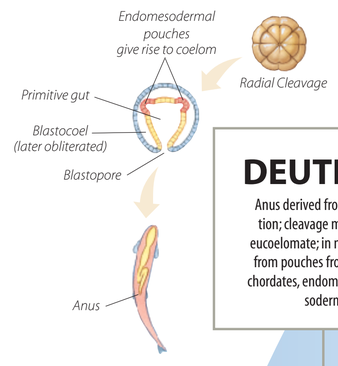
CHIEF TAXONOMIC SUBDIVISIONS and ORGAN SYSTEMS of the Animal Phyla

Kingdom Animalia



DEUTEROSTOMIA

Anus derived from blastopore, mouth a new forma--tion; cleavage mostly radial; all deuterostomes are eucoelomate; in nonchordates, endomesoderm arises from pouches from primitive gut (enterocoelous); in chordates, endomesoderm arises from splitting of me--sodermal bands (schizocoelous)

Ecdysozoa

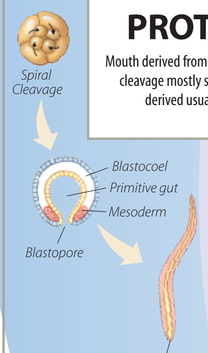
Grow by molting; locomotion not by cilia; common set of homeobox genes

Lophotrochozoa

Grow by increasing body mass; ciliary locomotion; trochophore larva (often)

PROTOSTOMIA

Mouth derived from blastocoel, anus is a new formation; cleavage mostly spiral and mosaic; endomesoderm derived usually from the "4d" blastomere



RADIATA

With primary radial or biradial symmetry; tissue level of organiza--tion; with mouth and gastric cavity but no anus

PARAZOA

Cellular level of organization; no organs or tissues; body with pores, canals, and chambers

Protozoan Groups

Unicellular; singly or in col--onies; cytoplasmic level of organization; with differ--entiated organelles

