Quick Study® ACADEMIC

ZOOLOGY

What is an animal? A multicellular, eukaryotic, heterotrophic organism lacking cell walls

CLASSIFICATION OF THE METAZOAN KINGDOM

ACOELOMATA
No cavity between body wall and organs

PLATYHELMINTHES - Flatworms

NEMERTEA - Ribbon/Proboscis worms; possibly coelomates

PSEUDOCOELOMATA
Embryonic blastocoel persists as body cavity

NEMATODA - Roundworms

PROTOSTOMIA
Schizocoelous body cavity

ANTHROPODA - Spiders, crabs, scorpions, insects, shrimp

ANNELIDA - Segmented worms

MOLLUSCA - Snails, slugs, bivalves, squids, octopods

DEUTEROSTOMIA
Enterocoelous body cavity

CHORDATA - Tunicates, lancelets, vertebrates

HEMICHORDATA - Acorn worms

ECHINODERMATA - Sea stars, sea urchins, sand dollars

RADIATA
Body with radial symmetry

CNIDARIA (COELENTERATA) - Anemones, Corals, Jellyfish

CTENOPHORA - Comb jellies

BILATERIA
Body with bilateral symmetry

EUCOELOMATA
Body cavity lined with mesodermal tissues

PARAZOA
Poorly defined tissues and organs

PLACOZOA - Primitive metazoan

PORIFERA - Sponges

EUMETAZOA
Tissues, organs, digestive tract

METAZOAN CHARACTERISTICS

1. Advantages
   a. Larger size
   b. Increased mobility
   c. Internal homeostasis
   d. Relative independence from environment

Symmetry

1. Radial - Circular arrangement with numerous planes creating equal halves; no front/back or left/right sides; possess top/bottom or oral/aboral surfaces (1)
   - Sessile or pelagic forms
2. Bilateral - Possess left/right sides (2)
   - "Cephalization" or concentration of sensory structures in the head
   - Unidirectional, active movement using head for orientation

1 RADIAL

2 BILATERAL

Embryology

1. **Zygote**--> 2 cell--> 4 cell--> 8 cell--> 16 cell--> **Morula** (solid ball of cells)--> **Blastula** w/ **blastocoel chamber**--> **Gastrula** w/**blastopore** and **archenteron** (embryonic gut) (3)

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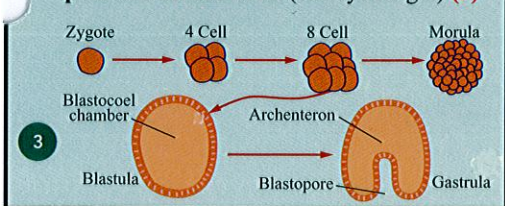
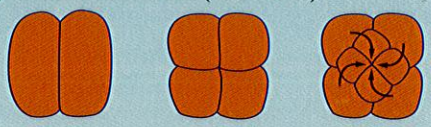
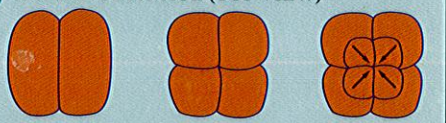


2. Three germ layers (from which all tissues develop) in place during gastrula phase: **Endoderm, Mesoderm, Ectoderm**
   Diploblastic - Organisms produce only ectoderm and endoderm
   Triploblastic - organisms produce all three layers
3. **Protostome/deuterostome classification**
   a. Cleavage patterns
   Spiral cleavage - New cells placed at juncture between previous cells; protostome feature (4)
   Radial cleavage - New cells placed directly beside or on top of previous cells; deuterostome feature (5)

