

VERTEBRATE BIOLOGY

BIOL 330/4

2013-2014

Lectures 1-11

Lecture 1

- Vertebrate diversity*
- Amniotes ad Anamniotes*
- Binomial nomenclature*
- Linnaeus system of classification*
- Clades and Taxa*
- Evolutionary relationships: Derived, Shared derived and Ancestral*
- Fossils and evolutionary hypothesis*
- Phylogenetics*
 - *Convergent and parallel evolution*
 - *Conservation*
- Early history and vertebrate evolution*
- Vertebrate structure*
- Phylogeny of animal kingdom*
- Four distinct features of a chordate*
- Three subphyla: Vertebrata, Urochordata and Cephalochordata*
- hox genes*

Characteristics of a Vertebrate:

- Embryonic development: Endo-, Ecto- and Mesoderm*
- Vertebrate tissue types*
- Mineralized tissue*
- Vertebrate skeleto-muscular system*
 - *layers in cranium*
 - *shape of myomeres*
- Vertebrate energy acquisition and metabolism*
- Vertebrate cardiovascular system*
- Excretory and reproductive systems*

Lecture 2

- ☑ *Evidences that vertebrates originated in water*
- ☑ *Prominent features of early vertebrates: Ostracoderms, myllokuningia, astraspis*
- ☑ *Origin and advantages of mineralized tissues*
- ☑ *The conodont confusion*
- ☑ *Extant jawless fishes (Agnathas)*
 - *Hagfishes*
 - *Lampreys*
- ☑ *Jawed vertebrates: variety of new behaviours*
 - *Presence of jaws*
 - *Paired pectoral and pelvic fishes*
- ☑ *Jawed vertebrates: basic body plan*
 - *Toothed jaws*
 - *Internal gill rakers*
 - *Olfactory tracts*
 - *Spiracle*
 - *Semicircular canals in the inner ear*
 - *Septum*
 - *Centra in vertebrate*
 - *Paired pectoral and pelvic fishes*
- ☑ *Jawed vertebrates: Jaws and teeth, ribs, soft tissue*
- ☑ *Anterior branchial arches and mandibular arches --> vertebrate jaw*

Lecture 3

- ☑ *Water vs Air*
 - *Density*
 - *Viscosity*
 - *Oxygen content*
 - *Electrical conductivity*
- ☑ *Obtaining oxygen in water (gills) from Air (lungs) and across the skin*
- ☑ *Adjusting buoyancy*
 - *To go deeper/shallower*
 - *Physostomes and Physoclists*
 - *Gas glands*
- ☑ *Sensing in water*

- Vision
- Chemosensation
- Touch, sound, pressure and motion: Lateral line & Neuromast organs
- Electroreception (mechanism)
- ☑ Internal environment of vertebrates
 - Water and salt regulation, kidneys and nephrons
 - ➔ Exchange of water and ions in different types of fishes
 - Dealing with the water temperature
 - ➔ Endotherm
 - ➔ Ectotherm
 - ➔ Heterotherm
 - Insulation
- ☑ Body size and surface to volume ratio

Lecture 4

- ☑ Chondrichthyes: Cartilaginous fishes
- ☑ Chondrichthyes:
 - Neoselachii
 - ➔ Galeomorpha
 - ➔ Squalomorpha
 - ➔ Batoidea
 - Holocephalii
 - ➔ Chimaeriformes
- ☑ Chondrichthyes: Evolutionary specialization
 - Teeth
 - Tails
- ☑ Chondrichthyes: General characteristics
 - Refined sensory systems
 - Jaws, teeth and feeding
 - Reproduction

Lecture 5

- ☑ Osteichthyes: Boney fishes
- ☑ Boney fishes: Ancestral and shared derived characters
- ☑ Sister groups of boney fishes

◎ *Sarcopterygii: Distinct feature and Estivation*

- ➔ *Dipnoan*
- ➔ *Coelocanth*

◎ *Actinopterygii*

- ➔ *Polypteriforms*
- ➔ *Acipenseriforms*
- ➔ *Neoterygians*

★ *Teleosts*

1. *Osteoglossomorpha*
2. *Elopomorpha: Life cycle of American eel*
3. *Clupeomorpha: Weberian apparatus and alarm pheromones*
4. *Eusteleostei*

★ *Lepisosteiformes*

★ *Amiiformes*

☑ *Early forms of Actinopterygii*

☑ *Actinopterygii: Teleost specializations*

- ◎ *Protrusible jaws*
- ◎ *Pharyngeal jaws*
- ◎ *Fin specializations*
- ◎ *Reduced dermal armour*

