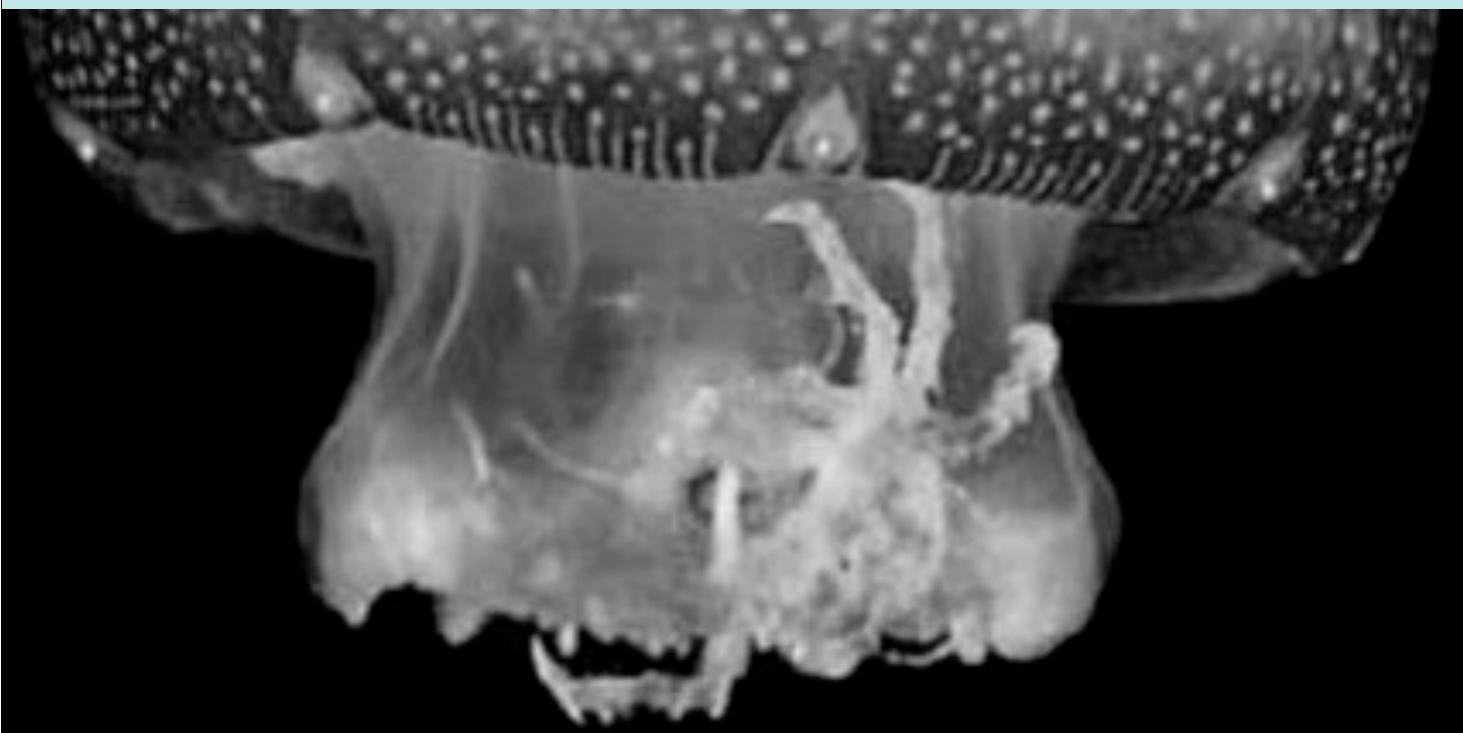
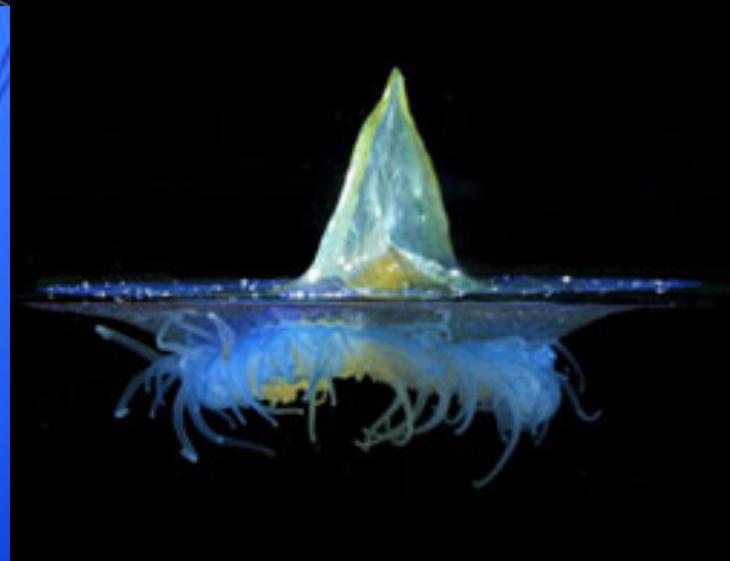
