

Oyster ABCs:

Anatomy, Biology and Classification

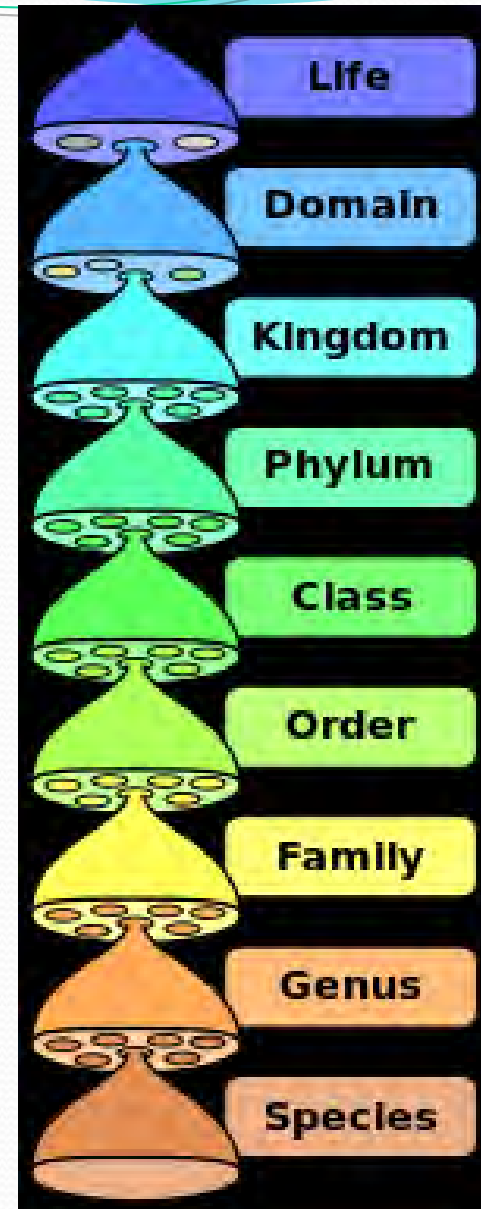
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Taxonomy

- Branch of biology that classifies, identifies and names organisms
- Defines groups of organisms with shared characteristics and evolutionary relationships
- Classification from broader categories to specific ranking



Taxonomy

- Kingdom: Animalia (35 phylums)
- Phylum Mollusca
 - Latin for "soft things"
 - Largest most diverse marine phylum
 - 25% of named marine organisms
 - About 100,000 recognized species

Class - Gastropoda
(snails, slugs, conchs,
periwinkles and sea slugs)



sea slugs



slugs



snails

Class - Bivalvia
(clams, oysters, mussels and scallops)



scallops

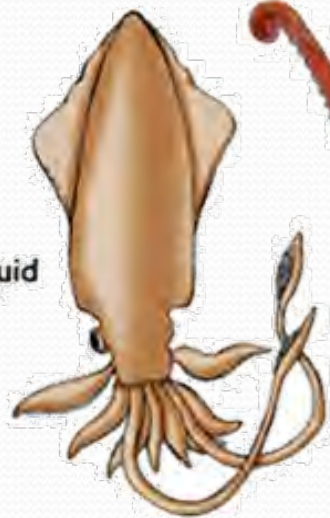


clams

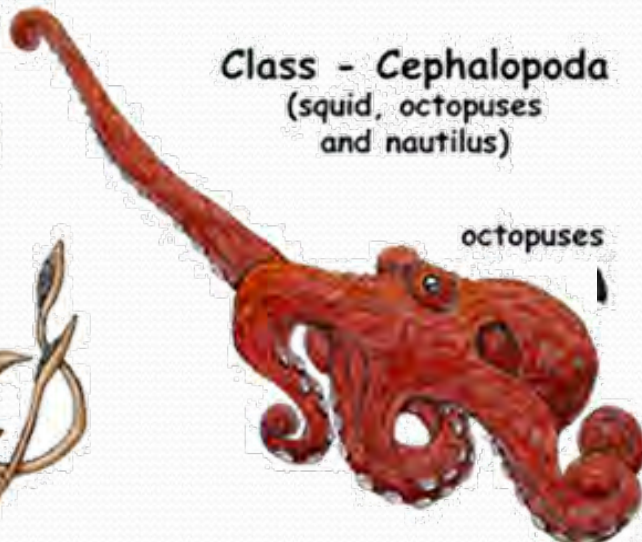


mussels

Class - Cephalopoda
(squid, octopuses
and nautilus)



squid



octopuses

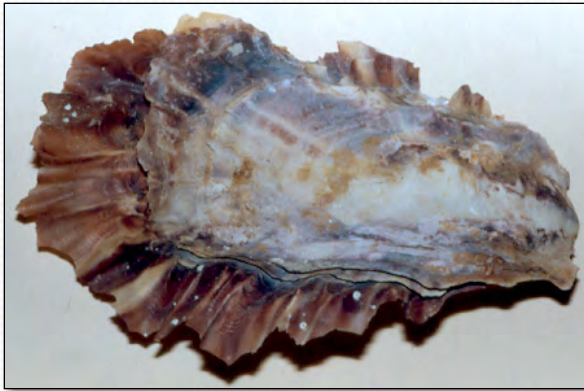
Classes in Phylum Mollusca

- Gastropoda - snails
- Cephalopoda - squid, octopus
- Polyplacophora - chitons
- Scaphopoda - tusk shells
- Bivalvia - oysters, clams, scallops, mussels



