

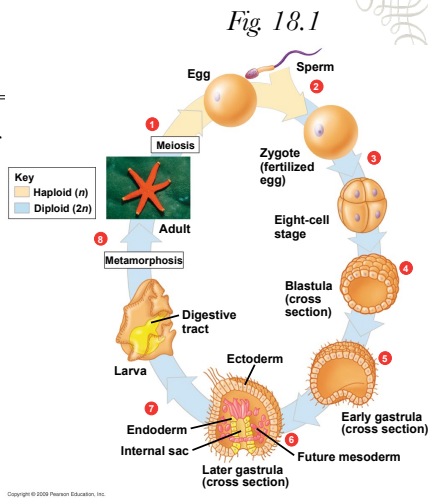
# CHAPTERS 18 & 19: ANIMAL EVOLUTION AND DIVERSITY

Honors Biology 2012

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## ANIMALS

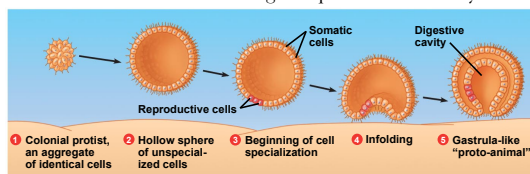
- \* Eukaryotic, multicellular heterotrophs whose cells lack cell walls
- \* Most animal cells are diploid
- \* Haploid gametes fuse to form a zygote
- \* Most animals have a blastula, gastrula, and larval stage



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## EVOLUTION OF ANIMALS

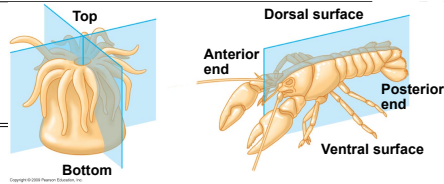
- \* About 550 million years ago Cambrian explosion produced many animal fauna (adaptive radiation)
- \* Ecological causes: Evolution of hard body coverings led to complex predator-prey relationships
- \* Geological Causes: Atmospheric O<sub>2</sub> reached high enough concentration to support metabolism of active animals
- \* Genetic causes: Variations in Hox genes produced diversity



*Fig 18.2*

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# BODY PLANS

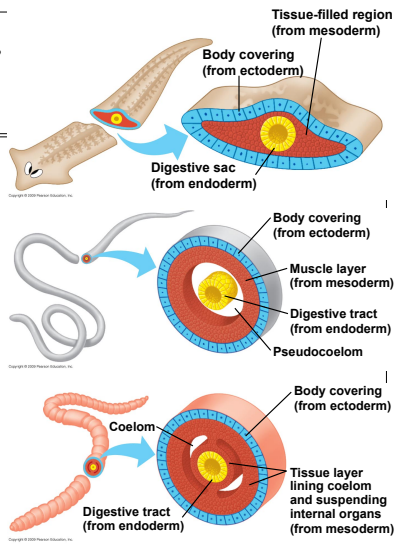


- \* Radial symmetry - any slice through the central axis divides the animal into mirror image halves
- \* Bilateral symmetry - have mirror image right and left sides, distinct head and tail, and a back (dorsal) and belly (ventral) surface
- \* Body plans vary in organization of tissues
- \* Sponges lack true tissues
- \* Tissue layers organized into ectoderm, endoderm, and mesoderm

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# BODY PLANS

Fig 18.3



- \* Body cavities (coeloms)
- \* No coelom (ex. flatworms)
- \* Pseudocoelom - partially lined with mesoderm tissue
- \* True coelom - completely lined by mesoderm tissue

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# PHYLOGENETIC TREES

- \* Hypothesis for the evolutionary history of the groups involved
- \* Based on comparative morphology

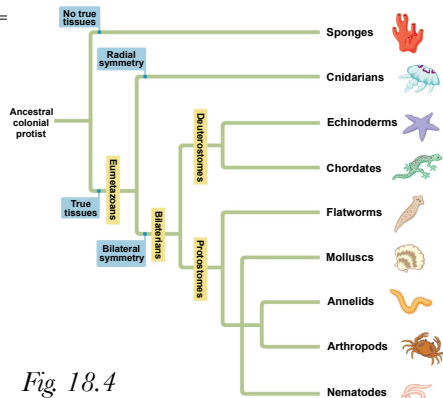
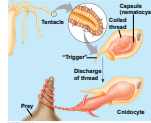
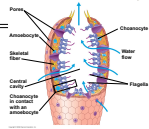