4 SPIRAL CLEAVAGE (TOP VIEW)

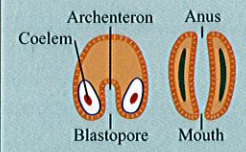


5 RADIAL CLEAVAGE (TOP VIEW)

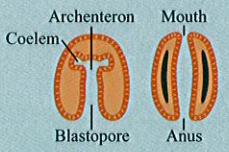


   b. Developmental fate of cells
   Determinate - Fate of cells determined early; separated early cells incapable of developing into entire organism; protostome feature
   Indeterminate - Fate of cells determined relatively late; separated early cells can develop into entire organism; allows for "twinning" or genetically identical individuals; deuterostome feature
   c. Coelom formation - Body cavity lined by mesodermal tissues
   Schizocoely - Derived from split in mesoderm; protostome feature (6)
   Enterocoely - Derived from outgrowth of archenteron; deuterostome feature (7)

6 SCHIZOCOELY

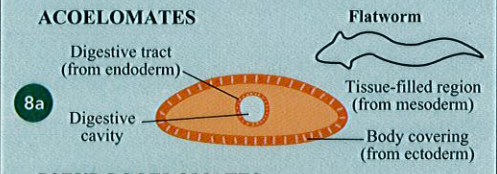


7 ENTEROCOELY

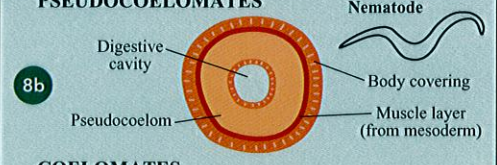


   d. Blastopore fate
   Mouth; a second opening in embryo forms anus; protostome feature
   Anus; a second opening in embryo forms mouth; deuterostome feature
   e. Body plans
   Acoelomates - No cavity between body wall and organs (8a)
   Pseudocoelomates - Embryonic blastocoel persists as body cavity (8b)
   Coelomates - Body cavity lined with mesodermal tissues (8c)

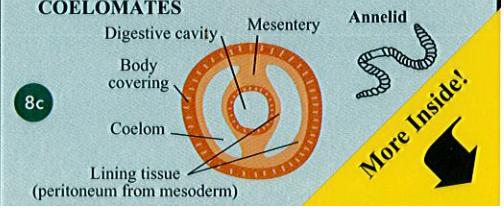
ACOELOMATES



PSEUDOCOELOMATES



COELOMATES



More Inside!

The Parazoans

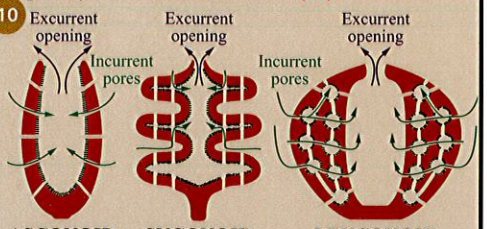
Phylum PLACOZOA (9)

1. General characteristics
   a. One species
   b. Microscopic, simple structure

Phylum PORITERA
Sponges

1. General characteristics
   a. 9000 species
   b. Lack true tissues, organs, mouth and gut
   c. Sessile
   d. System of water canals lined by flagellated collar or choanocyte cells used for filter feeding
   e. Mostly marine
   f. Extensive regenerative capabilities
   g. Three body plans, with each an increase in complexity and total surface area (10)

10



Phylum Ctenophora

Comb jellies (16)

1. General characteristics
   a. 100 species
   b. Entirely marine
   c. Motile
   d. Superficially resemble cnidarian medusa
   e. Eight comb rows for locomotion
   f. Two tentacles which possess colloblasts for adhesion

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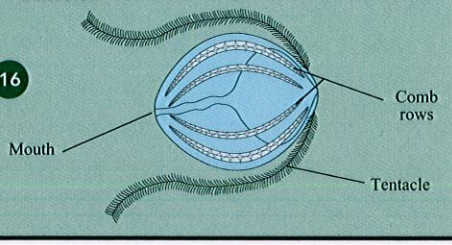
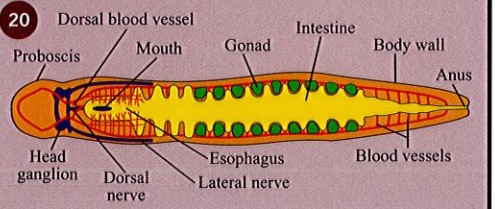


