



KINGDOM
ANIMALIA:
NINE MAJOR
PHYLA

PART 2

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Phylum: Nematoda

(neem' uh-toe-duh) (Gr. *nema*, genitive *nematos* thread, + *-odes* like, of the nature of)

Characteristics

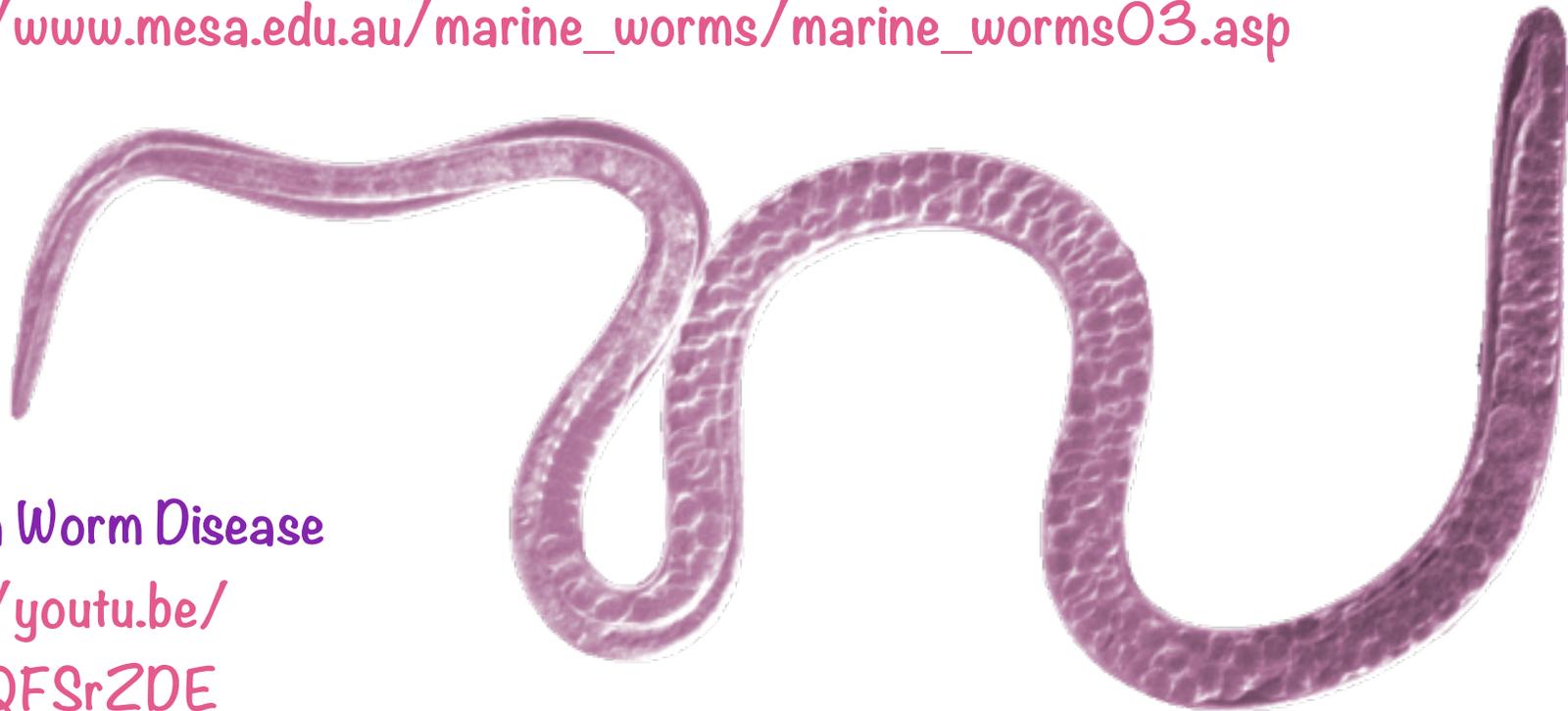
- There are about 10,000 species named; there would be an estimated 500,000 species if all were known.
- They live in the sea, in fresh water, and in soil, from polar regions to the tropics, and from mountain tops to the depths of the sea.
- Good topsoil may contain billions of nematodes per acre.
- They **parasitize** virtually every type of animal and many plants.
- They are cylindrical in shape.
- Their outer covering contains several layers of flexible, nonliving cuticle (**collagen**) secreted by the epidermis; three layers are crisscrossing fibers.
- They lack **motile** cilia or flagella.
- The muscles of their body run in a longitudinal direction only.