Class Bivalvia - 20,000 described species

Oysters



Clams



Scallops



Mussels



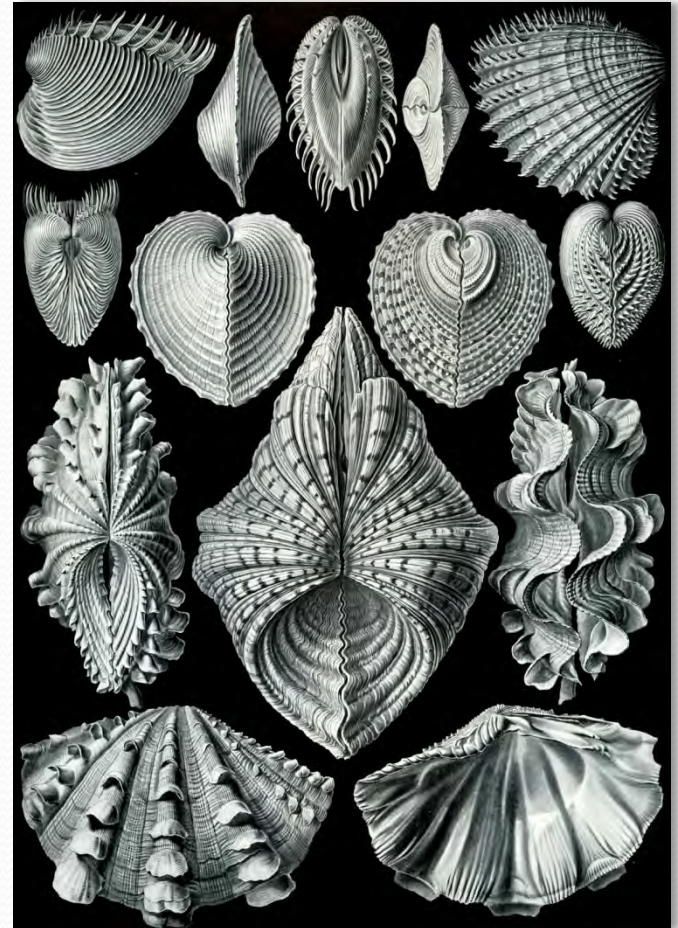
Shipworms



Bivalve form

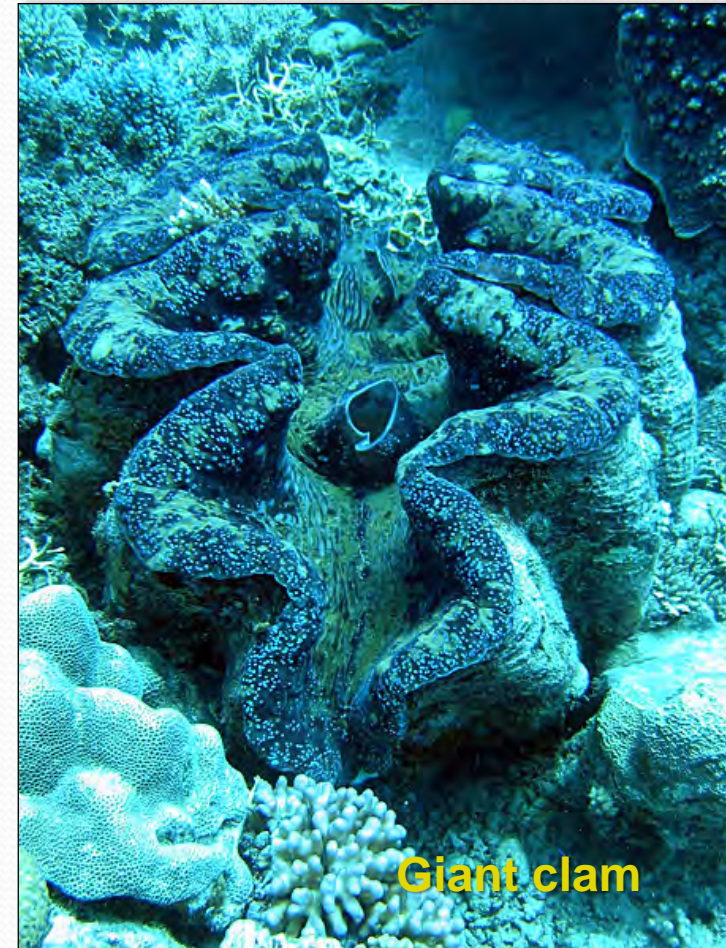


- Two valves, halves, or shells
- Bilateral symmetry - both sides about same size
- Compressed laterally - sideways
- Shell
 - Joined by hinge ligament
 - Held closed by adductor muscles



Bivalve form

- Mantle
 - Encloses body and water space
- Foot
- Gills
 - Gas exchange
 - Filter feeding



Oyster Taxonomy

- Order Ostreacea



Kumamoto



European Flat



Atlantic



Pacific



Olympia

- Family Ostreidae

- "True" oyster
- About 70 species
- Most are edible and support valuable fisheries and aquaculture industries worldwide

Oyster Taxonomy

- Genus: *Crassostrea*
Species: *virginica*
- Latin for "thick" oyster
- Called Virginia, American, Eastern
- Exists for millions of years - used for food, tools, weapons and decoration
- Iconic species, integral part of history of coastal water bodies
- Today, <1% of oysters of 17th century populations remaining



Distribution

- Native to east coasts of Canada and US, Gulf of Mexico, Caribbean and as far south as northern coast of South America
- Found in estuaries, bays, sounds
- Able to tolerate a wide range of environmental conditions



Oyster Ecology

- Lives on surface of sediments
- Sessile - stays in one place
- Forms reefs - intertidal and subtidal
- "Foundation" or "keystone" species
- Provides habitat for many species by creating hard substrate for attachment and refuge



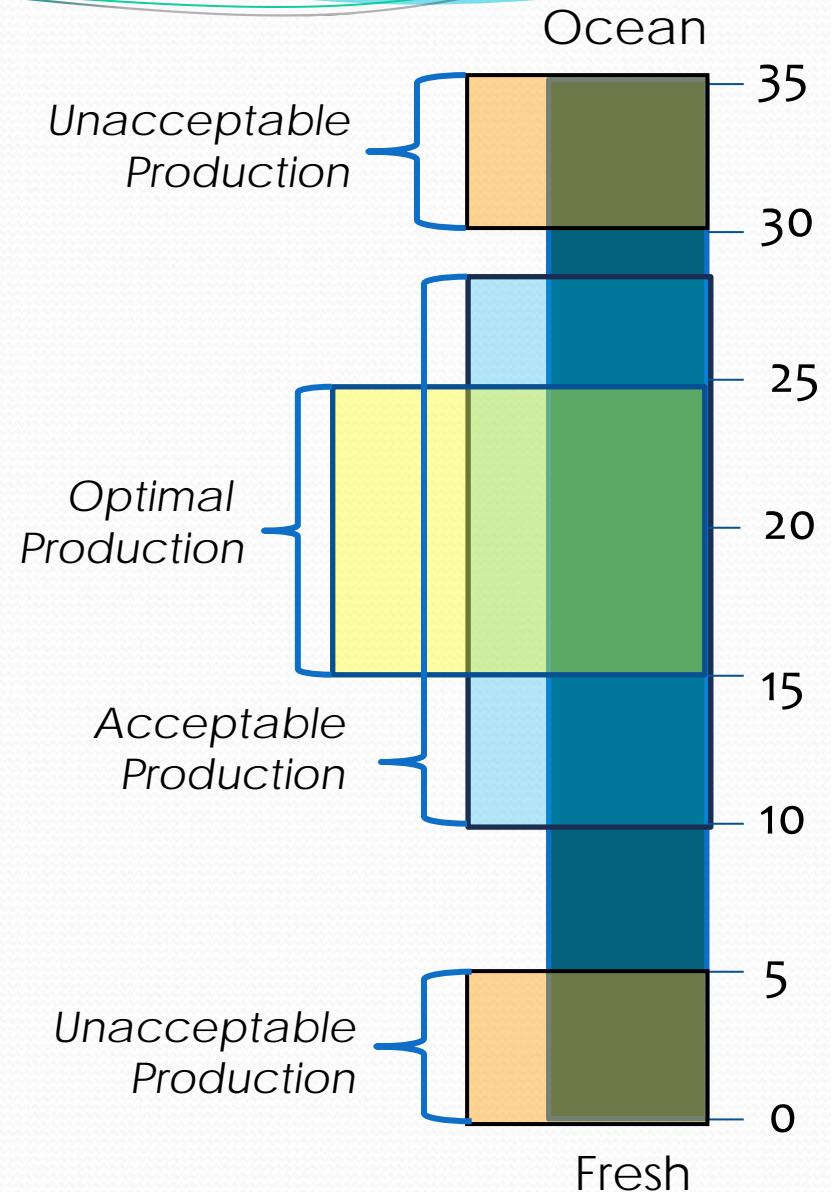
Environmental factors - Water temperature

- Poikilothermic or cold-blooded: metabolic rate related to water temperature
- In Gulf of Mexico, growth is almost year-round
- Crop periods: 8-12 months
- Optimal range for growth: 70-85°F
- Stressful conditions: >90°F