Phylum Nemertea

Ribbon / Proboscis Worms (20)

1. General characteristics
   a. 900 species
   b. Mostly marine
   c. Possess proboscis in chamber (may be a coelom)
   d. Complete digestive tract
   e. Closed circulatory system

20



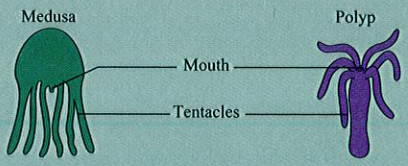
THE EUMETAZOANS - RADIATA

Phylum CNIDARIA

Anemones, Corals, Jellyfish

1. General characteristics
   a. 10,000 species
   b. First "true" tissues; "diploblastic"
   c. Primitive organ development
   d. Possess gut, no anus "Incomplete digestive tract"
   e. Possess Cnidocytes with exerting cellular structures called Cnidae. Three types of Cnidae:
      - **Nematocyst** - stinging
      - **Spirocyst** - adhesive
      - **Ptychocyst** - tube construction
   f. Solitary or colonial
   g. Sessile or motile
   h. Two body plans: (11)

11



2. Classification
   a. Class **HYDROZOA - Hydra, Hydroids, Portuguese-Man-of-War (12), Fire Coral**
      - Many alternate between medusa and polyp, with the latter more conspicuous
   b. Class **SCYPHOZOA - Jellyfish (13)**
      - Medusa predominant phase, and typically larger than hydrozoan medusa

12

13

   c. Class **ANTHOZOA - Anemones (14), Corals (15)**
      - Entirely polypoid, medusa lacking

14

15

THE EUMETAZOANS - BILATERIA: ACOELOMATA

Phylum PLATYHELMINTHES

Flatworms

1. General characteristics
   a. 20,000 species
   b. Dorso-ventrally flattened
   c. Possess cephalization
   d. Organ development; triploblastic
   e. Incomplete digestive tract
2. Classification
   a. Class **TURBELLARIA (17)**
      - Mostly free-living and marine
      - Planarians are freshwater
      - Primitive excretory structure called flame cells
      - Considerable regenerative capabilities

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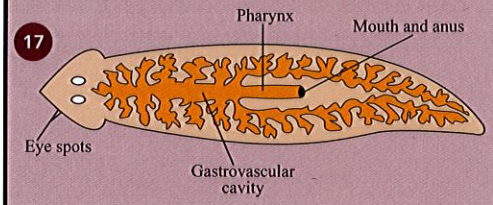

   b. Class **TREMATODA - Flukes (18)**
      - Parasitic
      - Possess complex life cycles with different hosts

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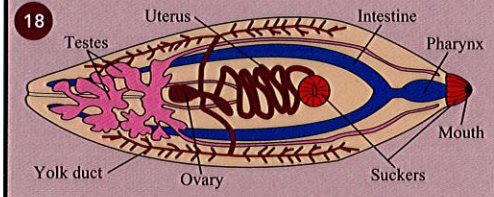

   c. Class **CESTODA - Tapeworms (19)**
      - Parasitic
      - Adult typically in digestive tract of vertebrate
      - Lack digestive tract entirely
      - Hooked attachment structure called scolex
      - Egg-filled proglottid segments

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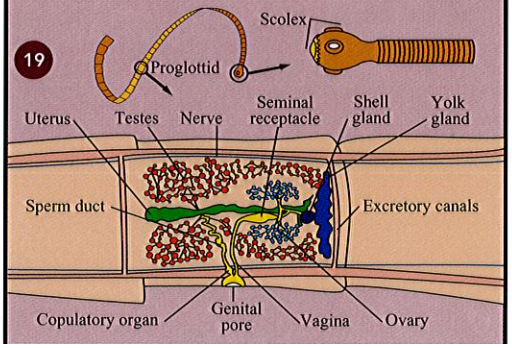
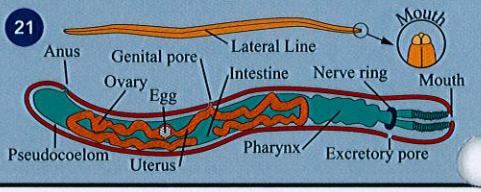