- They do not have **protonephridia**. Their excretory system consists of either one or more large gland cells opening by an excretory pore, or a canal system without gland cells, or both gland cells and canals together.
- The use of the **pseudocoel** as a hydrostatic organ is highly developed.
- Most are under 5cm long; many are microscopic. Some parasitic species are over a meter in length.
- Their **alimentary canal** consists of a mouth, a muscular pharynx, a long nonmuscular intestine, a short **rectum**, and a terminal **anus**.

Marine Education Society of Australasia: Marine Worms - Nematodes (Roundworms)

http://www.mesa.edu.au/marine_worms/marine_worms03.asp



Guinea Worm Disease

<http://youtu.be/8FYgQFSrZDE>

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- What are the main physical features of the phylum Nematoda?
- Into how many different classes have scientists divided this phylum?
- What kind of cellular organization do these organisms have? Do they have tissues? Organs? Organ systems?
- How do nematodes grow and develop? Do they have different stages of development? If so, describe those stages?
- How do nematodes obtain and use food? Describe their food.
- Describe the surroundings or habitat where nematodes live. How do nematodes protect themselves?
- How do nematodes reproduce?
- In what ways is Nematoda different from other phyla that we will study?
- What are your most important questions about the animals in this phylum?
- Which concepts relating to this phylum are most striking for you personally?



Phylum: Annelida

(a'-nel-i-duh) (L. *annulus*, little ring, + *-ida*, suffix)

Characteristics

- Examples of annelids are marine tube worms, earthworms, leeches, and tapeworms.
- All annelids are eukaryotes.

- They are heterotrophs that digest their food inside their bodies.
- Their bodies are **segmented**. They are symmetrically bilateral.
- The body wall has outer circular and inner longitudinal muscle layers.
- On the outermost layer of the body wall is a transparent moist **cuticle** secreted by **epithelium**.
- They have **chitinous setae**, often present on fleshy appendages called **parapodia**. The setae are absent in leeches.
- The **coelom** is well-developed and divided by **septa**, except in leeches; the coelomic fluid supplies **turgidity** and functions as a hydrostatic skeleton.
- Their **blood system** is **closed** and segmentally arranged. Respiratory pigments (hemoglobin, hemerythrin or chlorocruorin) are often present. They have **amebocytes** in their blood plasma.
- Their digestive system is complete (they have both a mouth and an anus) that is not arranged in segments.
- Respiratory gas exchange is through their skin, gills, or parapodia.
- Their excretory system is typically a pair of **nephridia** for each segment.
- They have a nervous system with a double ventral **nerve cord** and a pair of **ganglia** with lateral nerves in each segment. The brain is a pair of dorsal **cerebral ganglia** with connections to the cord.
- They have a sensory system of **tactile organs**, taste buds, **statocysts** (in some), **photoreceptor cells**, and eyes with lenses (in some).
- They are **hermaphroditic** or separate sexes. The larvae, if present, are **spherical** with cilia. Asexual reproduction by budding occurs in some.

Marine Education Society of Australasia: Marine Worms - Annelids (Segmented worms) at bottom also "Bristle Worms"