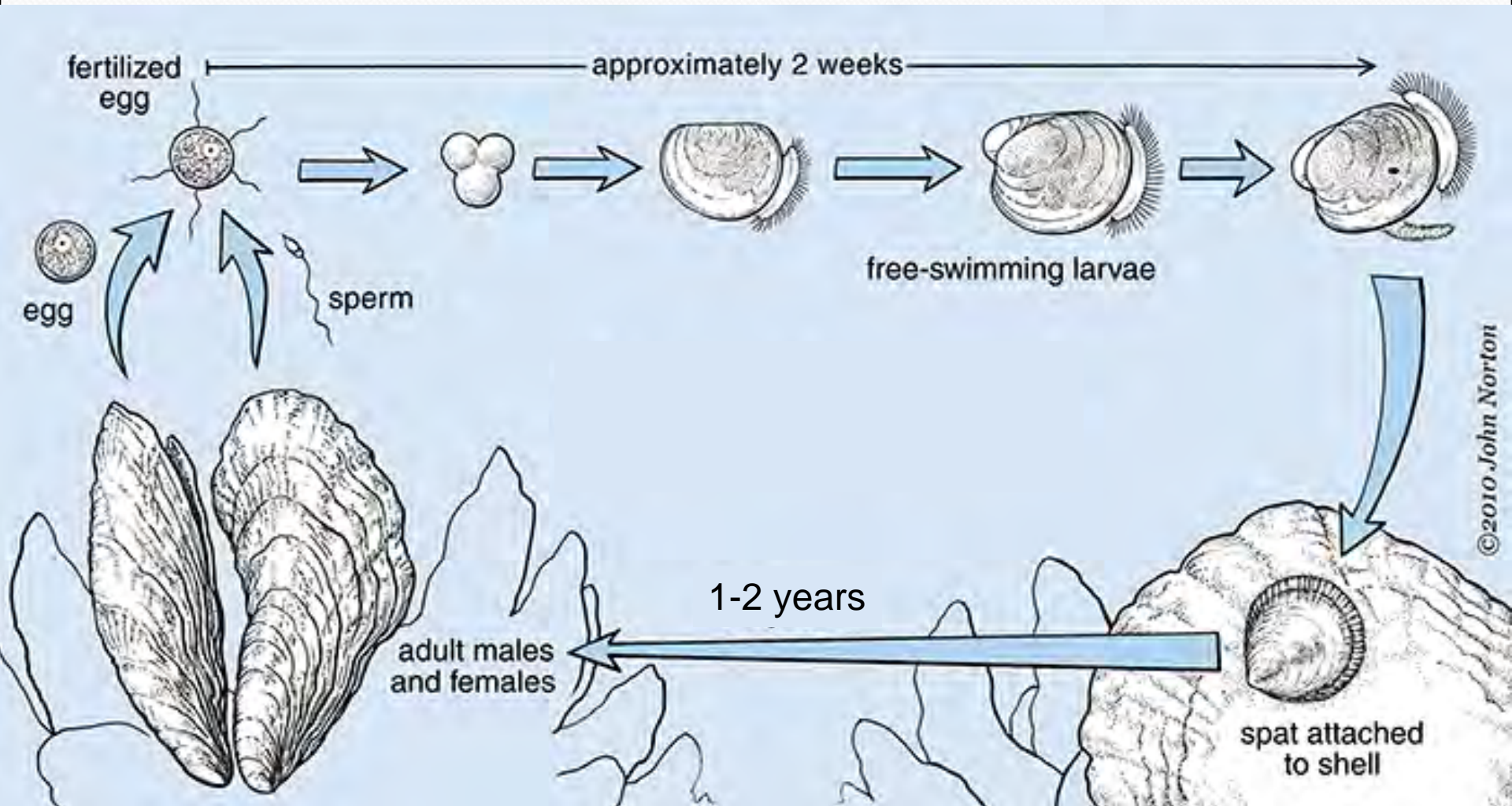


Environmental factors - Salinity

- Euryhaline: tolerates a wide range of salinities
- Optimal range for growth: 15-25 ppt
- Increased predation, pests and disease: >30 ppt
- Mortalities occur: <5 ppt
- Other factors include dissolved oxygen, water flow, food availability, and crowding



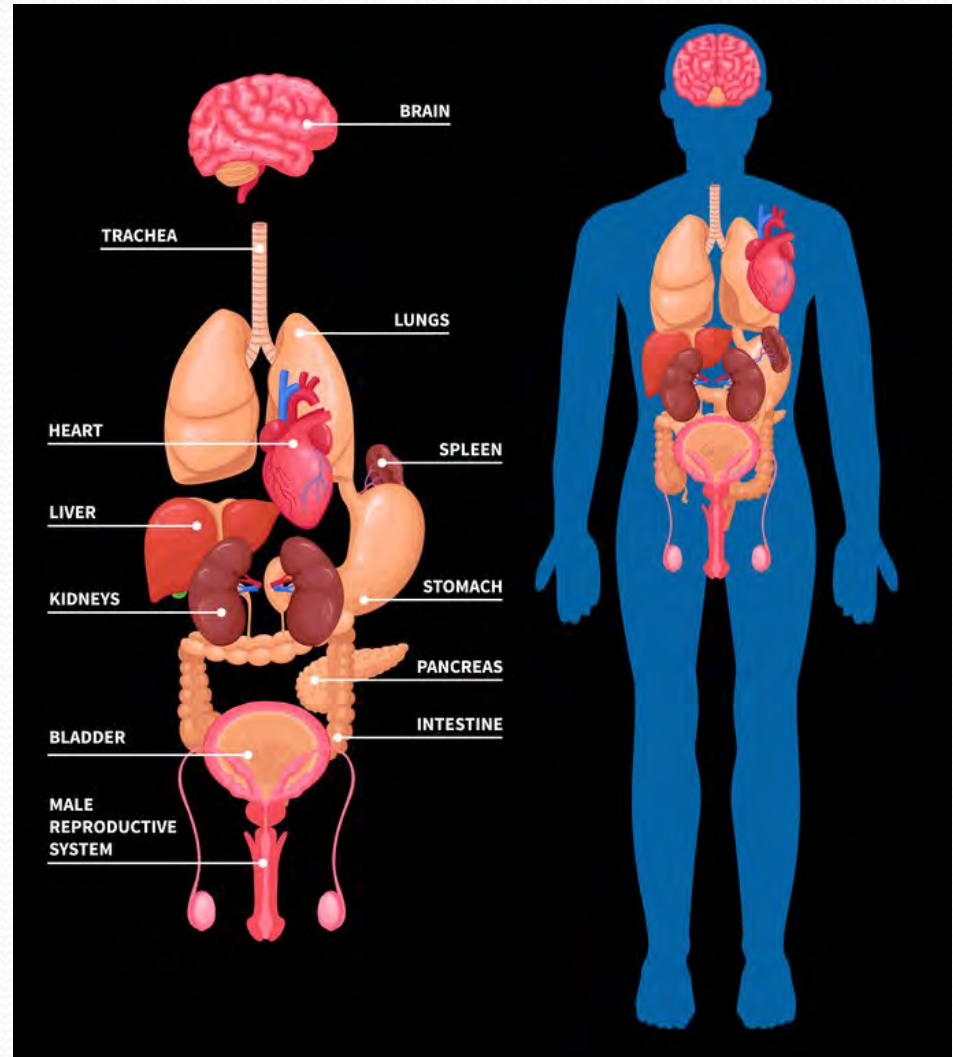
Oyster Life Cycle



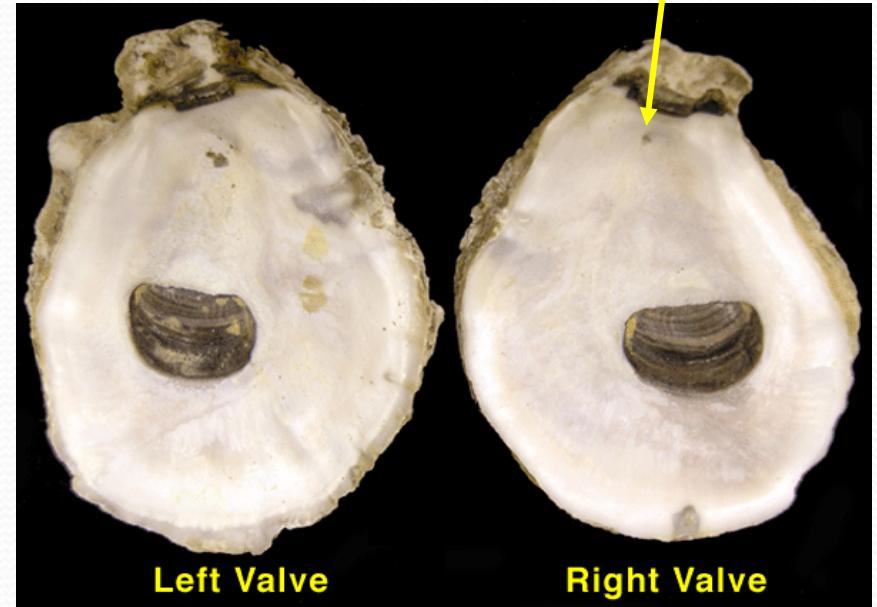
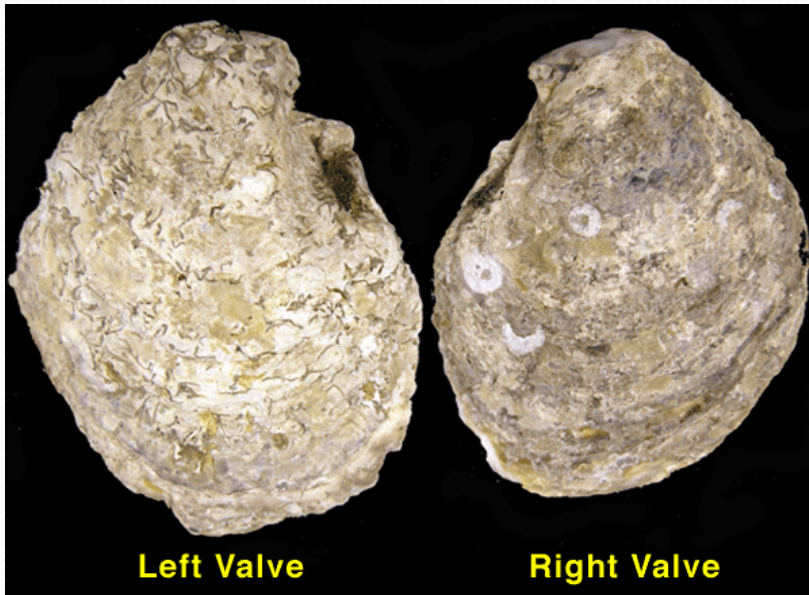
Anatomy

- Branch of biology that studies structure of living organisms and their parts
- Separates parts of an organism to determine position, relationships, and function

Oyster anatomy pictures were obtained from Maryland Sea Grant's website:
https://www.mdseagrant.org/interactive_lessons/oysters/anatlab/lab_e.htm



