



MARINE PRODUCTS IN PHARMACEUTICALS: POLYSACCHARIDES

PART 1: INTRODUCE MARINE SPECIES
PART 2: EXTRACTION AND CHARACTERIZATION

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Introduction

-About 70% of the Earth's surface is covered by the oceans, and offer a great source of novel bioactive compounds[1].

During their evolution the different marine organisms such as bacteria, macro- and microalgae, sponges and fish have developed various kinds of defense mechanisms, based on the use of a great variety of specific and potent natural molecules [2].

1. Aneiros, A.; Garateix, A. Bioactive peptides from marine sources: Pharmacological properties and isolation procedures. *J. Chromatogr. B Anal. Technol. Biomed. Life Sci.* **2004**, *15*, 41–53.
2. Rasmussen, R.S.; Morrissey, M.T. Marine biotechnology for production of food ingredients. *Adv. Food Nutr. Res.* **2007**, *52*, 237–292.

Persian Gulf

Kuwait



Iraq



Iran



KSA



Qatar



Bahrain



Area : 239 km²

Max Depth : 100 m

UAE



Marine organisms

Rich source for the discovery of novel natural compounds:

-Small molecules: terpenoids, polyethers, polyketides, lipoproteins, and small antimicrobial peptides),

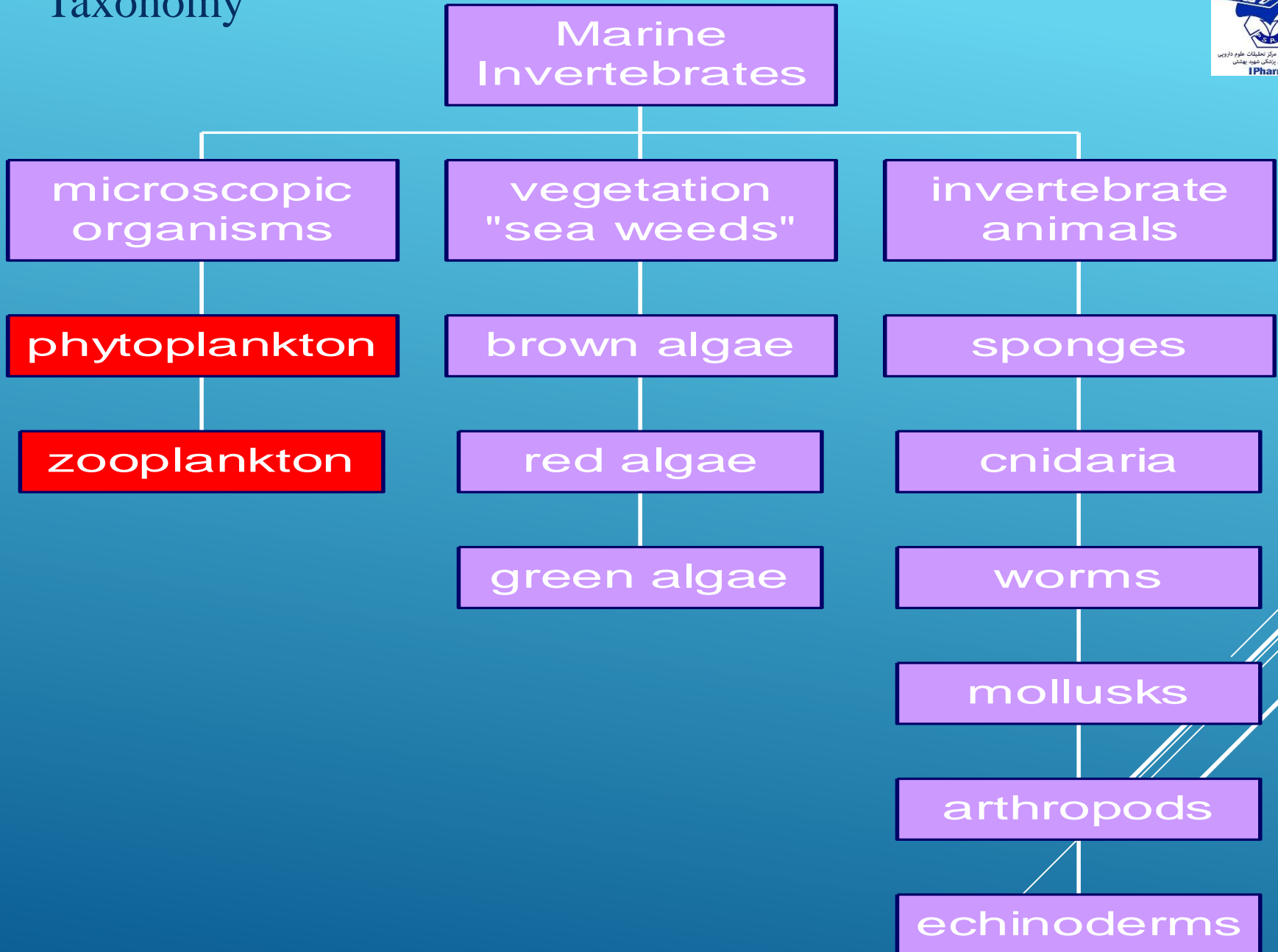
Used as defense systems against predators

