecological Significance

9. Occupies the ecological boundary between aquatic and terrestrial environments.
10. Tolerates fluctuating tidal conditions and, in many species, variable salinity.
11. Demonstrates specialized adaptation to intertidal mudflats without being a direct ancestor of amphibians.

3. Camel (*Camelus dromedarius*)



Taxonomy

- Kingdom: Animalia
- Phylum: Chordata
- Subphylum: Vertebrata
- Class: Mammalia

- Order: Artiodactyla
- Family: Camelidae
- Genus: *Camelus*
- Species: *dromedarius*

Identification

1. Large herbivorous mammal with one hump.
2. Long legs and broad, padded feet; long eyelashes and closable nostrils.

Morphological and Physiological Adaptations

3. Broad feet prevent excessive sinking into sand.
4. The hump stores fat, which can be metabolized for energy.
5. Efficient kidneys help reduce water loss through urine.
6. Changes in body temperature within physiological limits can reduce the need for evaporative cooling.
7. Closable nostrils and long eyelashes protect against blowing sand.
8. Tough lips allow feeding on thorny desert vegetation.

Ecological Significance

9. Well adapted to arid and semi-arid environments.
10. Water conservation and tolerance of dehydration support survival where water is scarce.
11. Feeding adaptations permit exploitation of vegetation unavailable to many other herbivores.

4. Polar Bear (*Ursus maritimus*)



Taxonomy

- Kingdom: Animalia
- Phylum: Chordata
- Subphylum: Vertebrata

- Class: Mammalia
- Order: Carnivora
- Family: Ursidae
- Genus: *Ursus*
- Species: *maritimus*

Identification

1. Large carnivorous mammal with thick fur and a substantial fat layer.
2. Large paws and a powerful body; pale-looking coat.

Morphological and Physiological Adaptations

3. Thick fur and body fat provide insulation against extreme cold.
4. Large paws distribute body weight on snow and assist swimming.
5. Fur-covered foot surfaces provide insulation and traction.
6. A streamlined body and strong limbs support swimming.
7. A well-developed sense of smell helps locate prey.

Ecological Significance

8. Adapted to the Arctic environment and sea-ice habitats.
9. Its adaptations support hunting marine-associated prey, especially seals.
10. Its survival is closely linked to the availability of sea ice and the Arctic marine ecosystem.

5. Chameleon (*Chamaeleo* sp.)



Taxonomy

- Kingdom: Animalia
- Phylum: Chordata
- Subphylum: Vertebrata

- Class: Reptilia
- Order: Squamata
- Family: Chamaeleonidae
- Genus: *Chamaeleo*

Identification

1. Arboreal reptile with independently moving eyes.
2. Grasping feet and, in many species, a prehensile tail.
3. Long projectile tongue.

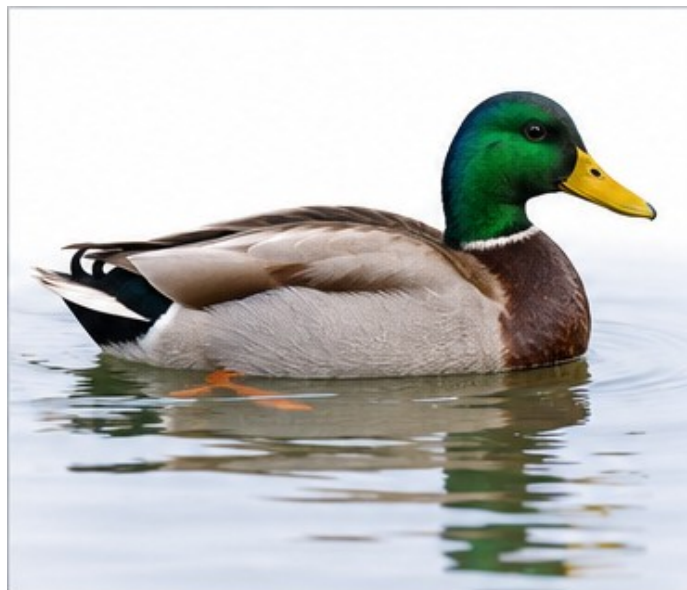
Morphological and Physiological Adaptations

4. Specialized digits help grasp branches.
5. A prehensile tail provides additional support in species possessing one.
6. Independently moving eyes help detect prey and monitor the surroundings.
7. The projectile tongue enables rapid capture of prey.
8. Changes in skin colour can assist communication and thermoregulation and may contribute to camouflage.

Ecological Significance

9. Specialized for climbing and feeding in vegetation.
10. Visual and feeding adaptations facilitate prey capture with limited body movement.
11. Colour changes may help it respond to social and environmental conditions.