Fig 18.4

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# INVERTEBRATE DIVERSITY

- \* Phylum Porifera (sponges) - no true tissues
  - \* Suspension feeders - filter food particles from water
  - \* Sessile - cannot escape from predators
- \* Phylum Cnidaria (Cnidarians) - have two tissue layers (epidermis and inner cell layer)
  - \* Use tentacles to capture prey and push them into their mouths
  - \* Radial symmetry
  - \* Polyp and medusa stages

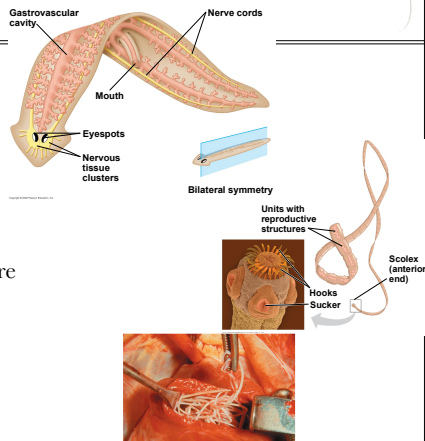


*Figs.  
18.5 &  
18.6*

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# INVERTEBRATE DIVERSITY

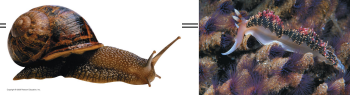
- \* Phylum Platyhelminthes (flatworms) - simplest bilateral animals
  - \* Planarians have heads with light-sensitive eyespots
  - \* Flukes and tapeworms are parasitic flatworms
- \* Phylum Nematoda (roundworms) - bilateral symmetry and three tissue layers



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# INVERTEBRATE DIVERSITY

- \* Phylum Mollusca (molluscs) - have a true coelom and a circulatory system
  - \* Gastropods - largest group of molluscs (include snails and slugs)
  - \* Bivalves - shells divided into two halves (clams, oysters, mussels, and scallops)
  - \* Cephalopods - have large brains and sense organs including image-focusing eyes



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# INVERTEBRATE DIVERSITY

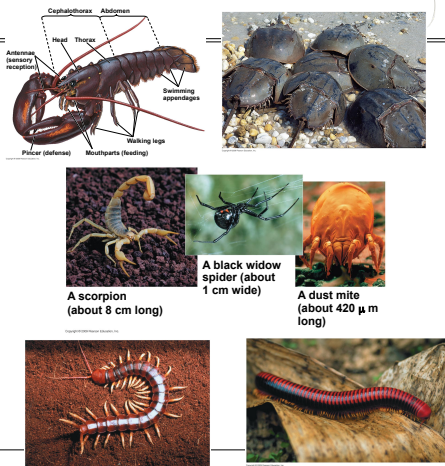
- \* Phylum Annelida (annelids) - have a closed circulatory system; nervous system with a simple brain and nerve cord; true coelom
- \* Earthworms
- \* Polychaetes - largest group
- \* Leeches



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# INVERTEBRATE DIVERSITY

- \* Phylum Arthropoda (arthropods) - segmented bodies, exoskeleton, jointed appendages, open circulatory system
- \* Includes crayfish, lobsters, crabs, barnacles, spiders, ticks, and insects



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# INVERTEBRATE DIVERSITY

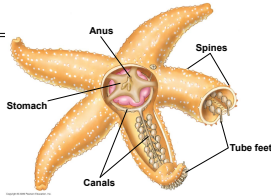
- \* Insects
  - \* 70% of all animal species
  - \* Successful because of jointed appendages, exoskeleton, flight, waterproof cuticle
  - \* Some undergo a complete metamorphosis



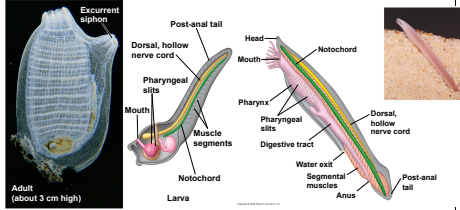
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# INVERTEBRATE DIVERSITY