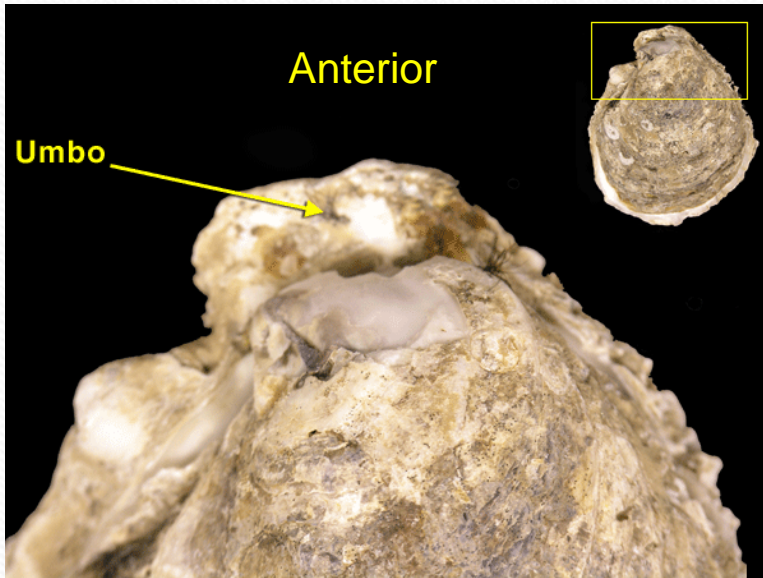
Shell Anatomy



- Shorter of two shells is right valve, flat
- Larger shell is left valve, cupped
- Characteristic central scar (dark area) marking point of muscle attachment

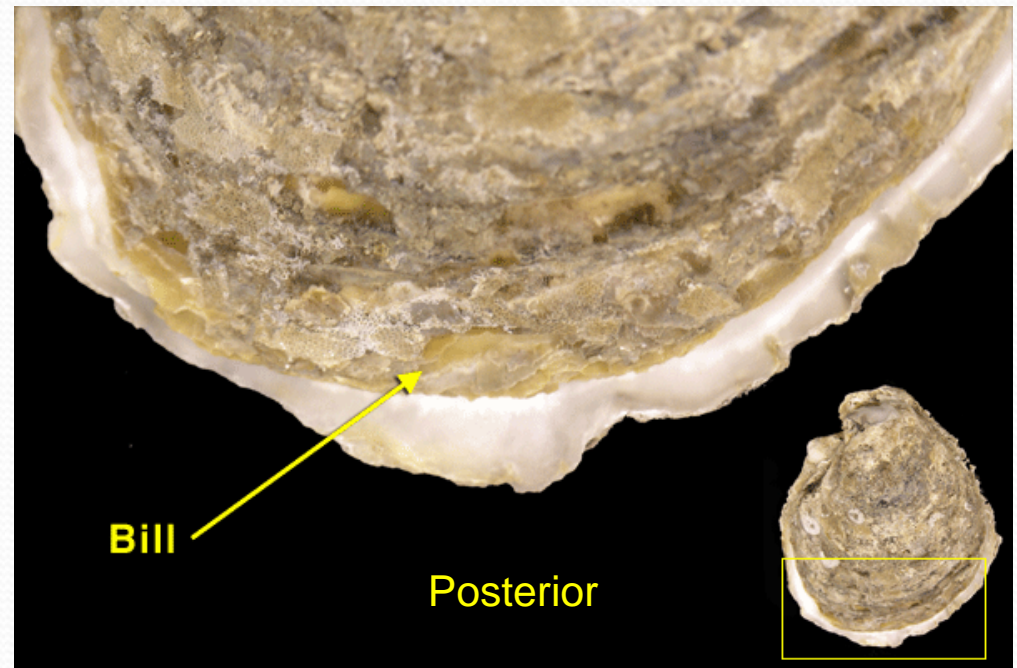


Shell Anatomy



- Umbo - "beak"
 - Pointed or anterior end of shell
 - Oldest part of the shell

- Bill
 - Larger, curved or posterior end of shell
 - Newest part of shell, where growth occurs



Shell Measurements



Shell Height

- From anterior (hinge) to posterior (bill) ends
- Longest dimension
- Typically referred to as **Shell Length**



Shell Length

- From ventral to dorsal sides
- Values are between those for SH and SW



Shell Width

- Across left and right valves
- Shortest dimension
- Refers to "thickness" or cup

Measurements

- Shell height (SH), length (SL) and width (SW) are used to calculate the following:



$$\text{Fan Ratio} = \text{SL}/\text{SH}$$



$$\text{Cup Ratio} = \text{SW}/\text{SH}$$

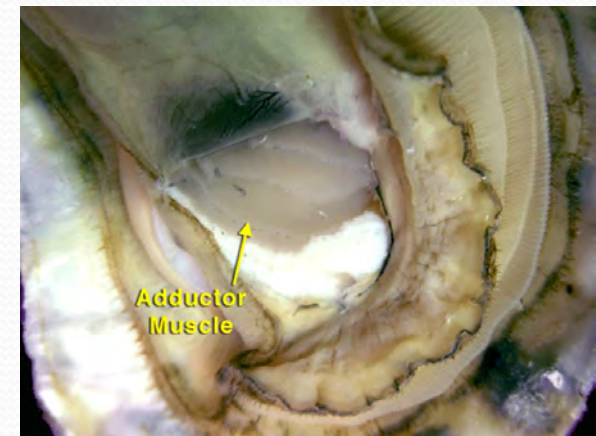
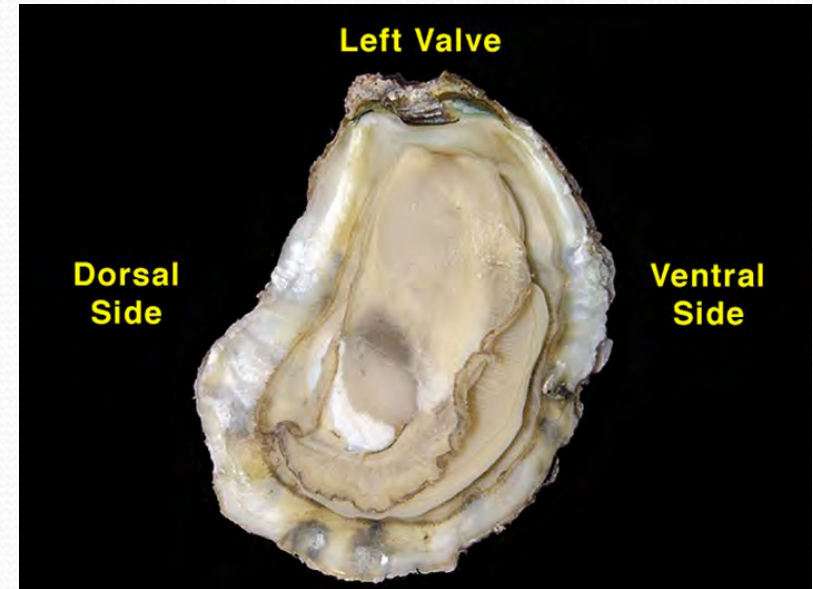
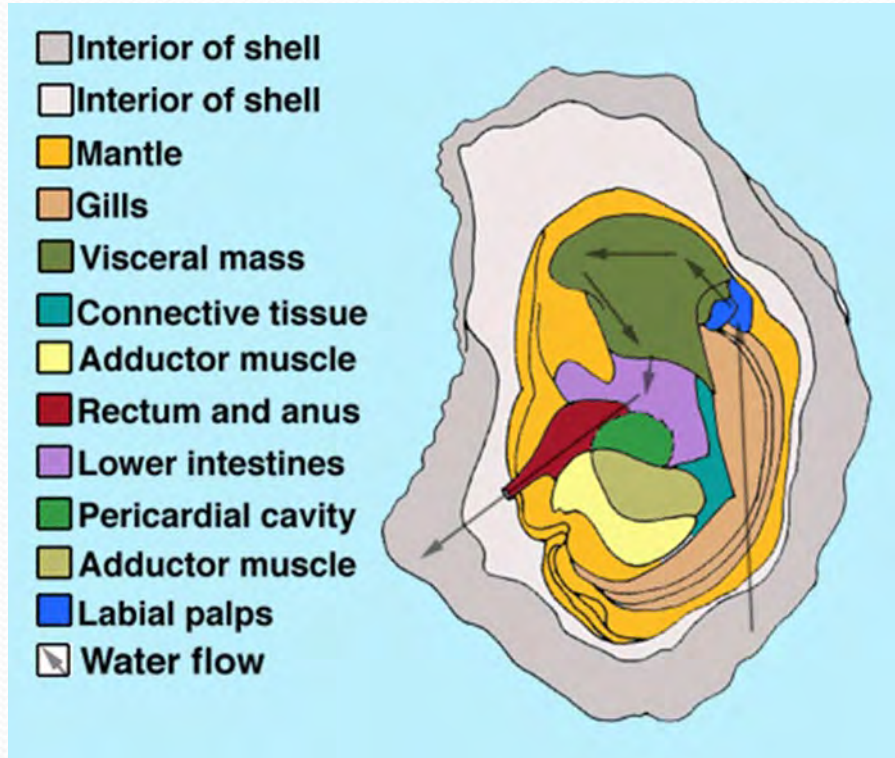
- Fan ratios of 0.66 and above and cup ratios of 0.33 and above are considered favorable by industry experts for half shell oysters designated for raw bars