http://www.mesa.edu.au/marine_worms/marine_worms02.asp

Endeavor Hydrothermal Vents

<https://youtu.be/XAkQxP9s7-g>

Giant Black Smoker Hydrothermal Vent: Nautilus Live

<https://youtu.be/KtFFmDGlsa4>

Galapagos Rift 2011: New Hydrothermal Vent Discovered

https://youtu.be/2FFnrW_SUdM

Weird Worms Live Near Pacific Ocean's Deepest High-Temp Vent: Nat. Geographic

<https://youtu.be/qK5dXMHSlu8>

Earthworm Dissection

<http://youtu.be/8p-GAX4Xb2A>

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- What are the main physical features of the phylum Annelida?
- Into how many different classes have scientists divided this phylum?
- What kind of cellular organization do these organisms have? Do they have tissues? Organs? Organ systems?
- How do Annelids grow and develop? Do they have different stages of development? If so, describe those stages?
- How do Annelids obtain and use food? Describe the food of these organisms.
- Describe the surroundings or habitat where Annelids live. How do Annelids protect themselves?
- How do Annelids reproduce?
- In what ways are Annelids different from other phyla that we have studied?
- What are your most important questions about the animals in this phylum?
- Which concepts relating to this phylum are most striking for you personally?

Phylum: Mollusca

(muh-luhs' kuh) (L. *mollusca*, soft)

Characteristics

- Examples include snails, slugs, clams, oysters, mussels, octopi, squid, and nautili.
- All mollusks are eukaryotes.
- They are heterotrophs that digest their food inside their bodies.
- Their body is bilaterally symmetrical (bilateral asymmetry in some).
- They are unsegmented. They usually have a definite head.
- Their **ventral** body wall is specialized as a muscular foot. It is variously **modified**, but it is used chiefly for **locomotion**.
 - Their **dorsal** body wall forms a pair of folds called the **mantle**, which encloses the mantle cavity. It is modified into gills or a lung, and secretes a shell. The shell is absent in some.
 - The surface **epithelia** are usually **ciliated**. These bear **mucous glands** and sensory nerve endings.
 - The **coelom** is mainly limited to an



- area around the heart and perhaps the **lumen** of the **gonads**.
- They have a complex digestive system. They usually have a rasping organ (**radula**) with **chitinous** teeth used to scrape food. The anus is usually emptying into the mantle cavity.
 - They have an open circulatory system (mostly closed in cephalopods) of heart (usually three chambered), blood vessels, and **sinuses**. There is respiratory pigment in the blood. Most have a **hemocoel**, a main cavity that bathes tissues in oxygenated blood.
 - Gaseous exchange is by the gills, lung, mantle, or body surface.
 - They have one or two **kidneys (metanephridia)** opening into the hemocoel and usually emptying into the mantle cavity.
 - Their nervous system is made up of paired **cerebral, pleural, pedal**, and **visceral ganglia**, with nerve cords in a network in the deepest layers of the skin. The ganglia are centralized in a **nerve ring** in gastropods and cephalopods.
 - They have sensory organs of touch, smell, taste, **equilibrium**, and vision (in some). Eyes are highly developed in cephalopods.

Marine Education Society of Australasia: Molluscs (three pages)