Phylum	Classes	Skin and Exoskeleton	Endo-skeleton	Muscular Motor	Digestive	Respiratory	Excretory	Circulatory	Reproductive	Nervous	Sensory
CHORDATA Body segmented; axial notochord, which may be permanent or temporary; dorsal tubular nerve cord; paired gill slits in pharynx at some stage, postanal tail at some stage; endostyle or thyroid gland NOTE: Subphyla Urochordata and Cephalochordata are protochordates (having no cranium or vertebral column). The remaining classes belong to subphylum Vertebrata.	Mammalia	Stratified epidermis with keratinized layer, hair, nails, scales, dermis, glands	Vertebrae, cartilage, bone,	Smooth, cardiac, and skeletal muscles arranged in patterns of gross units	Alimentary canal typically divided into mouth with jaws, oral cavity, pharynx, esophagus, stomach, small intestine, cecum, large intestine, anus; accessory glands present (liver, pancreas, salivary glands: Embryologically, the basic plan is a stomodeum (ectodermal), a midgut (endodermal), and a proctodeum (ectodermal)	Lungs	Pronephros, mesonephros (embryonic), metanephros in adult	4-chambered heart with two artria and two ventricles; closed system; hepatic portal	Dioecious; gonads, ducts, copulatory organs	Dorsal tubular brain and spinal cord with cranial, spinal, and autonomic nerves	Special sense organs of taste, smell, hearing; eyes
	Aves	Stratified epidermis with keratinized layer, feathers, scales, beaks, claws, dermis	Vertebrae, cartilage, bone			Lungs	Pronephros, mesonephros (embryonic), metanephros in adult	4-chambered heart with two artria and two ventricles; closed system; hepatic and renal portal	Dioecious; gonads, ducts, copulatory organs (in some)		
	Reptilia	Stratified epidermis with keratinized layer and scales, dermis	Vertebrae, cartilage, bone			Lungs	Pronephros, mesonephros (embryonic), metanephros in adult	3-4 chambered heart with two atria and 1-2 ventricles; closed system; hepatic and renal portal	Dioecious; gonads, ducts, copulatory organs		
	Amphibia	Stratified epidermis partly cornified (keratinized), dermis, glands	Vertebrae, cartilage, bone			Branchial gill slits, gills, lungs, skin	Pronephros (embryonic), opisthonephros in adult	3-chambered heart with two artria and one ventricle; closed system; hepatic and renal portal	Dioecious; gonads, ducts		Special sense organs of taste, smell, hearing; eyes; lateral-line; electroreceptors
	Sarcopterygii	Stratified epidermis, dermal scales, glands	Cranium, vertebrae, cartilage, bone			Branchial gill slits, gills, lungs	Pronephros (embryonic), opisthonephros in adult	3-chambered heart with two atria and one ventricle; closed system; hepatic and renal portal	Dioecious; gonads, ducts		
	Actinopterygii	Stratified epidermis, dermal scales, glands	Cranium, vertebrae, cartilage, bone			Branchial gill slits, gills	Pronephros (embryonic), opisthonephros in adult	2-chambered heart ; closed system; hepatic and renal portal	Usually dioecious; gonads, ducts, copulatory organs (in some)		
	Chondrichthyes	Stratified epidermis, dermis, placoid scales, glands	Cranium, vertebrae, cartilage			Branchial gill slits, gills	Pronephros (embryonic), opisthonephros in adult	2-chambered heart; closed system; hepatic and renal portal	Dioecious; gonads, ducts, copulatory organs		
	Cephalaspidomorphi	Stratified epidermis, dermis (corium), glands	Persistent notochord; cartilaginous cranium and neural arches		Alimentary canal without jaws or distinct stomach	Branchial gill slits, gills	Pronephros (embryonic), mesonephros (opisthonephros) in adult	2-chambered heart; closed system; hepatic portal	Monoecious, gonad, no duct	Dorsal tubular nerve cord and brain; cranial and spinal nerves	
	Myxini	Stratified epidermis, dermis, glands	Persistent notochord; fibrous cranium; cartilaginous pharyngo-skeleton		Alimentary canal without jaws or stomach	Branchial gill slits, gills	Pronephros, mesonephros	2-chambered heart with atrium and ventricle; accessory hearts; closed system; hepatic portal	Monoecious, gonad, no duct	Dorsal tubular nerve cord and brain; cranial and spinal nerves	Special sense organs of taste, smell, and hearing; degenerate eyes; lateral-line; elcectroreceptors
	Cephalochordata	Simple epidermis, cuticle	Notochord, connective tissue	Muscles (myotomes), cilia	Endostyle; alimentary canal; pharynx	Branchial gill slits	Many nephridia (solenocyte type)	No heart; dorsal and ventral aorta, hepatic portal; closed system	Dioecious; gonads, no ducts	Dorsal tubular nerve cord, spinal nerves	Cerebral eye, epidermal sensory cells