Oyster Growth

- Shell consists of calcium carbonate in crystalline form
- New shell forms at ventral end (bill) by secretion of protein matrix and calcium
- Variation of shell shape due to overcrowding, substrate orientation, and environmental conditions, such as water flow

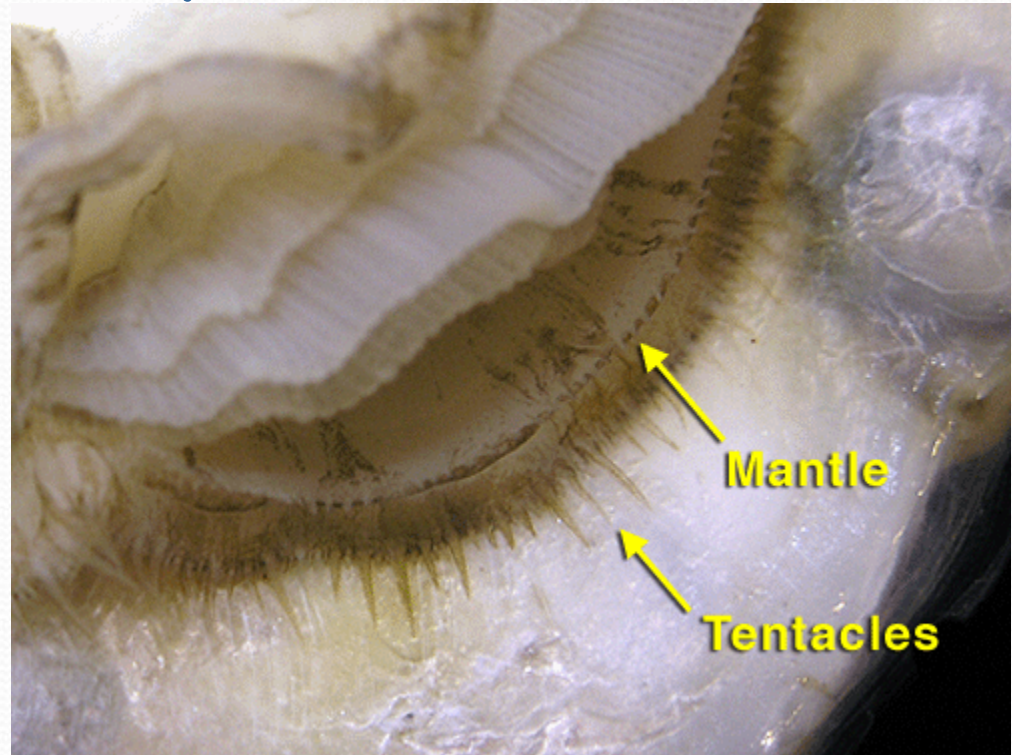
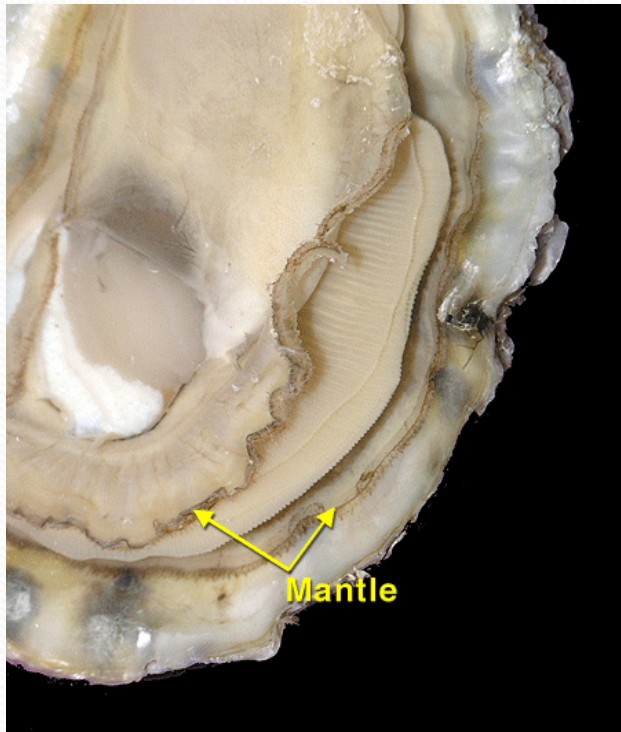


Internal Anatomy



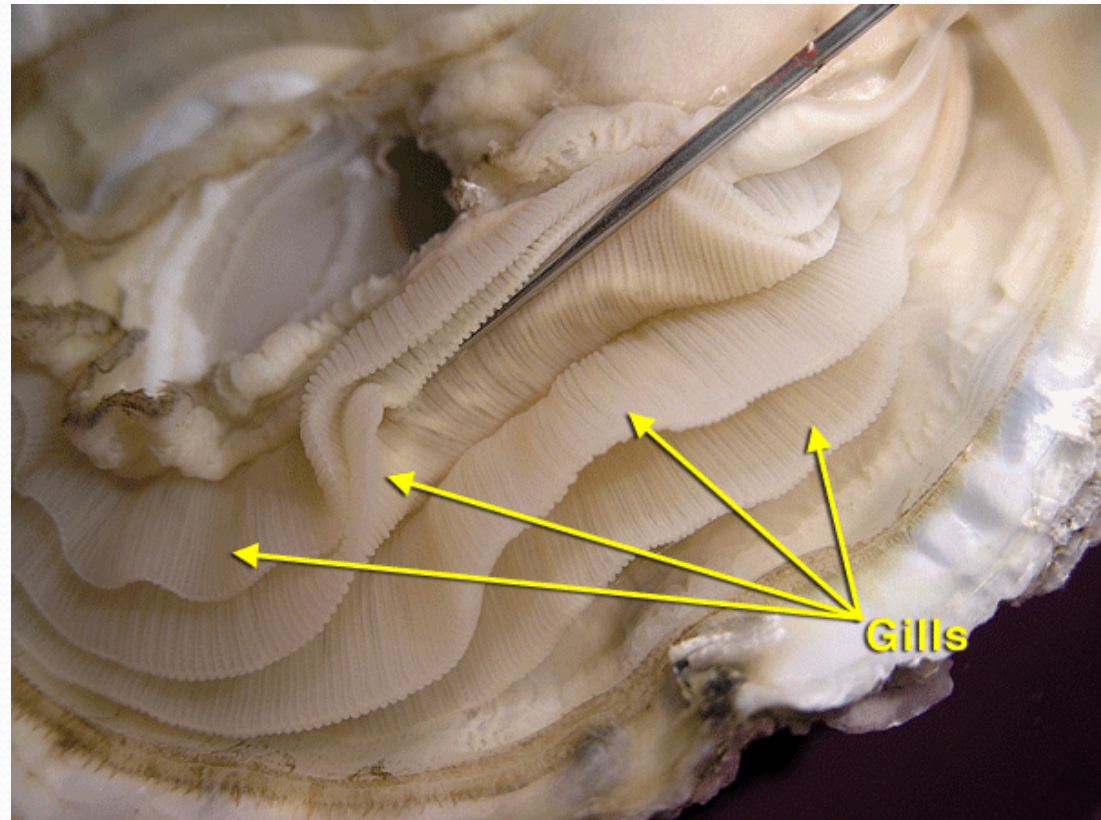
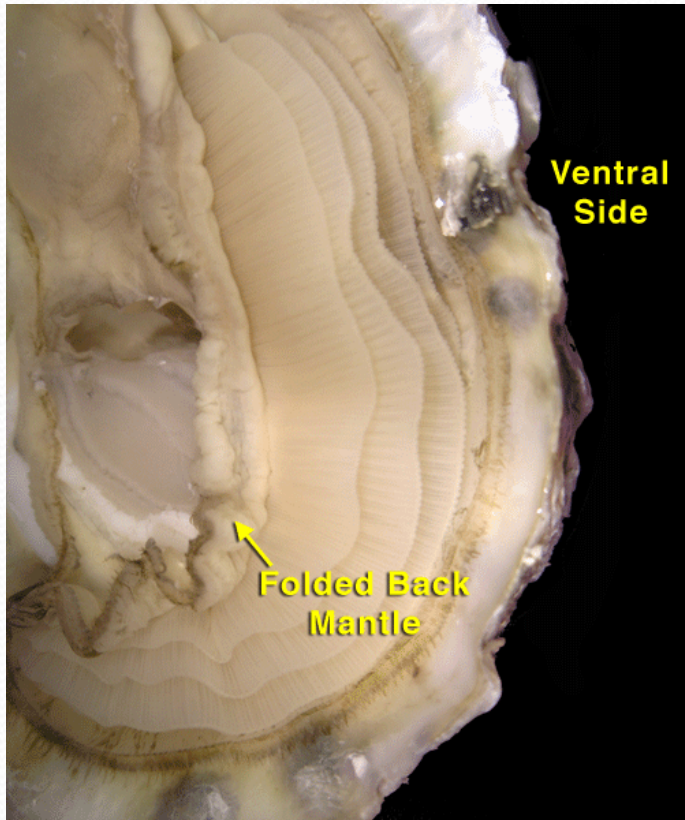
- One large central adductor muscle
- Muscle keep valves closed from predators or during adverse environmental conditions