6. Duck (*Anas sp.*)



Taxonomy

- Kingdom: Animalia
- Phylum: Chordata
- Subphylum: Vertebrata

- Class: Aves
- Order: Anseriformes
- Family: Anatidae
- Genus: *Anas*

Identification

1. Aquatic or semi-aquatic bird.
2. Webbed feet and a broad bill; body covered with feathers.

Morphological and Physiological Adaptations

3. Webbed feet increase the surface area for swimming.
4. Water-resistant outer feathers help maintain insulation.
5. Down feathers trap air and conserve body heat.
6. The preen gland produces oil that helps maintain feather condition.
7. Bill structures support different feeding methods according to species and diet.

Ecological Significance

8. Adapted to wetlands, ponds, lakes and other aquatic habitats.
9. Webbed feet facilitate swimming and movement in water.
10. Feeding adaptations allow ducks to exploit aquatic plants, invertebrates and other food resources.

PART II. ANIMALS OF EVOLUTIONARY IMPORTANCE

7. *Peripatus* (*Peripatus* sp.)



Taxonomy

- Kingdom: Animalia
- Phylum: Onychophora
- Class: Udeonychophora
- Genus: *Peripatus*

Identification

1. Elongated, soft body with numerous pairs of unjointed lobopodial legs.
2. Antennae and slime-producing oral papillae are present.
3. Tracheal respiratory system.

Diagnostic Characters

4. Body exhibits external segmentation.
5. Lobopodial legs lack the distinct joints characteristic of arthropod appendages.
6. The tracheal system opens to the exterior through spiracles.
7. Slime glands open through oral papillae.
8. Its combination of anatomical features distinguishes it from annelids and arthropods.

Evolutionary Relationships and Significance

9. Onychophora is a distinct lineage within Panarthropoda, closely related to Arthropoda and Tardigrada.
10. Lobopodial legs provide a valuable comparison with those of fossil lobopodians.
11. Its body organization helps researchers investigate the evolution of jointed appendages in arthropods.
12. Comparisons of its nervous, respiratory and locomotory systems provide insight into panarthropod evolution.
13. It illustrates how living species can retain useful ancestral characteristics while also evolving specialized features.

8. Horseshoe Crab (*Limulus polyphemus*)



Taxonomy

- Kingdom: Animalia
- Phylum: Arthropoda
- Subphylum: Chelicerata
- Class: Xiphosura
- Family: Limulidae
- Genus: *Limulus*
- Species: *polyphemus*

Identification

1. Broad, horseshoe-shaped carapace.
2. Long, pointed telson.
3. Book gills and chelicerate appendages.

Diagnostic Characters

4. The body has a broad prosomal carapace and a posterior opisthosomal region.
5. Cheliceræ are present rather than antennae.
6. Book gills occur on the ventral surface.
7. A long telson projects from the posterior end.
8. The body organization distinguishes it from crustaceans and insects.

Evolutionary Relationships and Significance

9. Horseshoe crabs belong to the chelicerate lineage of arthropods.
10. Their fossil record documents a long evolutionary history of the broader horseshoe-crab lineage.
11. Their anatomy is important for comparative studies of marine arthropods.

12. Their compound eyes and other light-sensitive organs contribute to research on the evolution of arthropod sensory systems.
13. The term “living fossil” refers to the persistence of certain broad anatomical features, not an absence of evolutionary change.

9. *Balanoglossus* (*Balanoglossus* sp.)



Taxonomy

- Kingdom: Animalia
- Phylum: Hemichordata
- Class: Enteropneusta
- Genus: *Balanoglossus*

Identification

1. Worm-like marine animal.
2. Body divided into proboscis, collar and trunk.
3. Pharyngeal gill slits are present.

Diagnostic Characters

4. The body is distinctly divided into three regions.
5. Pharyngeal slits are present in the trunk region.
6. A stomochord extends into the proboscis region.
7. Its developmental and anatomical characteristics distinguish it from both chordates and other marine worms.

Evolutionary Relationships and Significance

8. Hemichordates belong to the deuterostome lineage.
9. Hemichordates and echinoderms form the group Ambulacraria.
10. Pharyngeal slits provide a useful comparison with those of chordates.
11. The stomochord is not homologous to the chordate notochord, despite older comparisons.

12. Molecular and developmental studies help explain evolutionary relationships among hemichordates, echinoderms and chordates.
13. It demonstrates that similarities between animal groups must be evaluated using multiple lines of evidence.

10. Amphioxus (*Branchiostoma sp.*)



Taxonomy

- Kingdom: Animalia
- Phylum: Chordata
- Subphylum: Cephalochordata
- Class: Leptocardii
- Genus: *Branchiostoma*

Identification

1. Small, elongated, fish-like marine animal.
2. Notochord persists throughout life.
3. Dorsal hollow nerve cord, pharyngeal slits and post-anal tail are present.