-Macromolecules: proteins, glycoproteins, and polysaccharides

Used as cell surface receptors [3],
in cell development and differentiation [4]
and the innate immunity system [5].

3. Vasta, G.R.; Ahmed, H. Animal lectins as cell surface receptors: Current status for invertebrate species signaling mechanisms in protozoa and invertebrates. In *Progress in Molecular and Subcellular Biology*; Springer: Berlin, Germany, 1996; Volume 17, pp. 158–182.
4. Kilpatrick, D.C. Animal lectins: A historical introduction and overview. *Biochim. Biophys. Acta* **2002**, *1572*, 187–197
5. Sharon, N.; Lis, H. History of lectins: From hemagglutinins to biological recognition molecules. *Glycobiology* **2004**, *14*, 53R–62R. [CrossRef] [PubMed]

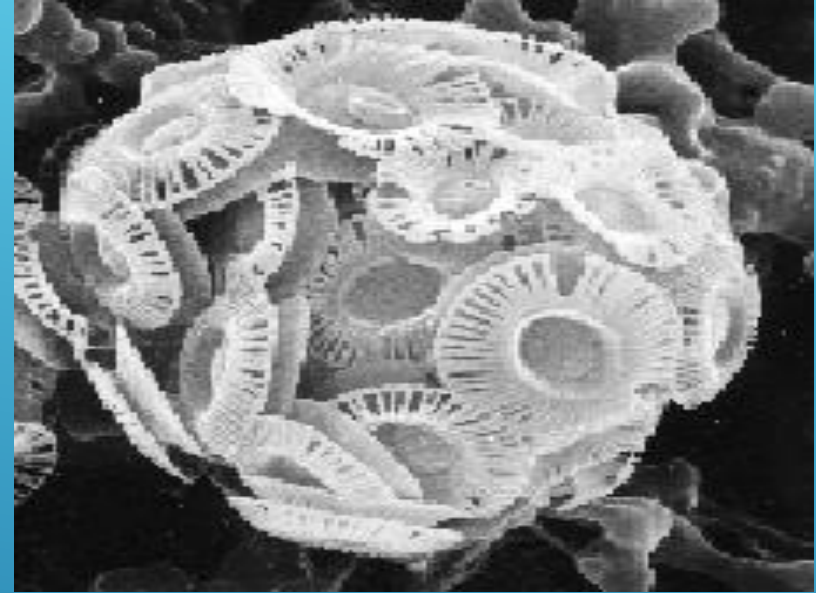
Taxonomy



PHYTOPLANKTON

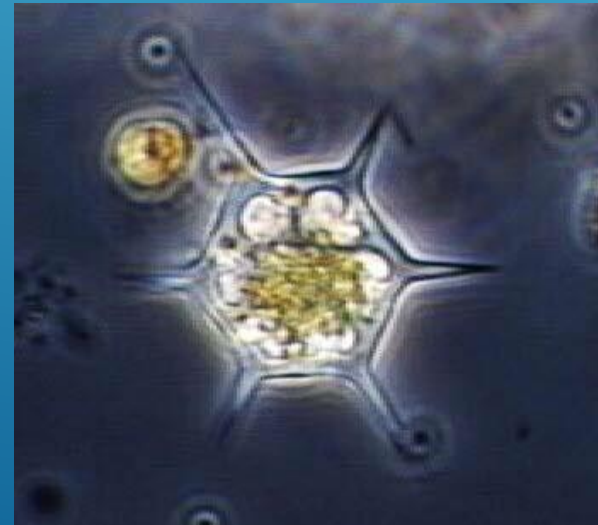
Coccolithophores →

- Extremely small
- Flagellated
- Shells made of CaCO_3

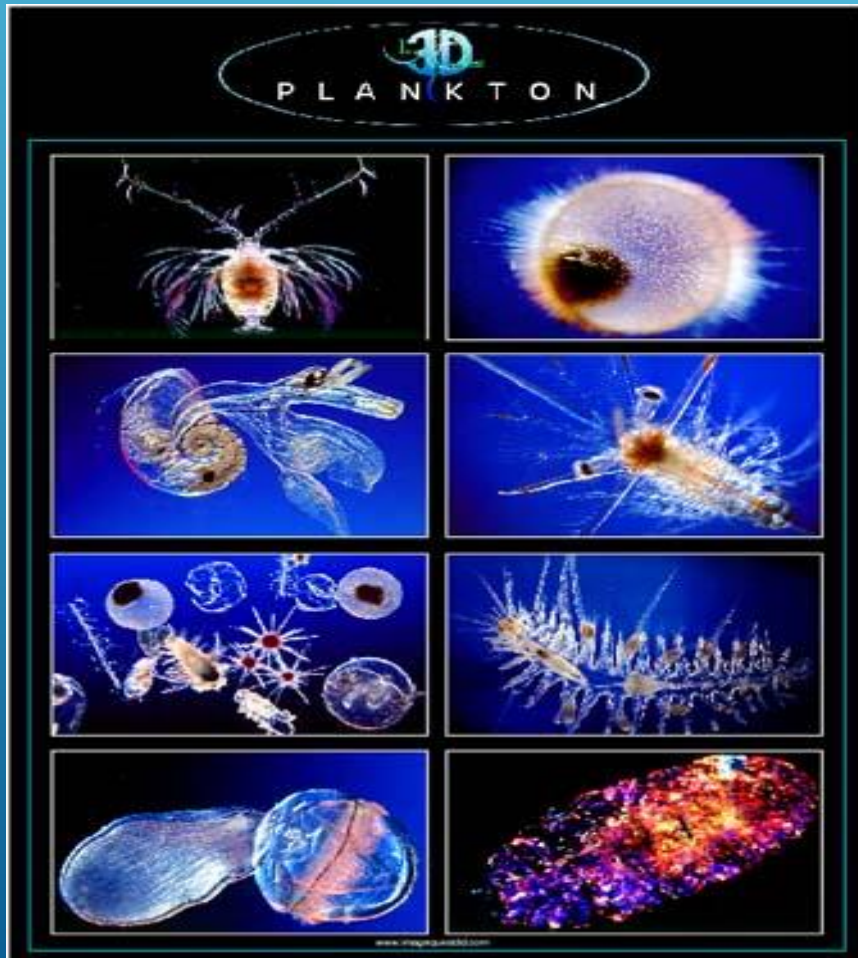


Silicoflagellates →

- Very small
w/internal glass
skeleton

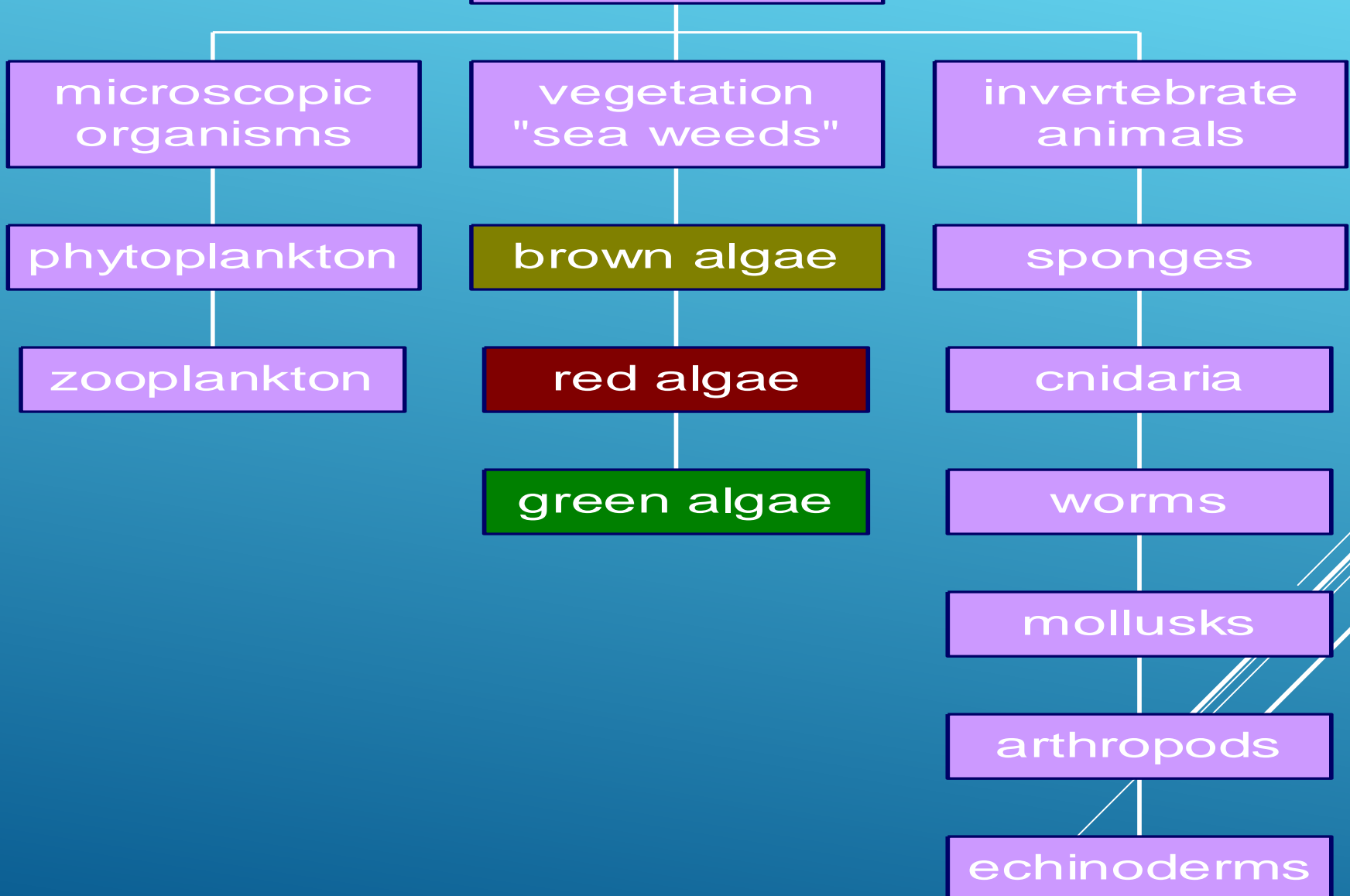