<http://www.mesa.edu.au/molluscs/default.asp>

Cephalopods

<http://youtu.be/IVjxvrXGEHk>

Cephalopods are Clever Hunters

<http://youtu.be/O43hgHGn4KQ>

Nautilus Encounter

<http://youtu.be/nUW3Mg-UfSA>



Mussel Dissection

<http://youtu.be/O-lxHCPif9c>

Monsters of the Deep

<http://youtu.be/2BfviWg7kKM>

Jonathan Bird's Blue World: Giant Clams

<http://youtu.be/2-32RfYNbOY>

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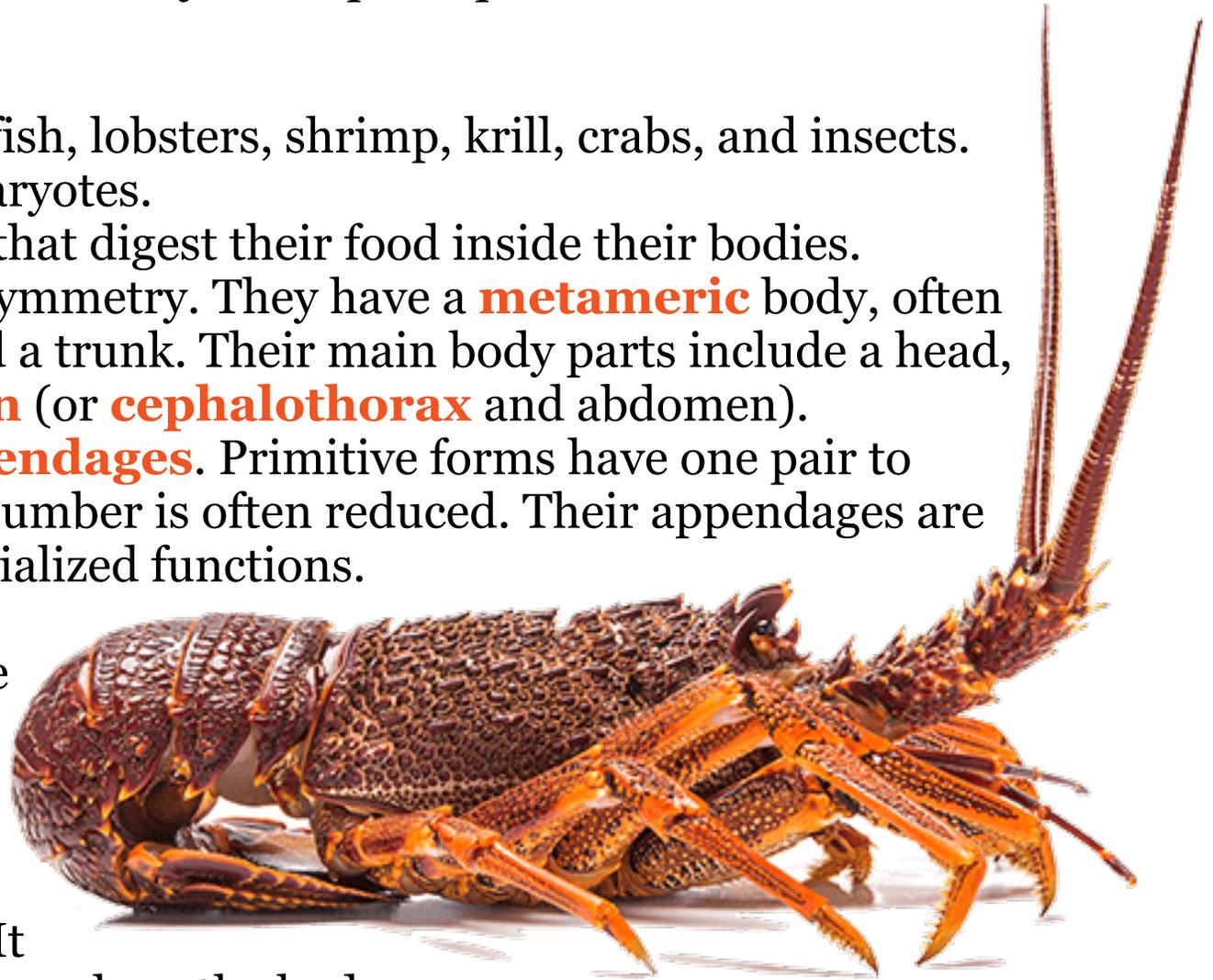
- What are the main physical features of the phylum Mollusca?
- Into how many different classes have scientists divided this phylum?
- What kind of cellular organization do these organisms have? Do they have tissues? Organs? Organ systems?
- How do Mollusks grow and develop? Do they have different stages of development? If so, describe those stages?
- How do Mollusks obtain and use food? Describe the food of these organisms.
- Describe the surroundings or habitat where Mollusks live. How do Mollusks protect themselves?
- How do Mollusks reproduce?
- In what ways are Mollusks different from other phyla that we have studied?
- What are your most important questions about the animals in this phylum?
- Which concepts relating to this phylum are most striking for you personally?

Phylum: Arthropoda

(ahr-throp' oh-duh) (Gr. *arthron*, joint, + *pous*, *podos*, foot)

Characteristics

- Examples include crayfish, lobsters, shrimp, krill, crabs, and insects.
- All arthropods are eukaryotes.
- They are heterotrophs that digest their food inside their bodies.
- They exhibit bilateral symmetry. They have a **metameric** body, often divided into a head and a trunk. Their main body parts include a head, **thorax**, and **abdomen** (or **cephalothorax** and abdomen).
- They have jointed **appendages**. Primitive forms have one pair to each **somite**, but the number is often reduced. Their appendages are often modified for specialized functions.
- They have an **exoskeleton** of cuticle containing protein, lipid, chitin, and often calcium carbonate secreted by the underlying epidermis. It is shed (**molted**) at intervals as the body grows.
- They have a complex muscular system, with the exoskeleton for attachment, **striated muscles** for rapid action, **smooth muscles** for **visceral organs**.