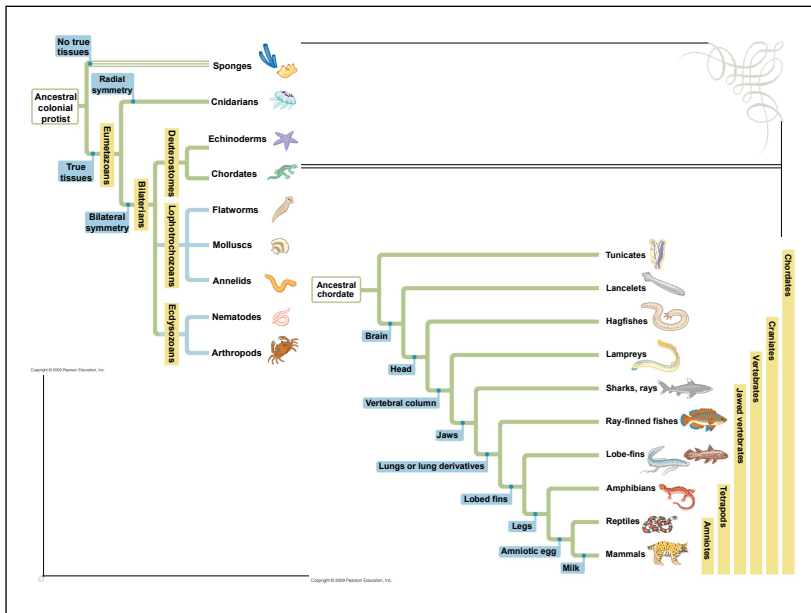
\* Phylum Echinodermata (echinoderms) - slow-moving and sessile, radial symmetry, water vascular system, exoskeleton



\* Phylum Chordata (chordates) - dorsal, hollow nerve cord



\* Tunicates and lancelets use pharyngeal slits for suspension feeding



# VERTEBRATE DIVERSITY

\* All contained within Phylum Chordata

\* Hagfish and lampreys

\* Craniates that lack a hinged jaw and paired fins

\* Hagfish only have the notochord for support, but lampreys have a notochord and rudimentary vertebral structures (vertebrates)

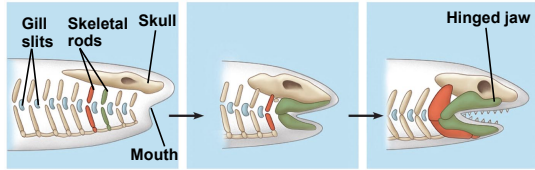
\* Hagfish produce slime as an antipredator defense

\* Lampreys are parasites that penetrate the sides of fish



# VERTEBRATE DIVERSITY

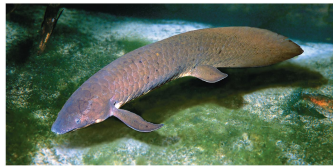
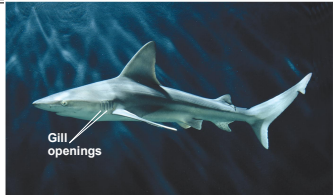
- \* Some vertebrate features arose 470 million years ago
- \* Paired fins and tails and hinged jaws
- \* Jaws arose from a modification of the pharyngeal gill slits that were used for trapping suspended food particles



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## VERTEBRATE DIVERSITY: JAWED FISH

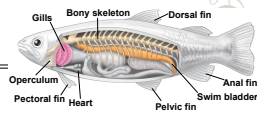
- \* Class Chondrichthyes (sharks and rays)
- \* Flexible skeleton made of cartilage
- \* Electrosensors on the heads of sharks help them locate prey
- \* Rays are adapted for life on the bottom of the sea with flat bodies and eyes on the tops of their heads
- \* Lobe-fins
- \* Have muscular pelvic and pectoral fins supported by rod-shaped bones



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## VERTEBRATE DIVERSITY: JAWED FISH

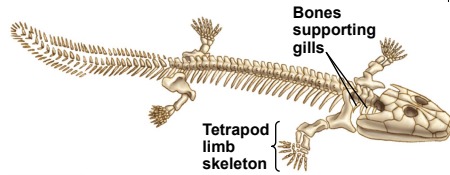
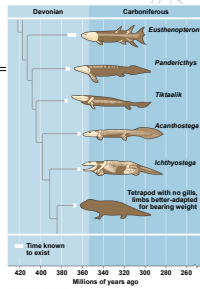
- \* Ray-finned fish
- \* Have an internal skeleton reinforced with  $\text{CaPO}_3$
- \* Have flattened scales covered with mucus
- \* Buoyant swim bladder (derived from ancestral lung)
- \* Includes more than 27,000 species



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## VERTEBRATE DIVERSITY: TETRAPODS

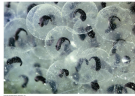
- \* Lobe-fin fish gave rise to the tetrapods (jawed vertebrates with limbs and feet)
- \* Scientists have collected fossils of many transitional forms



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## VERTEBRATE DIVERSITY: AMPHIBIANS