ZOOPLANKTON



- ▶ Zooplankton are animal drifters that consume phytoplankton
- ▶ They are the primary consumers of the aquatic ecosystem
- ▶ ← Macroscopic plankton

Marine Invertebrates



PHAEOPHYTA “BROWN ALGAE”

- ▶ Multicellular Protists (not plants)
- ▶ Largest group of kelp plants called “sea weed”
- ▶ Include *Macrocystis* → *Sargassum*, *Fucus*
- ▶ Holdfasts anchor the plant to rocks and substratum while air bladders support upright toward sunlight



SARGASSUM SP.

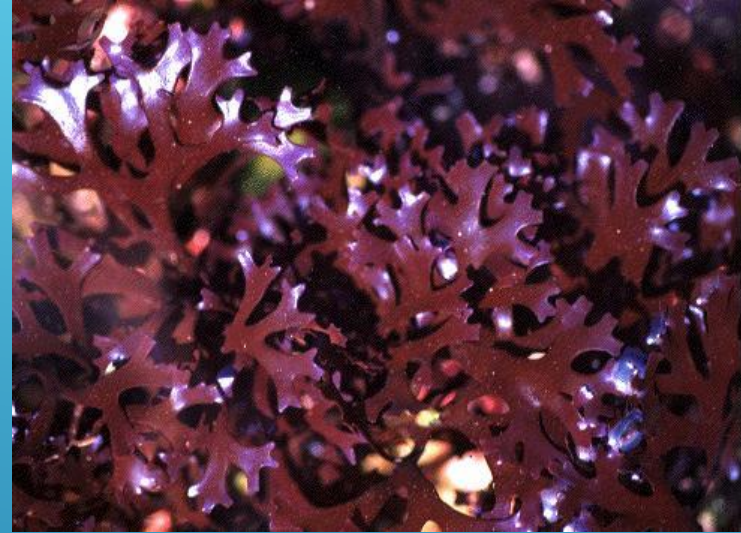
VS

FUCUS SP.