THE EUMETAZOANS - BILATERIA: PSEUDOCOELOMATA

Phylum NEMATODA - Roundworms (21)

1. General characteristics
   a. 80,000 species
   b. Freshwater, marine, terrestrial, parasitic
   c. Complete digestive tract with Cloaca (or common opening for several systems)
   d. Possess longitudinal muscles; no circular muscles

21



THE EUMETAZOANS - BILATERIA: ACOELOMATA PROTOSTOMIA

Phylum MOLLUSCA

Snails, bivalves, squids, slugs

1. General characteristics
   a. 100,000 species
   b. Marine, freshwater, terrestrial
   c. Soft-bodied with calcium carbonate shell (in most)
   d. Body plan
      - **Mantle**: Covers visceral mass and may secrete shell
      - **Head**: Site of sensory structures, brain and mouth
      - **Foot**: Used for locomotion and attachment
      - **Visceral Mass**: Contains organs (circulatory, digestive and excretory)
2. Classification (Eight total classes; four major)
   a. Class **POLYPLACOPHORA - Chitons (22)**
      - Shell consists of 8 articulated plates
      - Poorly-developed head
   b. Class **GASTROPODA - Snails (23), Slugs (24)**
      - Most have shell and exhibit **Torsion** or twisting of visceral mass so anus is above head
      - Others with reduced shell
      - Aquatic with some terrestrial representatives
   c. Class **BIVALVIA - Clams, Mussels, Oysters (25)**
      - Shell with two halves or valves

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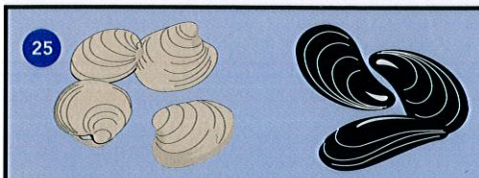
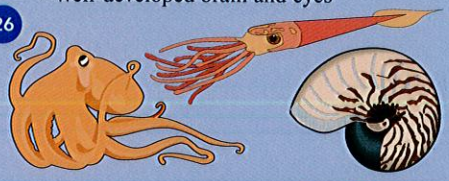
23

24

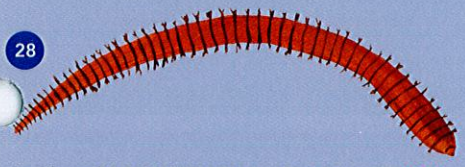


d. Class **CEPHALOPODA - Octopods, Squids, Nautiluses (26)**
- Shell absent or reduced in most; nautilus has distinct, spiraled shell
- Siphon for locomotion
- Tentacles with suckers
- Well-developed brain and eyes

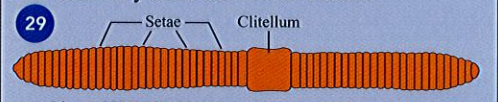


Phylum ANNELIDA
Segmented Worms

1. General characteristics
   a. 15,000 species
   b. Marine, freshwater, terrestrial
   c. Body linear with fused segments
2. Classification
   a. Class **POLYCHAETA - Tubeworms (27), Sandworms (28)**
      - Primarily marine
      - Well-developed head
      - Segments possess **parapodia** (fleshy locomotory structures) with chitinous **setae**



   b. Class **OLIGOCHAETA - Earthworms (29)**
      - Terrestrial and freshwater
      - Poorly-developed head
      - Setae very short and few in number



   c. Class **HIRUDINEA - Leeches (30)**
      - Mainly freshwater, terrestrial
      - Many parasitic, feeding on blood of vertebrates; facilitated by anesthetic and anticoagulant