Internal Anatomy



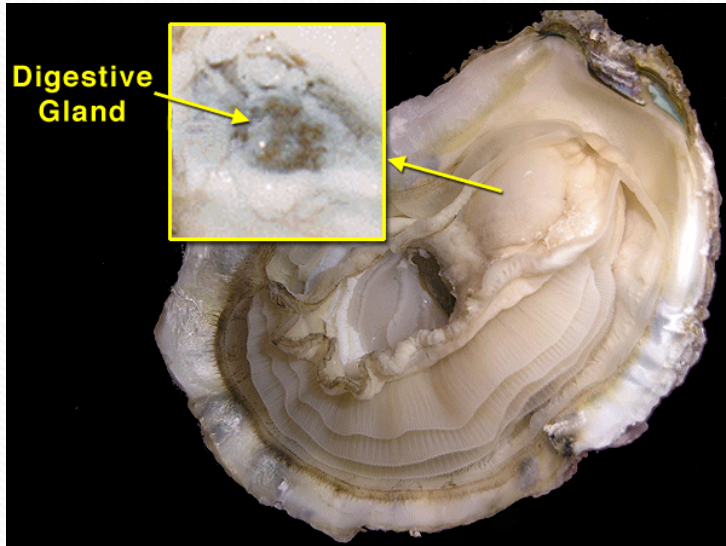
- Mantle - thin layer of tissue lines each valve and covers internal organs
- Contains glands that extract elements from water to form shell
- Tentacles around edge are small sensory organs used in detection of environmental stimuli

Respiratory System



- Gills - Largest organ of oyster, 4 folds of tissue
 - Chief organ for respiration (gas exchange)
 - Create water currents to collect food particles

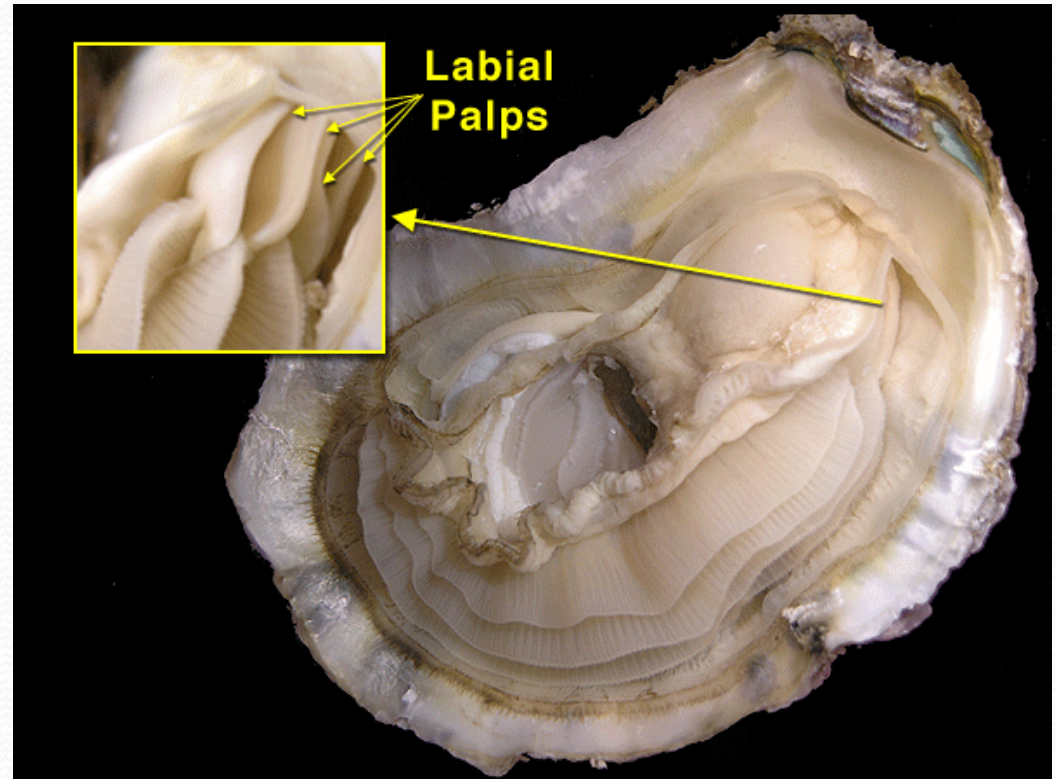
Digestive System



- **Stomach**

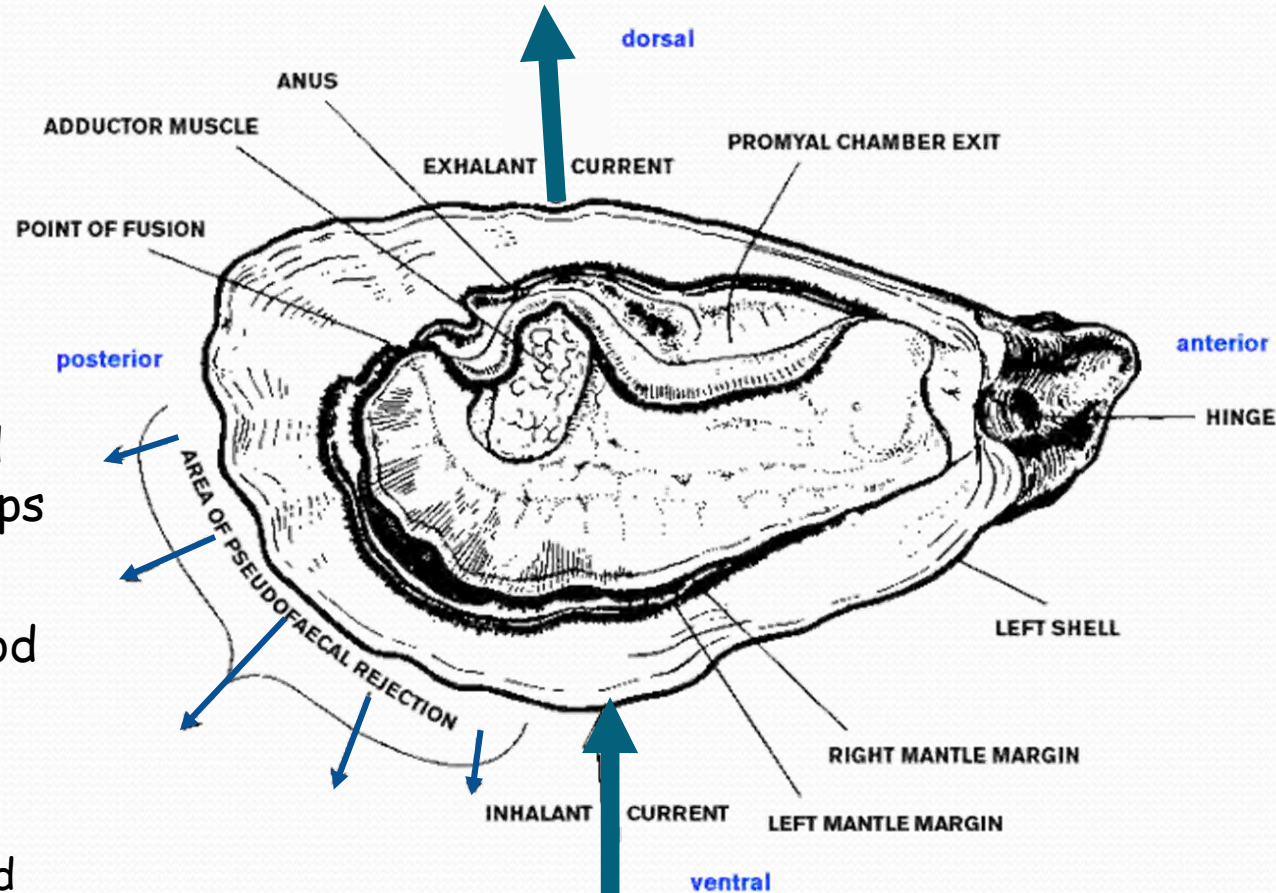
- Large sac-like organ surrounded by digestive gland
- Site for enzyme production and digestion