PROTISTS- RHODOPHYTA “RED ALGAE”

- ▶ Contain the red pigment called phycoerythrin
- ▶ Irish moss (*Chondrus* →)
- ▶ Red algae live in deeper water
- ▶ Coralline algae of coral reefs →



CHLOROPHYTA- “GREEN ALGAE”

- ▶ The ancestor to modern plants was a green algae
- ▶ only algae w/chlorophyll b like modern plants
- ▶ Examples: *Ulva* → *Codium*, *Acetabularia*



Marine Invertebrates

microscopic organisms

phytoplankton

zooplankton

vegetation
"sea weeds"

brown algae

red algae

green algae

invertebrate animals

sponges

cnidaria

worms

mollusks

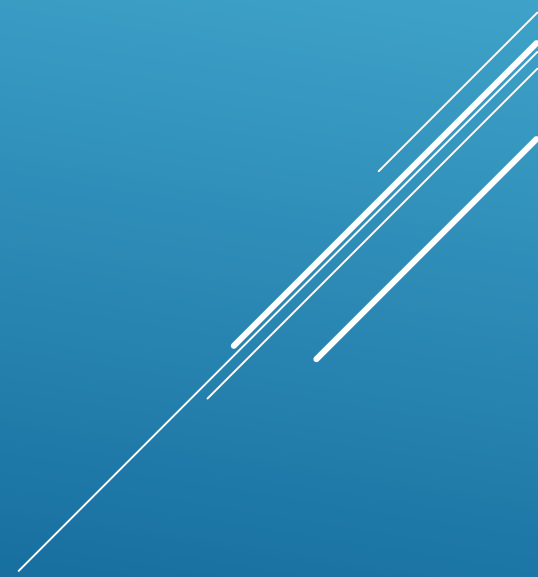
arthropods

echinoderms



SPONGES-
“ABSORBENT AND YELLOW AND
POROUS IS HE”

CORALS



JELLY FISH

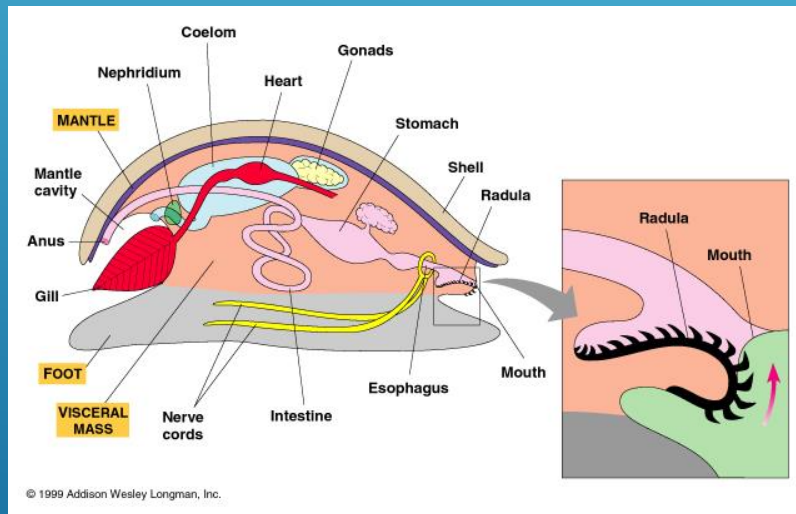


MARINE FLATWORMS



- ▶ Class Turbellaria: marine flatworms
- ▶ Free-living
- ▶ crawl by ventral cilia and some swim by undulating motion
- ▶ Carnivores and scavengers

PHYLUM MOLLUSCA



- ▶ 150,000 species
- ▶ Clam (bivalve), snail (gastropod), octopus (cephalopod)
- ▶ Defined by a mantle layer, visceral mass, and single muscular foot
- ▶ Mantle produces calcareous shell in most

GASTROPODA “PERIWINKLES”



- ▶ 75% of mollusks are gastropods
- ▶ ← *Littorina* occupy the highest part of the intertidal zone
- ▶ They graze on algae
- ▶ Feed with radula; breathe with gills



PHYLUM MOLLUSKA

CLASS BIVALVIA



- ▶ Many bivalves burrow into the sand
- ▶ Bivalves can move using their muscular “foot”
- ▶ A siphon (“neck”) can be extended from mud to the water for food

OYSTERS



- ▶ Baby oysters grow on the backs of others forming large colonies

PHYLUM MOLLUSKA

CLASS POLYPLACOPHORA



- ▶ A chiton
- ▶ Shell has 8 segments
- ▶ A strong muscular foot to hold onto rocks
- ▶ Trying to remove a chiton may kill it
- ▶ Adapted to withstand the force of waves
- ▶ Herbivores, grazers