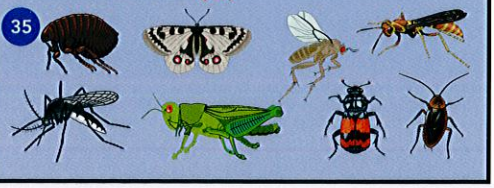
Phylum ARTHROPODA
Spiders, scorpions, insects, crabs, shrimp

1. General characteristics
   a. 1,000,000 species - **Most Successful Animal Phylum**
   b. Found in nearly every habitat
   c. Segmented body with hard **exoskeleton** and jointed legs
   d. Exoskeleton is **molted** during growth
   e. Body plan with regional specialization of segments
2. Classification
   a. Subphylum **TRILOBITOMORPHA - Trilobites**
      - Extinct, early arthropods
      - Many pairs of locomotor appendages
      - 1 pair of antennae or sensory structures
   b. Subphylum **CHELICERATA - Scorpions, Horseshoe Crabs, Spiders, Sea Spiders (31)**
      - Mostly terrestrial, some marine
      - Segments specialized into **cephalothorax** and **abdomen**
      - Possess **chelicerae** or clawlike mouthparts
      - 4 pairs of locomotor appendages
      - No antennae
      - Three classes, including:
        Class **Arachnida** with spiders, scorpions, ticks, mites

   c. Subphylum **CRUSTACEA - Barnacles, Shrimps, Lobsters, Crabs (32)**
      - Mostly marine, some freshwater and terrestrial
      - Segments specialized into **head, thorax,** and **abdomen**; 1st two segments sometimes fused into **cephalothorax**
      - Many pairs of locomotor appendages
      - Multiple feeding appendages
      - 2 pairs of antennae
      - Diverse groups within this taxon, including:
        - **Decapods** with crabs, shrimps, lobsters, crayfish
        - **Isopods** with marine representatives and pill bug
        - **Copepods** with numerous representatives in plankton
        - **Cirripedians** with barnacles

   d. Subphylum **UNIRAMIA - Centipedes, Millipedes, Insects**
      - Terrestrial
      - Segments range from unspecialized to specialized
      - 3 to many pairs of locomotor appendages
      - 1 pair of antennae
      - Three major classes:
        Class **Chilopoda** with centipedes (one pair of walking legs/segment) (33)
        Class **Diplopoda** with millipedes (two pairs of walking legs/segment) (34)

Class **Insecta** with numerous representatives, including fleas, moths, flies, wasps, mosquitoes, grasshopper, beetles, cockroaches, ants, termites, butterflies (35)



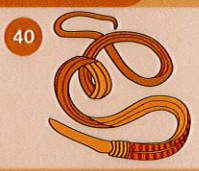
THE EUMETAZOANS - BILATERIA: EUCOELOMATA: DEUTEROSTOMIA
Phylum ECHINODERMATA
Sea stars, sea urchins, sand dollars

1. General characteristics
   a. 7,000 species b. Marine
   c. Possess spiny, calcareous skeleton
   d. Secondary radial symmetry in most
   e. Possess **water vascular system** with **tube feet** for locomotion
2. Classification (Six total classes; four major)
   a. Class **ASTEROIDEA - Sea Stars (36)**
      - Flattened central disc
      - Usually 5 arms
   b. Class **OPHIUROIDEA - Brittle Stars (37)**
      - Flattened central disc
      - Usually 5 narrow, jointed arms

   c. Class **ECHINOIDEA - Heart Urchins, Sand Dollars, Sea Urchins (38)**
      - Globular to flattened cylindrical body
      - Numerous spines
   d. Class **HOLOTHUROIDEA - Sea Cucumbers (39)**
      - Cylindrical to elongate body

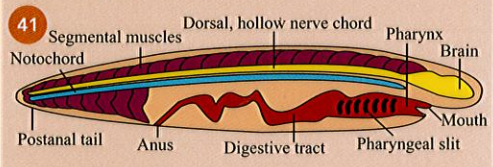
Phylum HEMICHORDATA
Acorn Worms (40)