- **Labial palps**
 - At ends of gills, provide for food sorting prior to entering mouth



Feeding

- Cilia on gills move water through animal
 - Microscopic hair-like appendages
- Mucous on gills trap entering particles
- Particles moved by food groove toward labial palps
 - Like a conveyor belt
- Labial palps sort out food before entering mouth
 - Rejected matter (silt, excess phytoplankton) dropped into mantle and released as pseudofeces

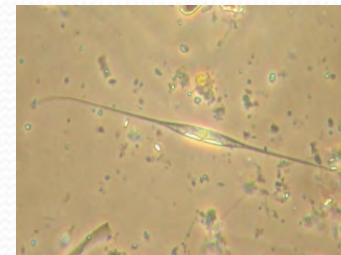
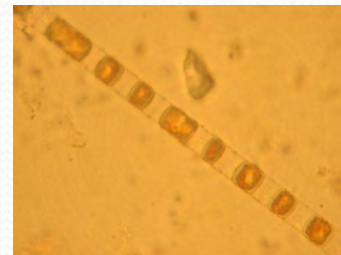
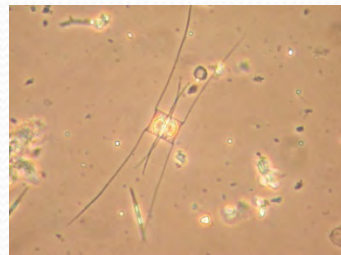
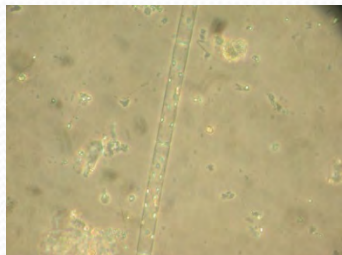
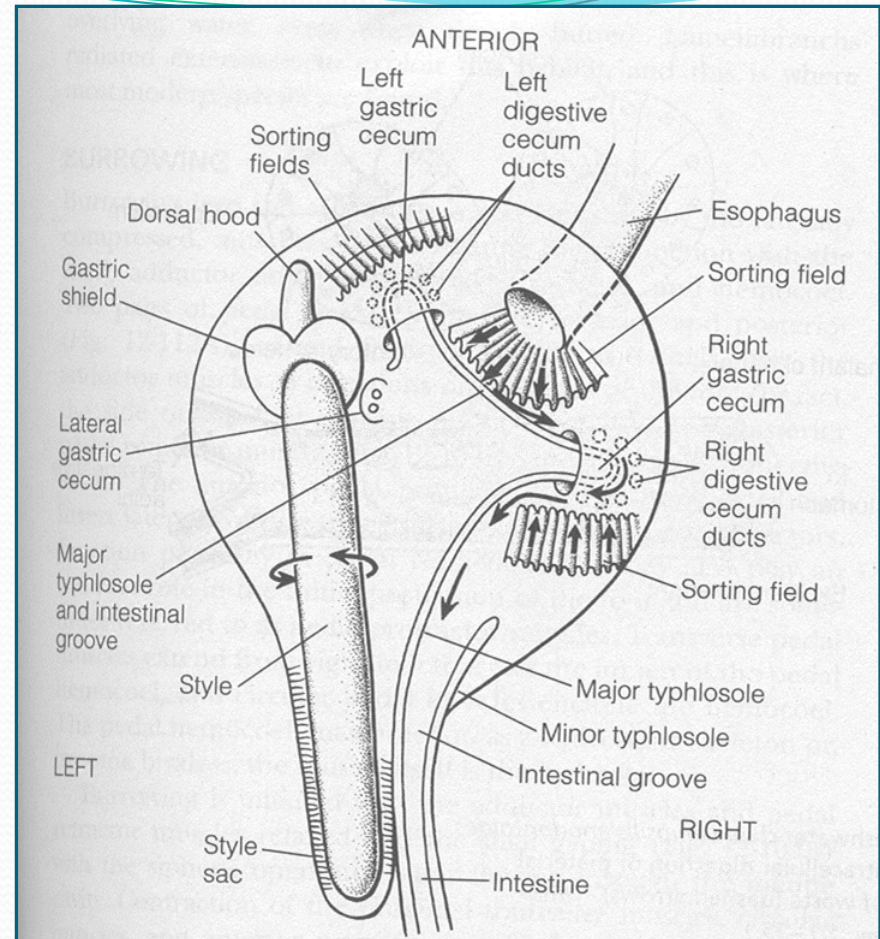


Filter feeder:

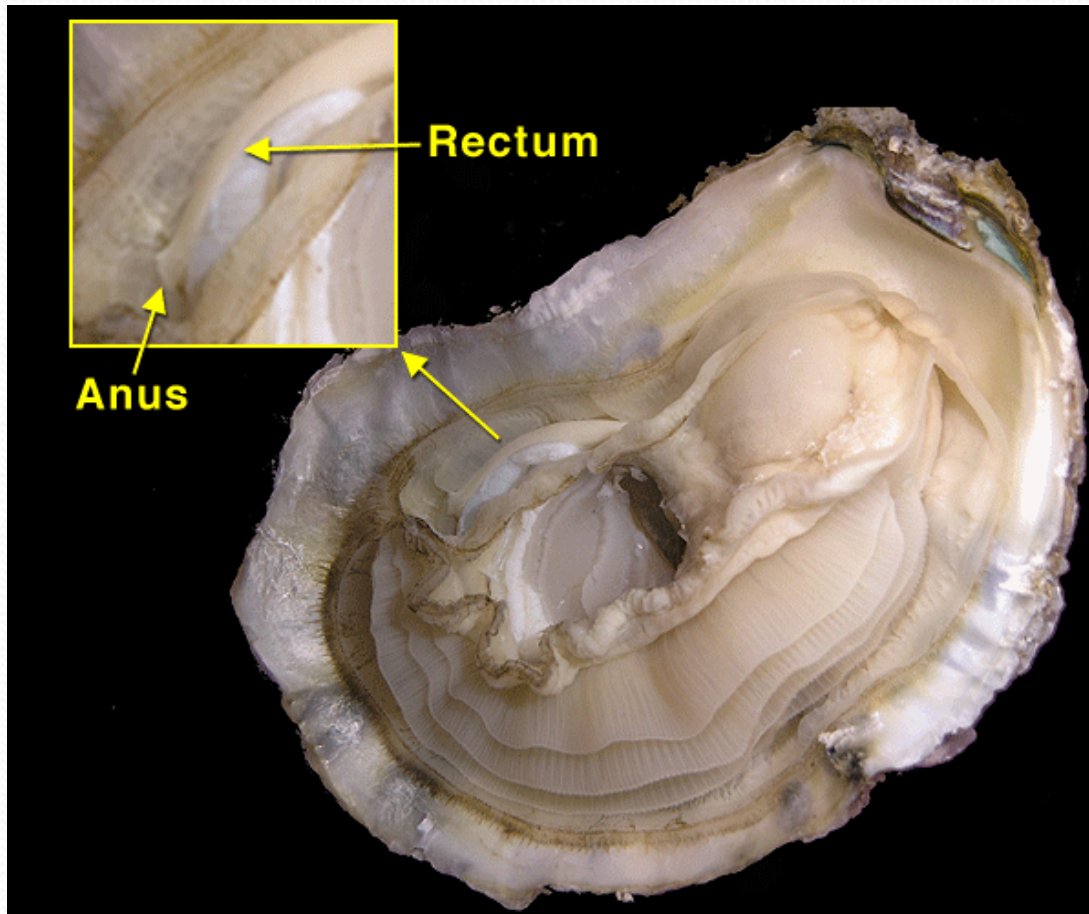
Adult can clear 25-50 gallons per day of particles as small as 2 microns