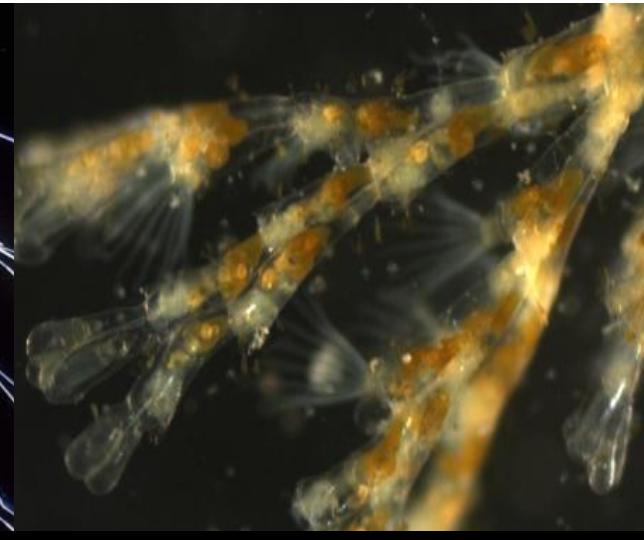
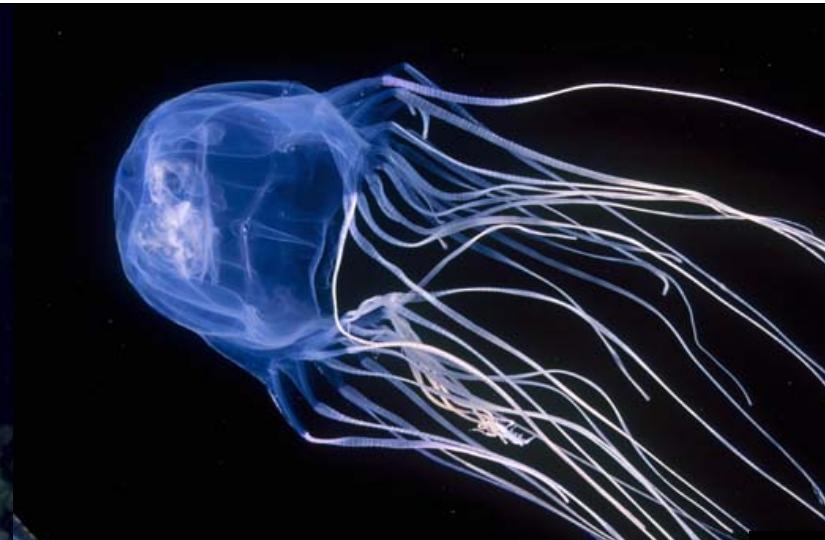