	Tunicata	Outer cellulose tunic or gelatinous covering; mantle of epidermis and dermis	Notochord, connective tissue	Muscles, cilia	Endostyle; alimentary canal; pharynx	Branchial gill slits	Body surface; nephrocytes store wastes in excretory vesicles	Tubular heart; open sinus channels	Monoecious; gonads, ducts; sexual and asexual in some	Dorsal tubular ganglion (larva), nerves (adult)	Ocelli, sensory cells, statocysts (chiefly in larva)
Hemichordata											
ECHINODERMATA Body unsegmented and usually pentamerous (in parts of 5 each); with secondary radial symmetry; calcareous endoskeleton of plates or spicules; water vascular system and podia (tube feet)	Asteroidea	Ciliated epidermis, thin cuticle	Dermal endoskeleton with calcareous plates (microscopic in Holothuroidea); spines, connective tissue; hydrostatic and hydraulic fluid pressure	Circular and longitudinal muscle fibers, water-vascular system and podia, tentacles (in some), pedicellariae (in Echinoidea and Asteroidea)	Alimentary canal, eversible stomach	Papulae (dermal branchiae); podia	Body surface, coelomocytes, pyloric ceca	Coelomic fluid; coelomocytes; hemal and perihemal systems	Mostly dioecious; gonads (usually 10); asexual by fission in some	Nerve ring, radial nerves, and subepidermal plexus	Eye spots, sensory cells in epidermis
	Ophiuroidea	Syncytial epidermis in most; little ciliation			Alimentary canal, no anus	Bursae	Bursae, coelomocytes		Mostly dioecious; gonads, bursal ducts; asexual by fission	Nerve ring, radial nerves	Sensory cells in epithelium
	Echinoidea	Ciliated epidermis, thin cuticle			Alimentary canal, masticatory apparatus (Aristotle's lantern)	Peristomial gills, podia	Coelomocytes carry waste to gills, podia and axial gland		Mostly dioecious; gonads, ducts	Circumoral nerve ring, radial nerves, subepidermal plexus	Sensory cells in epithelium, especially on podia, spines, and pedicellariae
	Holothuroidea	Epidermis, thin cuticle			Alimentary canal, retractile oral tentacles	Respiratory tree, podia, skin	Coelomocytes and respiratory tree		Dioecious; monoecious (few); single gonad, duct	Nerve ring, radial nerves, and subepidermal plexus	Statocysts, sensory cells in epidermis and podia
	Crinoidea	Syncytial epidermis, thin cuticle			Alimentary canal	Body surface, especially the podia	Coelomocytes		Dioecious; indefinite gonads	Oral, hyponeural, and aboral systems of rings, radial nerves	Sensory cells and free nerve endings in epidermis and podia
Nematomorpha											
Kinorhyncha											
Priapulida											
Tardigrada											
ARTHROPODA Body segmented, but somites often modified and specialized; jointed appendages; chitonous cuticle; no cilia * To represent the Arthropoda accurately would require 280 units	Insecta	Epidermis, molting chitinous cuticle	Connective tissue, hydrostatic and hydraulic fluid pressure	Striated muscles, jointed appendages	Foregut, midgut, hindgut	Tracheae	Malpighian tubules	Open system of heart, arteries, hemocoel, sinuses	Dioecious (most); gonads, ducts, copulatory organs	Cerebral ganglia, double ventral nerve cord with ganglia	Compound and simple eyes, antennae, tympanic organs, hair sensillae, sensory pits
	Diplopoda				Alimentary canal	Tracheae	Malpighian tubules				Eyes, antennae
	Chilopoda				Alimentary canal	Tracheae	Malpighian tubules				Simple eyes, antennae
	Crustacea				Alimentary canal, gastric mill	Branchiae (gills), body surface (in some)	Antennal or maxillary glands				Compound eyes, statocysts, antennules, antennae
	Arachnida				Foregut, midgut, hindgut, stomach with ceca	Tracheae, book lungs, gills	Malpighian tubules, coxal glands				Simple eyes, sensory hairs, pedipalps, no antennae
	Merostomata				Alimentary canal with crop, gizzard, and stomach	Book gills, body surface	Four pairs coxal glands				Simple eyes, sensory hairs, pedipalps, no antennae
Pentastomida											
Onychophora											
Chaetognatha											
Nematoda Vermiform, cylindrical, no circular muscles, microscopic to 1 m, free-living and parasitic		Epidermis cellular or syncytial, cuticle many-layered	Hydrostatic pressure	Longitudinal muscle fibers of fibrillar and protoplasmic zones	Mouth, triradiate pharynx, intestine, anus or cloaca	Body surface	Canals or renette cells, no flame cells	Body fluid with fixed cells	Dioecious (most); gonads, ducts, copulatory organs and spicules	Circumenteric ring, dorsal and ventral nerve cords	Sensory papillae, bristles, chemoreceptors (amphids and phasmids)