- The coelom is reduced in the adult. Most of body cavity consists of **hemocoel** (**sinuses**, or spaces, in the tissues) filled with blood.
- They have a complete digestive system. Their mouthparts are modified from appendages and are adapted for different methods of feeding.
- They have an open circulatory system, with dorsal **contractile heart**, arteries, and hemocoel (blood sinuses).
- They carry out respiration using their body surface, gills, **tracheae** (air tubes), or **book lungs**.
- Some have paired excretory glands called **coral**, paired **antennae**, or paired **maxillary glands**. Some have other excretory organs called **malpighian tubules**.
- Their nervous system is like the annelid plan, with dorsal brain connected by a ring around the gullet to a double nerve chain of ventral **ganglia**. Fusion of the ganglia is present in some species. They have well-developed sensory organs.
- The sexes are usually separate, with paired reproductive organs and ducts. They usually carry out internal fertilization. They are **oviparous** or **ovoviviparous**. They often exhibit **metamorphosis**. There is **parthenogenesis** in a few forms.



Marine Education Society of Australasia: Crustaceans (fourteen pages)

<http://www.mesa.edu.au/crustaceans/default.asp>

Crayfish Dissection

<http://youtu.be/W7FOjZgdc8A>

The Fastest Punch in the World: Smithsonian Channel

http://youtu.be/DtNAqK_V-lg



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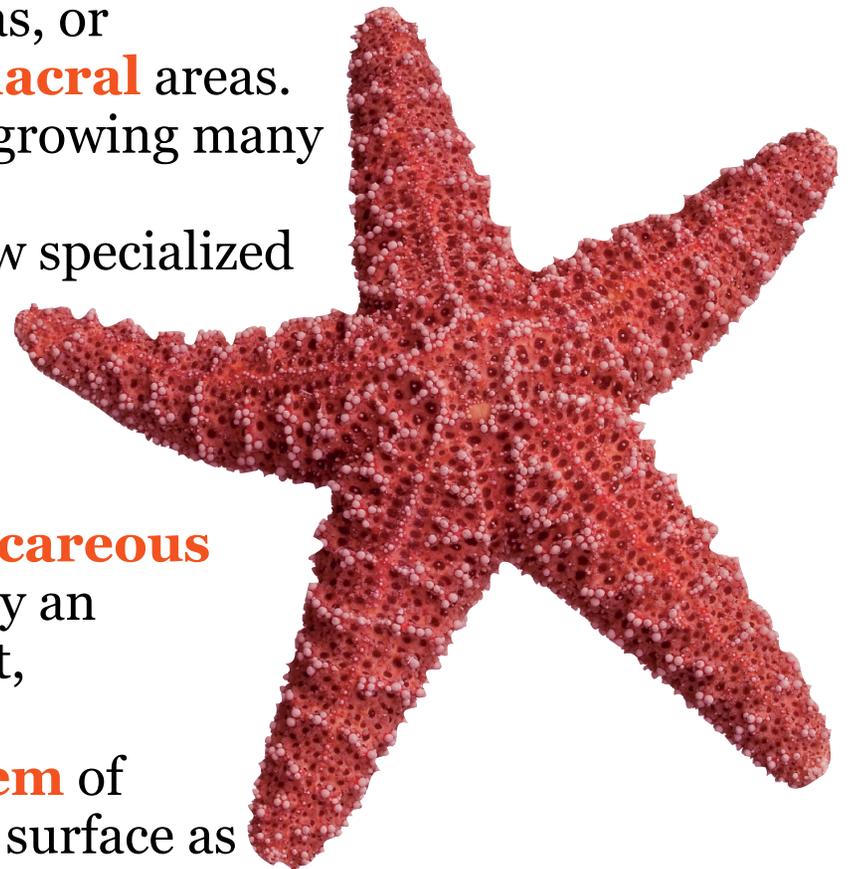
- What are the main physical features of the phylum Arthropoda?
- Into how many different classes have scientists divided this phylum?
- What kind of cellular organization do these organisms have? Do they have tissues? Organs? Organ systems?
- How do Arthropods grow and develop? Do they have different stages of development? If so, describe those stages?
- How do Arthropods obtain and use food? Describe the food of these organisms.
- Describe the surroundings or habitat where Arthropods live. How do Arthropods protect themselves?
- How do Arthropods reproduce?
- In what ways are Arthropods different from other phyla that we will study?
- What are your most important questions about the animals in this phylum?
- Which concepts relating to this phylum are most striking for you personally?