PHYLUM MOLLUSKA

CLASS CEPHALOPODS



- ▶ Include octopuses, squids, and nautiluses
- ▶ Cephalopods- “head foot”; shell is lost in some (not nautilus)
- ▶ Smart, fast and predatory
- ▶ tentacles and beak-like mouth
- ▶ mantle cavity functions as siphon for locomotion

Kingdom: Animalia

Phylum: Mollusca

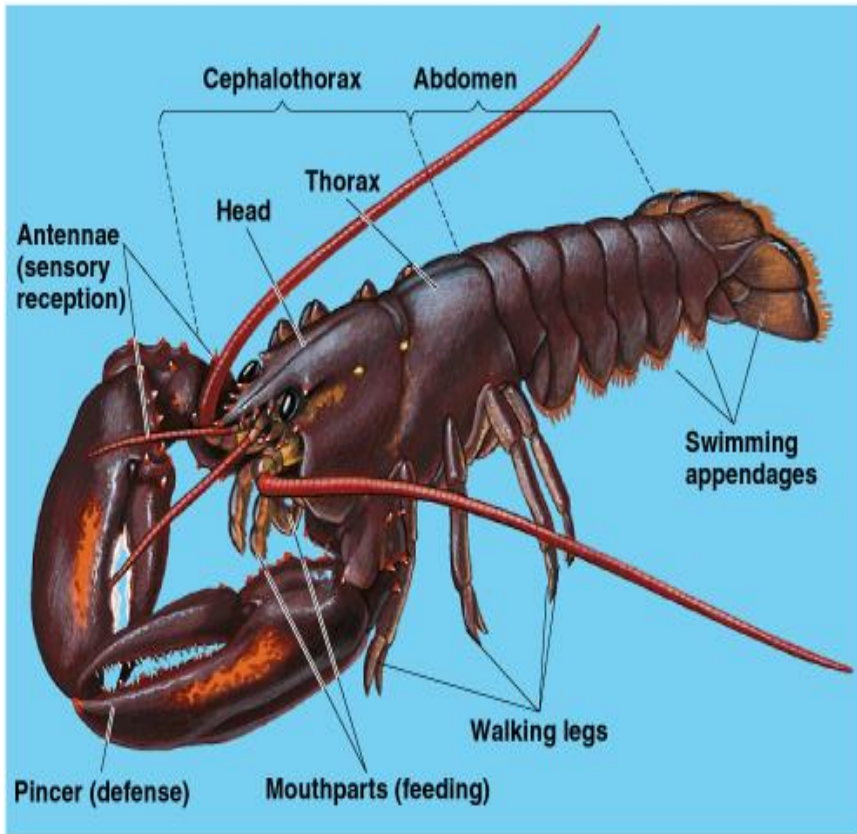
Class: Cephalopod

Name: Squidward Tentacles

Hobbies: playing clarinet



PHYLUM ARTHROPODA



- ▶ Arthropoda- “jointed feet”
- ▶ > 1 million species; 2 out of 3 animals is an arthropod
- ▶ Exoskeleton w/jointed appendages
- ▶ Include insecta, arachnida, ← crustaceans

PHYLUM ARTHROPODA

CLASS DECOPODA



- ▶ Decopoda means “ten feet”
- ▶ Include lobsters, crabs, and shrimp
- ▶ ← the green crab can be found living among sea weed at low tide
- ▶ ← a kelp crab

Kingdom: Animalia

Phylum: Arthropoda

Class: Decapoda

Name: Eugene Krab

Hobbies: eating dead stuff

(oh yeah, and making \$)



ECHINODERMATA

- ▶ Include sea stars, sea urchins, brittle stars, sand dollars, sea lilies, and sea cucumbers



PHYLUM- ECHINODERMATA



- ▶ Echinoderm- “spiny skin”
- ▶ bony endoskelton of CaCO_3 plates (ossicles)
- ▶ A unique water vascular system and tube feet function in locomotion, feeding, and gas exchange
- ▶ 7000 species all marine

SEA URCHIN



Sea Cucumber



SEA STAR EATING



- ▶ All echinoderms exhibit pentaradial symmetry
- ▶ Sea stars are predators of bivalves

Kingdom: Animalia

Phylum: Echinodermata

Class: Asteroidea

Name: Patrick Star

Hobbies: regenerating