1. General characteristics
   a. 80 species
   b. Possess **gill slits**
   c. Marine, burrowing or sessile worms



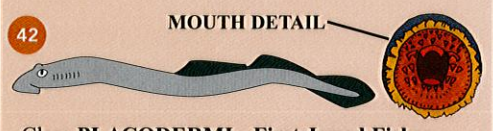
Phylum CHORDATA
Tunicates, lancelets, vertebrates (41)

1. General characteristics
   a. 58,000 species
   b. **Postanal tail**
   c. **Notochord** or flexible rod used for support
   d. **Dorsal, hollow nerve cord**
   e. **Pharyngeal slits** used for gills and filter-feeding



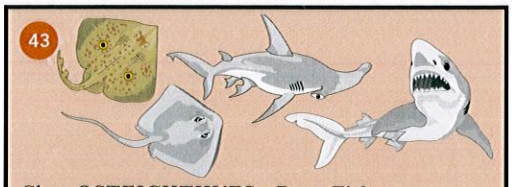
2. Classification
   a. Subphylum **UROCHORDATA - Tunicates, Sea Squirts**
      - Marine
      - Sessile and planktonic forms as adults, which lack most chordate features
      - All four chordate features present in larva
   b. Subphylum **CEPHALOCHORDATA - Lancelets**
      - Marine
      - Burrowing, filter-feeder
      - Fusiform body
      - All four chordate features persist in adult
   c. Subphylum **VERTEBRATA**
      - **Vertebral column** with **vertebrae** composed of Bone or Cartilage
      - Well-developed brain
      - Two pairs of limbs
      - Eight vertebrate classes:

Class **AGNATHA - Jawless Fishes: Lampreys, Hagfishes (42)**
- Circular mouth, but no hinged jaw
- Notochord persists throughout life
- Cartilaginous skeleton



Class **PLACODERMI - First Jawed Fishes**
- All are extinct

Class **CHONDRICHTHYES - Cartilaginous Fishes: Skates, Rays, Sharks (43)**
- Notochord persists throughout life
- Cartilaginous skeleton



Class **OSTEICHTHYES - Bony Fishes**
- Notochord may persist
- Bony skeleton
- Possess **swimbladder** or internal gas-filled buoyancy apparatus
- Three major subclasses:

Subclass **CROSSOPTERYGII - Lobe-finned Fishes** (44)
- Fleshy fins can be used for crawling or walking

Subclass **ACTINOPTERYGII - Ray-finned Fishes** (45)
- Largest group

Subclass **DIPNEUSTI - Lungfishes**
- Use lungs as supplement to gills

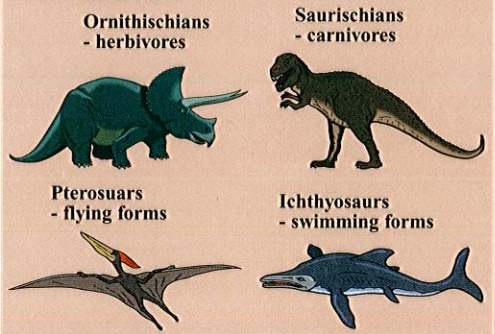
Class **AMPHIBIA - Salamanders, Frogs, Caecilians**
- Notochord does not persist
- Skin smooth and moist, most live in aquatic or moist habitats and require such conditions for reproduction
- Three major orders:

Order **APODA - Caecilians**
- Wormlike body
- Limbs absent

Order **URODELA - Salamanders, Newts** (46)
- Body with head, trunk, and tail

Order **ANURA - Frogs, Toads** (47)
- Body with fused head and trunk, tail absent in adult
- Tadpole larvae aquatic; metamorphose into terrestrial adult

Class **REPTILIA - Dinosaurs, Alligators, Snakes, Lizards, Turtles**
- Notochord does not persist
- Dry skin with keratinized scales or dermal plates
- Several extant (living) orders: three major
- Extinct groups (show adaptive radiation)
- The **dinosaurs**:



Order **CROCODILIA - Alligators** (48), **Crocodiles, Caimans**
- Most closely related to dinosaurs