Phylum: Echinodermata

(eh-kahy' nuh-dur-mah' tuh) (Gr. *echinos*, sea urchin, hedgehog, + *derma*, skin)

Characteristics

- Examples include sea urchins, sand dollars, sea stars, brittle stars, and sea cucumbers.
- All echinoderms are eukaryotes.
- They are heterotrophs that digest their food inside their bodies.
- Their body is not **metameric** with radial, **pentamerous symmetry** characterized by five or more radiating areas, or **ambulacra**, alternating with **interambulacral** areas.
- They have great **regenerative** abilities, regrowing many lost or damaged body parts.
- They have no head or brain. They have a few specialized sensory organs.
- They have a nervous system with a **circumoral ring** and radial nerves.
- They have an **endoskeleton** or dermal **calcareous ossicles** with spines or of **calcareous spicules** in the dermis. They are covered by an epidermis. The epidermis is ciliated in most, **pedicellariae** in some.
- They have a unique **water-vascular system** of coelomic origin that extends from the body surface as



- a series of tentacle-like projections (**podia**, or **tube feet**).
- Their locomotion is by tube feet, which project from the ambulacral areas, or by movement of spines, or by movement of arms, which project from the central disc of the body.
 - Their digestive system is usually complete. It is either **axial** or **coiled**. The anus is absent in some types.
 - Their coelom is extensive, forming the **perivisceral cavity** and the cavity of the water-vascular system.
 - Respiration is carried out by dermal **branchiae**, tube feet, respiratory tree (**holothuroids**), and **bursae**.
 - Excretory organs are absent.
 - The sexes separate (except a few **hermaphroditic**). Fertilization is usually external.
 - Their development is through free-swimming, bilateral, larval stages (some with direct development). They develop through **metamorphosis** to a radial adult or subadult form.



Marine Education Society of Australasia: Echinoderms (seven pages)

<http://www.mesa.edu.au/echinoderms/default.asp>

Jonathan Bird's Blue World: Sea Stars

<http://youtu.be/pSo30IRHaAw>

10 Things You Didn't Know About Sea Urchins

<http://youtu.be/oljZbs5haaY>



Detailed Sea Star Dissection South Dakota Public Broadcasting

<http://youtu.be/PZsvi-WCaVY>

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- What are the main physical features of the phylum Echinodermata?
- Into how many different classes have scientists divided this phylum?
- What kind of cellular organization do these organisms have? Do they have tissues? Organs? Organ systems?
- How do Echinoderms grow and develop? Do they have different stages of development? If so, describe those stages?
- How do Echinoderms obtain and use food? Describe their food.
- Describe the surroundings or habitat where Echinoderms live. How do Echinoderms protect themselves?
- How do Echinoderms reproduce?
- In what ways are Echinoderms different from other phyla that we have studied?
- What are your most important questions about the animals in this phylum?
- Which concepts relating to this phylum are most striking for you personally?