Rotifera Cylindrical, ciliated corona; pharynx with mastax; mostly microscopic		Syncytial epidermis, cuticle, lorica (in some)	Hydrostatic pressure of body fluid	Muscle layers, retractor muscles, smooth and striated muscles; ciliated corona	Mouth, mastax with trophi, alimentary canal, anus; feeding currents created by corona	Body surface	Protonephridia and bladder	Body fluid with ameboid cells	Dioecious; gonads, ducts, copulatory organs	Cerebral ganglia, nerves	Ocelli, ciliated pits, sensory bristles, dorsal antennae
Acanthocephala	Cephalopoda	Epidermis, shell reduced	Connective tissue, hydrostatic and hydraulic fluid pressure	Muscles, arms, suckers	Alimentary canal, anus, pharynx with jaws, radula	Gills	Paired metanephridia (except Solenogastres)	Branchial and systemic hearts, closed vessels, capillaries, hemocyanin	Dioecious; gonads, ducts, "hectocotylus arm"	Cephalic ring of cerebral, pleural, pedal and visceral ganglia and nerves	Complex eyes; statocysts; olfactory, tactile, and chemoreceptor cells
Gnathostomulida	Bivalvia	Epidermis, shell of two calcareous valves		Muscles, muscular foot	Alimentary canal, anus, crystalline style, no radula	Gills, mantle		Heart, arteries, open sinuses, hemoglobin, hemocyanin	Dioecious; gonads, ducts	Cerebral, visceral, pedal ganglia and connectives	Mantle ocelli, tactile organs, statocysts, osphradia, etc.
Entoprocta	Gastropoda	Epidermis, calcareous shell (in most)		Muscles, muscular foot	Alimentary canal, anus, radula, crystalline style (in some)	Gills or lungs, mantle		Heart, arteries, open sinuses, hemoglobin or hemocyanin (in some)	Dioecious; monoecious; gonads, ducts, copulatory organs	Cerebral, buccal, pedal ganglia and nerves	Eyes, osphradia, statocysts, tentacles
Ectoprocta	Scaphopoda	Epidermis, calcareous tubular shell		Muscles, muscular foot	Alimentary canal, anus, radula	Mantle		Sinuses	Dioecious; gonads, ducts,	Cerebral, pedal, pleural ganglia and connectives	Subradular organ, statocysts, tentacles
MOLLUSCA Body soft and unsegmented; viscera enclosed by the mantle; usually external calcareous shell of one or more pieces; ventral muscular foot; radula present (except Bivalvia and Solenogastres)	Solenogastres	Epidermis, embedded with spicules or scales		Muscles, foot vestigial	Alimentary canal, anus, radula absent	No true gills		Sinuses	Monoecious	Nerve ring, paired nerves	Scattered nerve endings
Brachiopoda	Polyplacophora	Epidermis, shell of calcareous plates		Muscles, muscular foot	Ciliated alimentary canal, anus, radula	Many paired gills		Heart, arteries, open sinuses	Dioecious; monoecious; gonads, ducts	Nerve ring, four longitudinal nerve cords	"Shell" eyes, osphradia, subradular organ, and other sense organs
Phoronida	Monoplacophora	Epidermis, limpetlike shell		Muscles, muscular foot	Alimentary canal, anus, radula, crystalline style	5 or 6 pairs of gills		Heart, arteries, open sinuses	Dioecious; gonads, ducts	Ganglia, nerve cords	Scattered small receptors
Sipuncula	Hirudinea	Cellular epidermis, nonchitinous cuticle	Connective tissue, hydrostatic and hydraulic fluid pressure	Circular and longitudinal muscles; suckers	Mouth with jaws, pharynx, crop, with ceca, intestine	Body surface	Segmental paired metanephridia	Closed system or open coelomic sinuses	Monoecious; gonads, ducts; internal fertilization	Cerebral ganglia, connectives, ventral nerve chain with segmental ganglia; giant axons	Ocelli, photoreceptor cells, sensillae, free nerve endings
ANNELIDA Body wormlike and segmented; coelom usually divided by septa; appendages not jointed	Oligochaeta			Circular and longitudinal muscles; setae	Mouth, pharynx, stomach (crop, gizzard), intestine, anus	Body surface		Closed system (in most) of dorsal (pumping) and ventral aortas, connectives, veins, capillaries; respiratory pigments	Monoecious; gonads, ducts; internal fertilization		Photoreceptors, sensory cells (some in clusters), free nerve endings
Echiura	Polychaeta			Circular and longitudinal muscles; parapodia, setae	Mouth, pharynx with chitinous jaws (in some), stomach, intestine; ciliated feeding tentacles (in some)	Body surface, tentacles, parapodia, gills (in some)			Dioecious; temporary gonads, nephridial ducts, external fertilization		Simple and complex eyes; statocysts; sensory pits and cells on tentacles, palps, and body surface