Order **SQUAMATA - Snakes, Lizards, Iguanas** (49)
- Largest order
- Some legless
- Skin with scales which are periodically shed

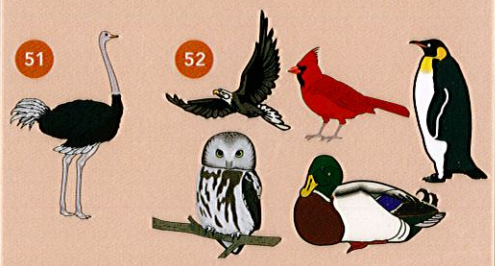
Order **CHELONIA - Turtles** (50)
- Body encased in dermal plates of dorsal **carapace** and ventral **plastron**

Class **AVES - Birds**
- Notochord does not persist
- Forelimbs adapted for flying
- Epidermal **feathers** and **leg scales**
- Skeleton with numerous air cavities to lighten bone
- Two major subclasses:

Subclass **ARCHAEORNITHES - Primitive Birds**

Extinct forms
- **Archaeopteryx**: With both reptilian features (toothed jaws, long tail) and avian features (feathers)

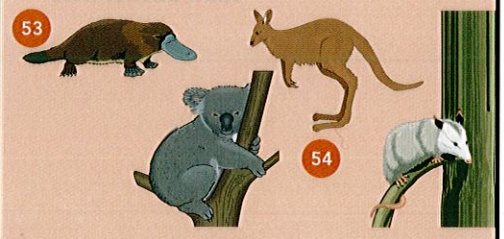
Subclass **NEORNITHES - Modern Birds**
- Numerous groups; two major ecological types
- **Ratites**: Large, flightless birds with a flat breastbone or **sternum** (51)
- **Carinates**: Flying or swimming birds with **carina** or keel on sternum (52)



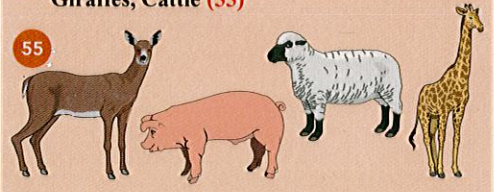
Class **MAMMALIA**
- Notochord does not persist
- Body covered with hair
- Young nourished by mammary glands
- Two major subclasses:

Subclass **PROTOTHERIA - Egg-layers**
- Primitive reptilian-like, egg-laying mammals with cloaca
- Order **MONOTREMATA - Platypus** (53), **Echidnas**

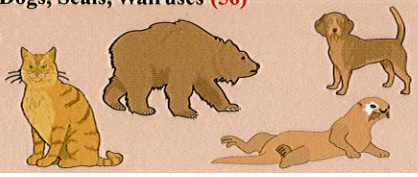
Subclass **THERIA - Marsupials, Placentals**
- Order **MARSUPIALIA - Koalas, Opossums, Kangaroos** (54)
- Embryonic development completed in a maternal pouch or **marsupium**
- Placentals are represented by numerous orders; some selected orders



- Order **ARTIODACTYLA - Deer, Pigs, Sheep, Giraffes, Cattle** (55)



- Order **CARNIVORA - Cats, Bears, Otters, Dogs, Seals, Walruses** (56)



- Order **CETACEA - Dolphins, Whales, Porpoises** (57)

- Order **EDENTATA - Armadillos, Sloths, Anteaters** (58)

- Order **INSECTIVORA - Moles, Hedgehogs, Shrews** (59)
- Order **LAGOMORPHA - Hares, Rabbits** (60)

- Order **CHIROPTERA - Bats** (61)
- Order **PROBOSCIDEA - Elephants** (62)

- Order **PERISSODACTYLA - Horses, Rhinoceroses, Zebras** (63)

- Order **PRIMATES - Apes, Humans, Monkeys** (64)

- Order **RODENTIA - Beavers, Mice, Chipmunks, Porcupines, Squirrels** (65)

- Order **SIRENIA "Manatees, Dugongs"** (66)

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ISBN 157222549-1

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February 2004

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