Phylum: Chordata

(kor-dah' tuh) (L. *chorda*, cord) subphylum

Subphylum: Vertebrata

(ver' tuh-brah' tuh) (L. *vertabratus*, backboned)



Characteristics

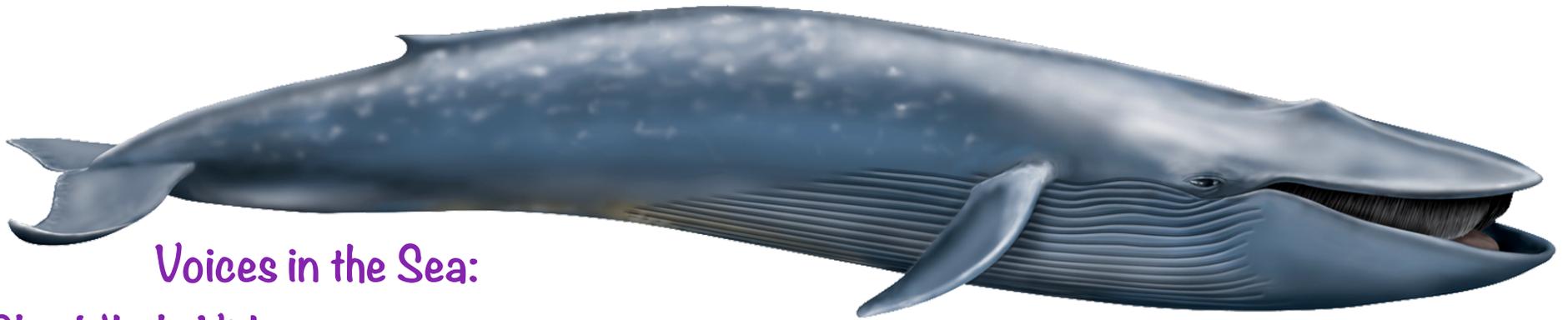
- Examples include sea lions, seals, dolphins, blue whales, and humans.
- All chordates are eukaryotes.
- They are heterotrophs that digest their food inside their bodies. They exhibit bilateral symmetry. They have a segmented body with three germ layers.

- They have a well-developed coelom.
- They all have a **notochord** (a skeletal rod) present at some stage of their life cycle.
- They have a single, dorsal, **tubular nerve cord**. The anterior end of the cord is usually enlarged to form a brain.
- **Pharyngeal gill slits** are present at some stage in their life cycle and may or may not be functional.
- They have a **postnatal tail**, usually projecting beyond the anus at some stage and it may or may not persist.
- They have a **ventral heart**, with **dorsal** and **ventral blood vessels**. They have a closed blood system.
- They have a complete digestive system.
- A well-developed **cartilage** or bony **endoskeleton** is present in the majority of the members (vertebrates).



Voices in the Sea: Home

http://cetus.ucsd.edu/voicesinthesea_org/index.html



Voices in the Sea:

Blue Whale Videos

http://cetus.ucsd.edu/voicesinthesea_org/videos/videoBlueUpdate.html

Jonathan Bird's Blue World: Sperm Whales of Dominica

<https://youtu.be/4E6FdqOYHl4>

Sea Turtle Migration

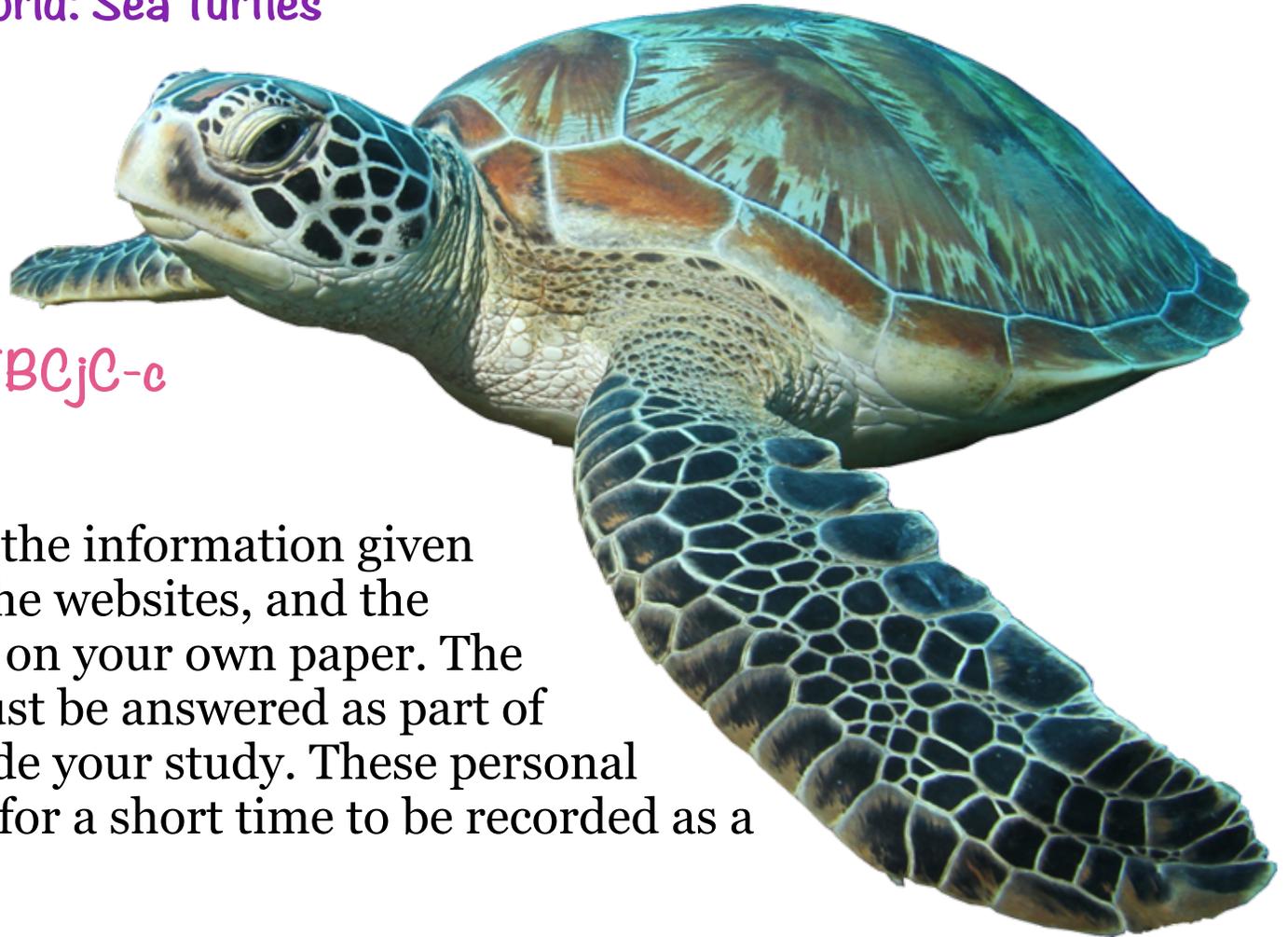
<http://youtu.be/2SOkXtmXuj8>

Jonathan Bird's Blue World: Sea Turtles

http://youtu.be/_44-x_gWE7Y

Giant Green Sea Turtles

<http://youtu.be/x-XwFBCjC-c>



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- What are the main physical features of the phylum Chordata?
- Into how many different classes have scientists divided this phylum?
- What kind of cellular organization do these organisms have? Do they have tissues? Organs? Organ systems?

- How do Chordates grow and develop? Do they have different stages of development? If so, describe those stages?
- How do Chordates obtain and make use of food? Describe the food of these organisms.
- Describe the surroundings or habitat where Chordates live. How do Chordates protect themselves?
- How do Chordates reproduce?
- In what ways are Chordates different from other phyla that we have studied?
- What are your most important questions about the animals in this phylum?
- Which concepts relating to this phylum are most striking for you personally?

Why should we worry about the ocean, about islands, about coral reefs, about the people and the animals that live there? We live so far away in a different place. It doesn't affect us. The coral reefs disappearing is not our problem.

There is a Samoan proverb:

"Aniui, Anini, Aveavai"

The town Anini was burning, and Aveavai said it served them right, for they were thieves; but the fire spread to Aveavai, and they, too, were burned out.

What truly is the problem? Why should we be concerned and act upon our concerns?



Octopus Lure Sinker (Ma'a Ta'i Fe'e)



Pule ta'i fe'e (octopus lure)

Coral Reef Adventure

<http://youtu.be/MYtK806uuFY>