Nemertea Body wormlike; rhynchocoel with eversible proboscis above digestive tract; parenchyma or mesenchyme in space between body wall and digestive tract	Enopla, Anopla	Ciliated epidermis	Parenchyma, rhynchocoel of proboscis; hydrostatic and hydraulic fluid pressure	Outer circular and inner longitudinal muscles	Mouth, foregut, intestine with or without ceca, anus	Direct body surface	Protonephridia	2 lateral and 1 dorsal blood vessels, lacunae	Dioecious (most); gonads, ducts	Cerebral ganglia, longitudinal nerve cords (lateral and dorsal)	Ocelli, ciliated pits, sensory nerve cells
Pogonophora	Cestoda	Tegument syncytial with subsurface cell bodies	Parenchyma, connective tissue	Muscle layers, muscular suckers	Absent; parasitic	Direct body surface	Protonephridia	Absent	Monoecious and dioecious; gonads, ducts, copulatory organs; parasitic forms have complex life cycles	Cerebral ganglia, longitudinal nerve cords, and transverse connections ("ladder" type)	No special organs, sensory nerve endings on scolex and other locations
PLATYHELMINTHES Body wormlike and flattened dorsoventrally; parenchyma (connective tissue) in spaces between organs	Trematoda	Tegument syncytial with surface cell bodies		Muscle layers, muscular suckers	Gastrovascular cavity of mouth, pharynx, intestine (no anus); parasitic			Gastrovascular cavity			Ocelli (in some)
Gastrotricha	Monogenea	Tegument syncytial with subsurface cell bodies		Muscle layers, muscular suckers	Gastrovascular cavity of mouth, pharynx, intestine (no anus); parasitic			Gastrovascular cavity			Ocelli (larvae and some adults); mechanoreceptors
Mesozoa	Turbellaria (Paraphyletic)	Cellular epidermis with mucous glands		Muscle layers, cilia	Gastrovascular cavity of mouth, pharynx, intestine (no anus)			Gastrovascular cavity			Ocelli, ciliated pits, epidermal cells
Placozoa Body is platelike; no symmetry, no organs, and no muscular or nervous system		Cellular epidermis with mucous glands	Intermediate layer	Flagellated cylinder cells	Ventral epithelium serves nutritive function	Direct body surface	No special structures	No special structures		No special structures	General reaction of ectoplasm
Cnidaria Radial or biradial symmetry; with tentacles and nematocysts; attached polyps and/or free medusae	Hydrozoa, Scyphozoa, Cubozoa, Anthozoa	Epidermis, (perisarc in some Hydrozoa); epidermis syncytial or cellular in Scyphozoa; calcareous skeleton in some Anthozoa	Mesoglia; hydrostatic and hydraulic fluid pressure; mesenchymal elements	Epitheliomuscular cells with contractile fibers in epidermal and gastrodermal layers	Gastrovascular cavity, intracellular and extra-cellular digestion, gastric filaments (Scyphozoa), septal filaments (Anthozoa)	Direct body surface	No special structures, excretory pore (in some)	Gastrovascular cavity	Monoecious and dioecious; gonads, no ducts; external fertilization	Epidermis, diffuse nerve net	Epithelial sensory cells, statocysts, ocelli (in some)
Ctenophora Biradial symmetry; eight meridional rows of ciliated swimming plates; adhesive cells (colloblasts); mesenchymal muscles	Tentaculata, Nuda	Epidermis (syncytial or cellular)	Gelatinous collenchyme, connective tissue	Mesenchymal muscle, ciliated comb plates	Mouth, pharynx, gastrovascular canals	Direct body surface	No special structures	Gastrovascular system	Monoecious; gonads, ducts (in a few)	Diffuse nerve net and plexus	Aboral sense organ, epidermal cells
PORIFERA Asymmetric or radially symmetric; no germ layers; with pores and canals; spongocoel and osculum; some cavities lined with choanocytes	Calcarea	Epidermis of pinacocytes, sometimes syncytial; permeated with pores	Calcareous spicules	Myocytes; flagellated choanocytes (collar cells); some pinacocytes are contractile	Canal system, choanocytes, amebocytes, food vacuoles; no mouth or digestive tract	Direct body surface	Amebocytes, direct body surface	No special structures	Scattered sex cells; gonads and ducts absent; dioecious or monoecious	Cell:T-cell excitation; nerve cells probably absent	General reaction of ectoplasm
	Hexactinellida		Siliceous spicules								
	Demospongiae		Siliceous spicules, spongin								

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