- \* Class Amphibia (frogs, salamanders, and caecilians) - First tetrapods to be able to move on land (most have tadpole larvae)
- \* Salamanders walk on land with side-to-side bending
- \* Frogs hop with powerful hind legs
- \* Caecilians are blind and legless (burrow in tropical soil)



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## VERTEBRATE DIVERSITY: REPTILES

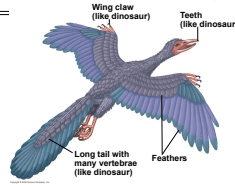
- \* Reptiles (including birds) and mammals are amniotes
- \* Amniotic egg provides a specialized membrane that protects the embryo
- \* Reptiles (lizards, snakes, turtles, crocodylians, and birds)
- \* Terrestrial adaptations include scales that are waterproofed with keratin
- \* Ectothermic - must absorb heat from the environment (most reptiles)
- \* Endothermic - use metabolism to produce heat (birds)



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## VERTEBRATE DIVERSITY: REPTILES (BIRDS)

- \* Birds evolved from two-legged dinosaurs called theropods
- \* Archaeopteryx - oldest bird (150 million years ago) with feathered wings
- \* Birds are reptiles with feathers, endothermic metabolism, and adaptations for flight
- \* Flight adaptations: loss of teeth, feathers with hollow shafts, strong and light bones
- \* Flight is costly in terms of metabolism



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## VERTEBRATE DIVERSITY: MAMMALS

- \* Mammals are endothermic amniotes with hair and mammary glands
- \* Generally have larger relative brain size
- \* Generally have a long period parental care
- \* First mammals arose 200 million years ago as nocturnal insectivores
- \* Marsupials diverged from eutherians (placental mammals) 180 million years ago
- \* Underwent adaptive radiation after the Cretaceous extinction

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## VERTEBRATE DIVERSITY: MAMMALS

- \* Monotremes - egg-laying mammals (ex. duck-billed platypus)
- \* Only mammals whose embryos are not nourished by a placenta within the uterus
- \* Marsupials - have a brief gestation and give birth to tiny, embryonic offspring
- \* Offspring complete development attached to mother's nipple in a pouch or marsupium
- \* Eutherians - give birth to fully developed young
- \* Commonly referred to as placental mammals because their placentas are more complex than marsupial placentas



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## VERTEBRATE DIVERSITY: PRIMATES

- \* Includes lemurs, tarsiers, monkeys, and apes
- \* Adaptations include: shoulder and hip joints that allow for climbing, grasping hands, forward pointing eyes (allows for better depth perception)
- \* Phylogenetic trees show primates are composed of three groups:
  - \* 1st group - lorises, lemurs, and pottos
  - \* 2nd group - tarsiers (small, nocturnal tree-dwellers with flat faces and large eyes)
  - \* 3rd group - anthropoids (monkeys, apes, and humans)
- \* Large brains, rely more on eyesight, have opposable thumbs

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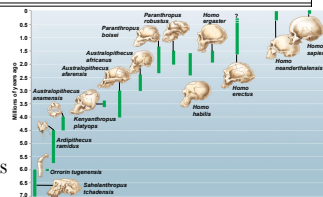
## VERTEBRATE DIVERSITY: PRIMATES (HOMINOIDS)

- \* Often called apes
- \* Include gibbons, orangutans, gorillas, chimpanzees, and humans
- \* Have relatively large brain size and high degrees of social organization
- \* Gibbons are the only fully arboreal apes
- \* Orangutans are shy and solitary and live in trees and on land
- \* Gorillas (largest of the apes) are fully terrestrial
- \* Chimpanzees are able to make use of tools
- \* Diverged from a common ancestor with humans between 5 and 7 million years ago (share 99% of their genes)

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## VERTEBRATE DIVERSITY: PRIMATES (HOMINIDS)

- \* Oldest hominid discovered was *Sakelanthropus tchadensis* (lived 6-7 million years ago)
- \* Adaptation of hominids
  - \* Bipedalism (arose about 4 million years ago)
- \* *Homo habilis* - fossils found with stone tools (2.4 million years ago)
- \* *Homo ergaster* - more sophisticated stone tools, long legs for long-distance walking (1.6-1.9 million years ago)
- \* *Homo erectus* - first to leave Africa



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# VERTEBRATE DIVERSITY: PRIMATES (HOMINIDS)

- \* Neanderthals - lived in Europe until about 30,000-40,000 years ago
- \* Brain was smaller but the same shape as human
- \* Diverged from human ancestors about 500,000 years ago
- \* Mitochondrial DNA analysis shows that all living humans inherited their mitochondrial DNA from a woman who lived 160,000-200,000 years ago in Africa