Diagnostic Characters

4. Notochord extends along the body and persists into adulthood.
5. A dorsal hollow nerve cord lies above the notochord.
6. Pharyngeal slits and a post-anal tail are present.
7. Segmented axial muscles occur along the body.
8. A distinct skull and vertebral column are absent.

Evolutionary Relationships and Significance

9. Amphioxus represents a surviving lineage of cephalochordates.
10. Its body organization illustrates the basic chordate characteristics.
11. Comparisons with vertebrates help explain the evolution of the axial skeleton and nervous system.

12. Its developmental biology provides insights into the evolution of chordate body plans.
13. Comparative genomic studies help identify ancestral genes and developmental mechanisms shared among chordates.
14. *Amphioxus* is not a direct modern ancestor of vertebrates; it represents a separate branch that shares common ancestry with them.

11. Archaeopteryx (*Archaeopteryx lithographica*)



Taxonomy

- Kingdom: Animalia
- Phylum: Chordata
- Subphylum: Vertebrata
- Clade: Dinosauria
- Clade: Theropoda
- Genus: *Archaeopteryx*
- Species: *lithographica*

Identification

1. Extinct feathered animal known from Late Jurassic fossils.
2. Feathers and wing-like forelimbs are present.
3. Teeth, clawed fingers and a long bony tail distinguish it from modern birds.

Diagnostic Characters

4. Preserved feathers provide direct evidence of feathered body covering.
5. Forelimbs are modified into wings.
6. Jaws possess teeth.
7. Fingers bear claws.
8. A long bony tail is present.

9. The combination of these traits is important for distinguishing it from modern birds.

Evolutionary Relationships and Significance

10. Archaeopteryx is an important fossil in the evolutionary history of birds.
11. It displays a combination of avian and non-avian theropod characteristics.
12. It supports the origin of birds within theropod dinosaurs.
13. It demonstrates that feathers evolved before the appearance of modern birds.
14. Its anatomy helps researchers investigate changes associated with the evolution of avian flight.
15. It provides evidence that evolutionary transitions involve combinations of ancestral and derived characteristics.

12. Tuatara (*Sphenodon punctatus*)



Taxonomy

- Kingdom: Animalia
- Phylum: Chordata
- Subphylum: Vertebrata
- Class: Reptilia
- Order: Rhynchocephalia
- Family: Sphenodontidae
- Genus: *Sphenodon*
- Species: *punctatus*

Identification

1. Lizard-like reptile with a prominent dorsal crest.
2. Parietal eye is present.
3. Distinctive skull and jaw characteristics.

Diagnostic Characters

4. The skull retains distinctive rhynchocephalian characteristics.
5. A parietal eye is present in the head region.
6. The dentition includes teeth associated with the jaw bones rather than the typical tooth attachment seen in many modern lizards.
7. A dorsal crest is often conspicuous.
8. These characteristics distinguish tuatara from true lizards, which belong to the order Squamata.

Evolutionary Relationships and Significance

9. Tuatara is the only surviving member of the order Rhynchocephalia.
10. Rhynchocephalians diverged from the lineage leading to modern squamates early in reptilian evolution.
11. Its skull provides important evidence for comparative studies of reptilian evolution.
12. The parietal eye helps researchers study the evolutionary history of light-sensitive organs in vertebrates.
13. Its distinctive dentition contributes to understanding the diversification of reptilian feeding structures.
14. Tuatara is often described as a “living fossil,” but it has continued to evolve and is not unchanged from its ancient relatives.

Viva Questions and Answers

1. Q. What is ecological adaptation?

Answer: Ecological adaptation is a structural, physiological, or behavioural feature that helps an organism survive and reproduce in its environment.

2. Q. How is Rohu adapted to aquatic life?

Answer: Rohu has a streamlined body, fins for swimming, gills for respiration, and a swim bladder for buoyancy.

3. Q. How does a mudskipper survive on mudflats?

Answer: It can breathe through its moist skin and the lining of its mouth when out of water for limited periods. Its strong pectoral fins help it move on mud.

4. Q. Why is Balanoglossus important in evolutionary studies?

Answer: It is a hemichordate that has pharyngeal gill slits and a stomochord. Its features are important for understanding deuterostome evolution, but it is not a true chordate.

5. Q. Why is Archaeopteryx considered a transitional fossil?

Answer: It possessed feathers and wings like birds, along with teeth, clawed fingers, and a long bony tail like non-avian dinosaurs. It provides evidence about the evolution of birds.

6. Q. Why is the tuatara (Sphenodon) called a living fossil?

Answer: The tuatara is the only surviving member of the ancient reptilian order Rhynchocephalia. It retains several distinctive ancestral features and helps us understand reptilian evolution.