Phylum Cnidaria

Anatomy, Life History, and Taxonomy

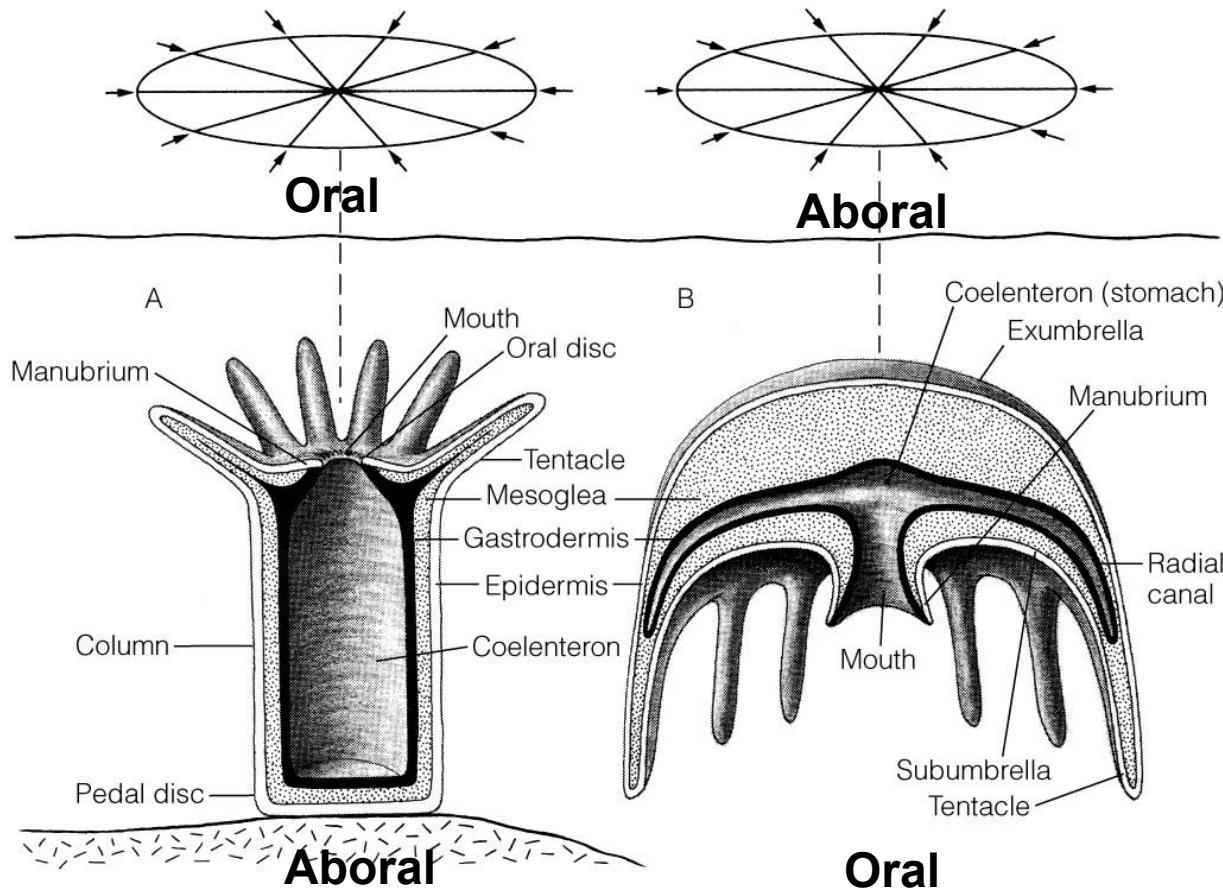


Who are the Cnidarians?