☑ *Fish locomotion*

☑ *Overcoming drag: Viscous and pressure*

☑ *Reproduction: Marine and fresh water fishes*

☑ *Teleosts: Mesopelagic, Bathypelagic*

Lecture 6

☑ *Conservation concerns for fishes*

◎ *Habitat loss*

➔ *Freshwater fishes*

- ★ *Habitat degradation: Dredging*
- ★ *Water Usage: Irrigation and overgrazing etc.*
- ★ *Building dams....fish ladders*
- ★ *Wetland drainage*

➔ *Freshwater fishes*

- ★ *Coral reef destruction*

- ★ *Dynamite fishing*
- *Overexploitation*
- *Interaction with cultured counterparts*
- *Invasive species: accidental and intentional*
- *Pollution*

Lecture 7

- ☑ *Origin and evolution of tetrapod characters*
- ☑ *Advantages of being on land*
- ☑ *Amniotic eggs*
- ☑ *Life on land: Air vs water*
 - *Density*
 - *Viscosity*
 - *Oxygen*
 - *Electrical conductivity*
 - *Heat conductivity*
- ☑ *Adaptations in land animals for the following features*
 - *Support on land*
 - ★ *Axial skeleton and muscles*
 - *Maintaining posture*
 - *Ventilating lungs*
 - ★ *Appendicular skeleton*
 - *Size and scaling*
 - *Locomotion on land*
 - ★ *Different modes of locomotion*
 - *Eating on land*
 - *Respiration on land*
 - *Blood and gravity*
 - *Sensory systems in the air*
 - ★ *Vision*
 - ★ *Smell*
 - ★ *Hearing*
 - ★ *Thermoregulation*
 - *Ecto- and Endo-thermy*
 - *Energy exchange*
 - *Conserving water on land*
- ☑ *Tetrapod origins*

- *Fish and tetrapod features of Tiktaalik*
- *Anamniotic and amniotic Palaeozoic tetrapods*
- *Earth History*
- *Palaeozoic extinctions*

Lecture 8

- ☑ *Common and diverse characteristics of amphibians*
- ☑ *Three lineages of amphibians*
 - *Urodeles (Salamanders)*
 - ★ *Characteristics*
 - ★ *Aggressive behaviour*
 - *Anurans (Frogs)*
 - ★ *Characteristics*
 - ★ *Locomotory specializations*
 - ★ *Diversity and body forms*
 - *Apodans (Caecilians)*
 - ★ *Characteristics*
- ☑ *Diversity of amphibian life*
 - *Urodels: Reproduction, sexual dimorphism*
 - *Anurans: Vocalization, reproduction and parental care*
 - *Caecilians: Reproduction*
- ☑ *Tadpole Metamorphosis*
- ☑ *Exchange of water and gas*
- ☑ *Behavioural control of water loss*
- ☑ *Skin: Defence mechanisms*
- ☑ *Uses of Amphibians: Hunting, pest control, food etc.*
- ☑ *Amphibian decline:*
 - *Habitat destruction*
 - *Overexploitation*
 - *Climate change*
 - *UV-B radiation*
 - *Chemical contaminants*
 - *Diseases*

Lecture 9

- ☑ *Synapsids and Sauropsids*
- ☑ *Challenges of efficiently living on land*
 - *Respiration and locomotion*
 - *Increasing gas exchange*
 - *Transporting oxygen to muscles*
 - *Retaining heat: endothermy*
 - *Conserving water and getting rid of waste: ammonia, urea, uric acid*
- ☑ *Sensory systems: smell, sight and brain*

Lecture 10

- ☑ *Turtles: similarities and difference from amphibians*
- ☑ *Turtles on phylogenetic tree*
- ☑ *Turtles*
 - *Shell and skeleton*
 - *Respiration*
 - *Social behaviour*
 - *Nesting behaviour*
 - *Egg development*
 - *Hatching behaviour*
 - *Threats to turtles*

Lecture 11

- ☑ *Lepidosauria: Tuatara, lizards and snakes*
 - *Lizards: feeding, predator escape, social behaviour, reproduction, behavioural control of body temperature*
 - ★ *Iguanidae*
 - ★ *Chameleontidae*
 - ★ *Gekkonidae*
 - ★ *Scincidae*
 - ★ *Varanidae*
 - ★ *Komodo dragons*

© *Snakes: feeding specialization, snake venom, reproduction*

★ *Locomotory specialization*

➔ *Lateral undulation*

➔ *Rectilinear locomotion*

➔ *Concertina locomotion*

➔ *Sidewinding locomotion*

Parthenogenesis

Parental care

Crocodylians: Heart structure