Feeding

- "Crystalline style" in stomach
 - Thin, glass-clear organ looks like a worm
 - Grinds phytoplankton like a mortar and pestle
 - Allows nutrients enclosed in phytoplankton silica shell to be released

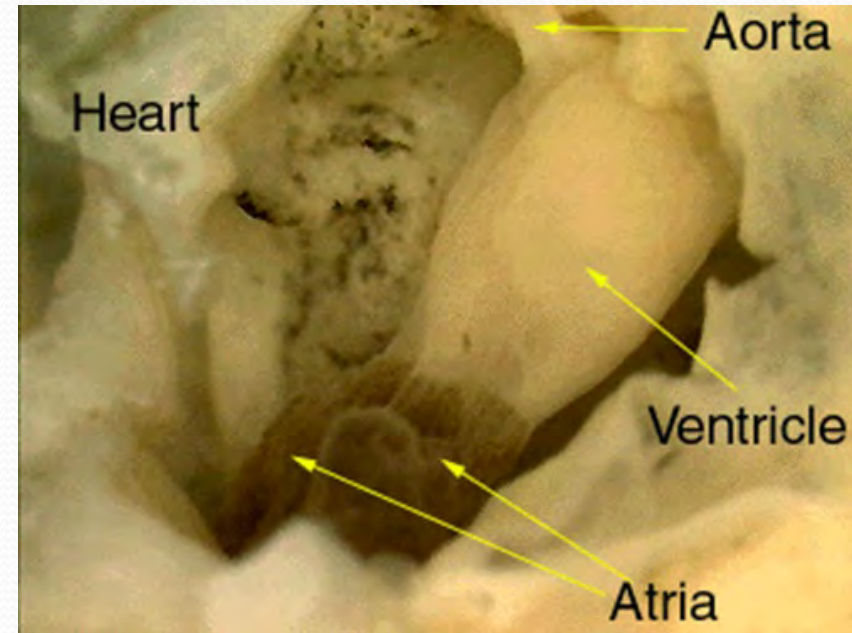
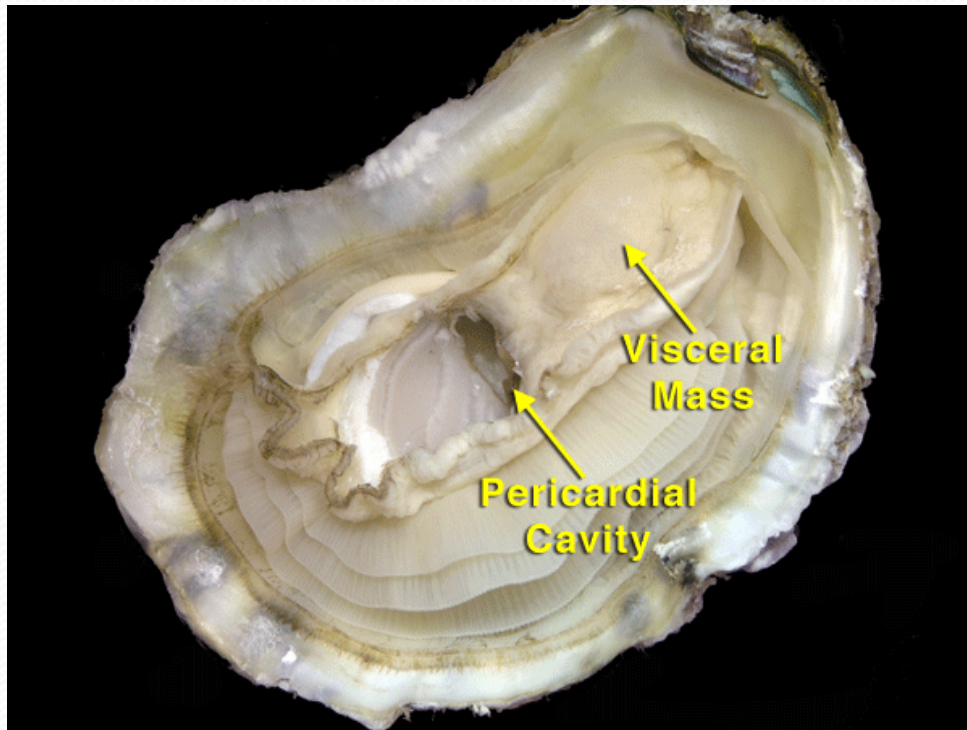


Excretory System



- From stomach, digested materials pass to intestines
 - Absorption of nutrients
 - Processing of wastes
- Waste products pass to rectum and exiting out of anus

Circulatory System

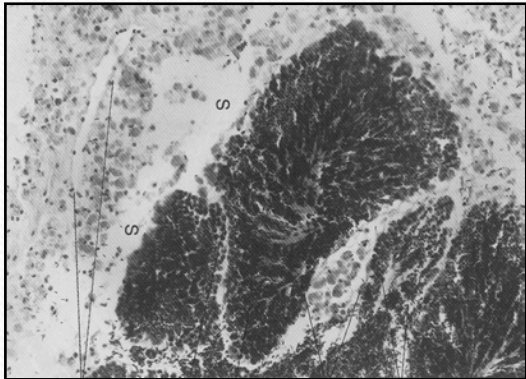


- Heart located in pericardial cavity
- Open system - hemolymph (fluid containing blood cells) circulates through cavities and sinuses of the oyster

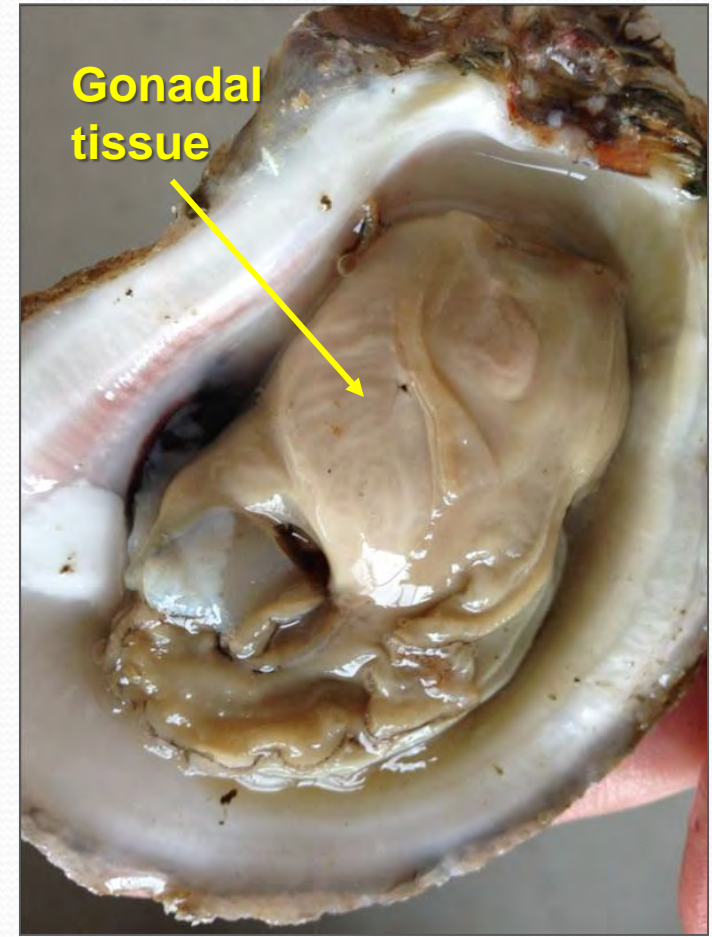
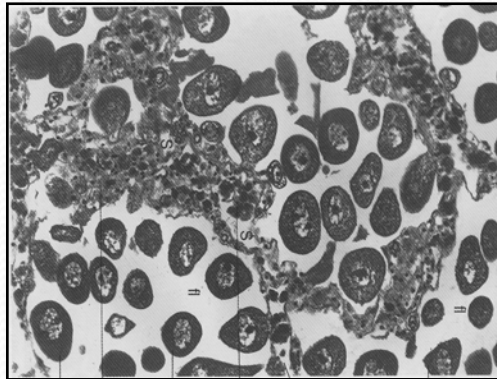
Reproductive System

- Gonadal tissue occurs throughout visceral mass
- Separate sexes but hermaphroditic
- Protandric - spawns as male in first year, becomes female in second year
- Water temperatures $>75^{\circ}\text{F}$ and salinity $>10\text{ppt}$ trigger spawning
- Spawns between March and November

Males - Sperm



Females - Eggs





*He was a bold man that first ate
an oyster. Jonathan Swift, 1700s*