Ecology and Body Plan

- Almost entirely marine
- 10,000 living species have been described



Polyp and Medusa Contrasted

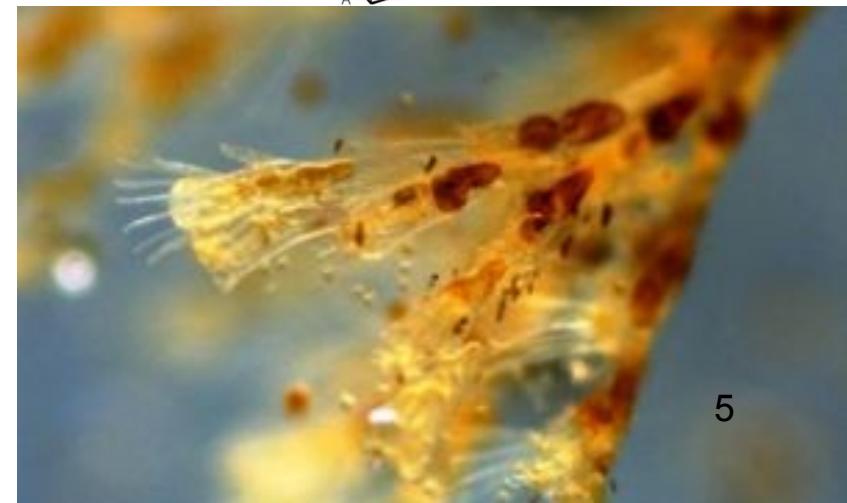
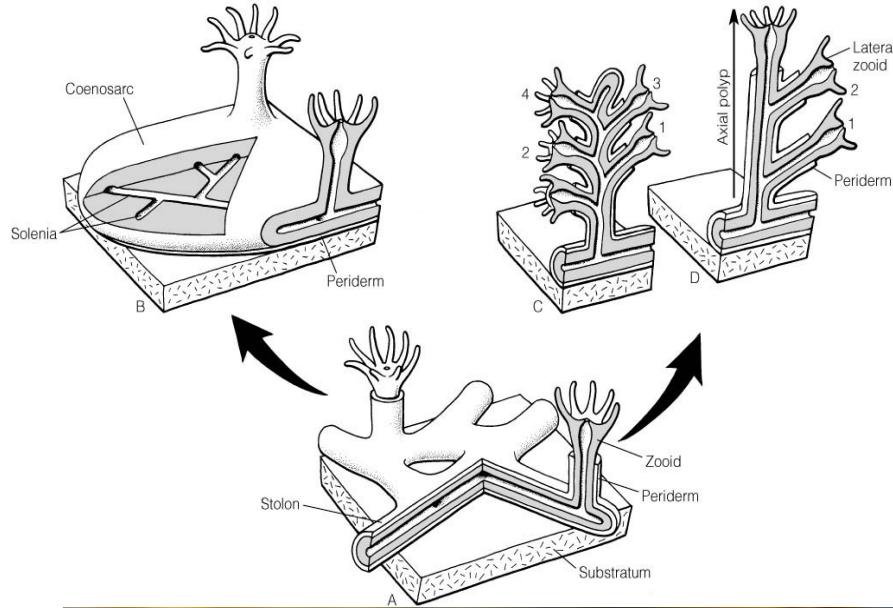
- **Polyp**
 - Attached to substrate
 - Cylindrical shape
 - Thin layer of Mesoglea
 - Often with hard skeleton
 - Reproduce both sexually and asexually
 - Solitary or colonial
- **Medusa**
 - Usually free swimming
 - Saucer or bell shaped
 - Thick layer of Mesoglea
 - Without a hard skeleton
 - Always reproduce sexually; sometimes asexually
 - Usually solitary



Colonies & Polymorphism

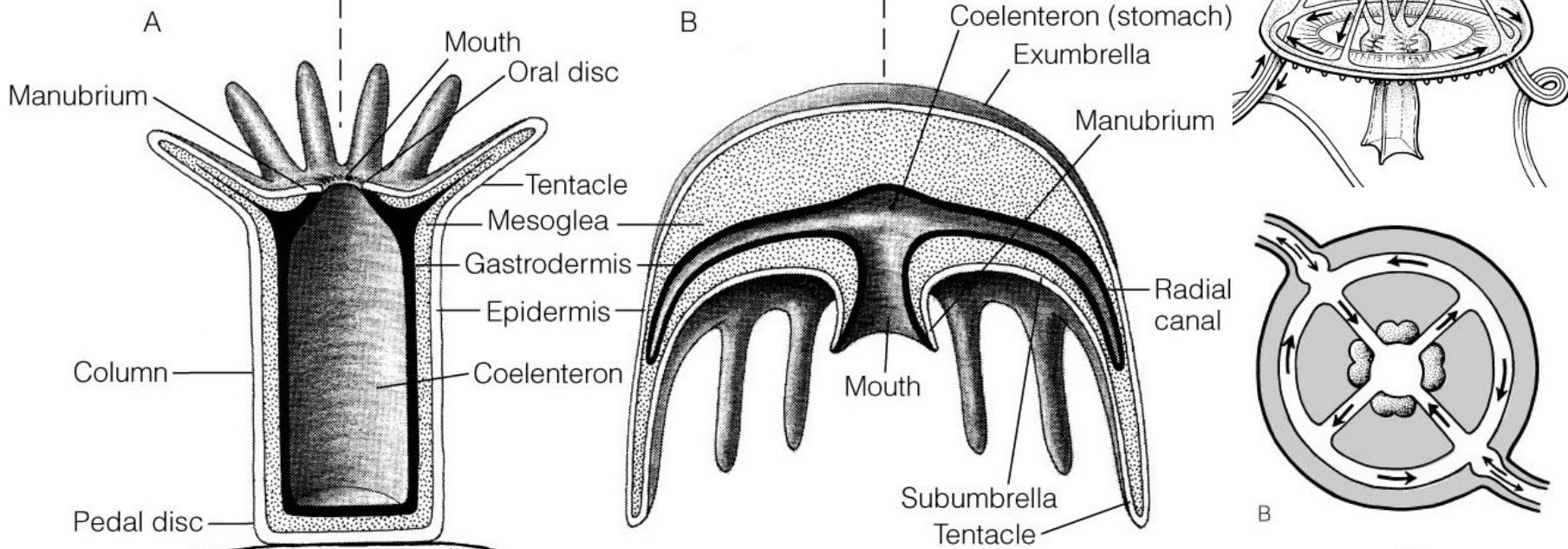
Many Cnidarians form colonies

- Share a common gut & nerve network
- Often accompanied by polymorphism; **zooids**

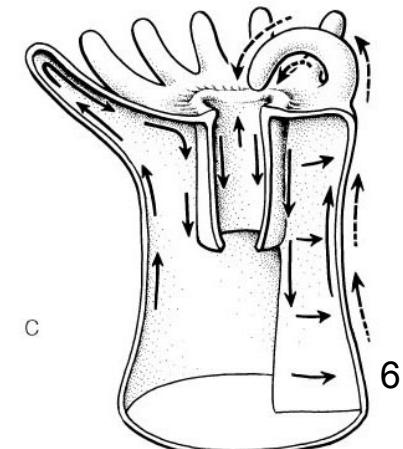


Gastrovascular Cavity

- GVC responsible for circulation

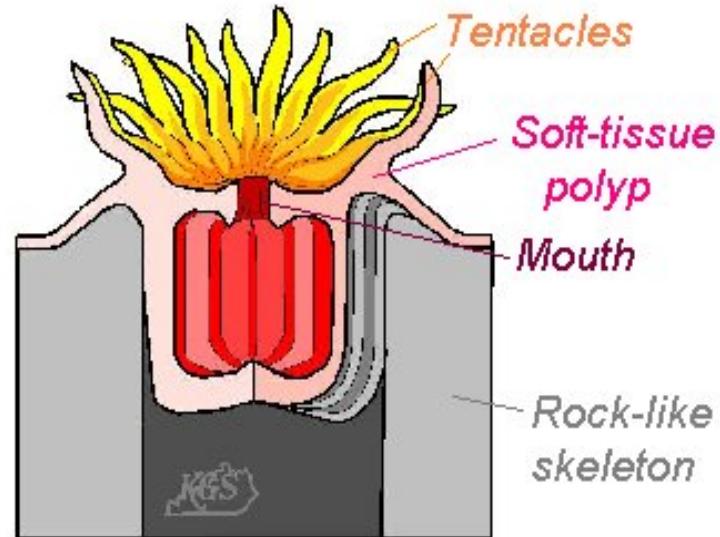


- Respiration occurs by diffusion
- Waste management by diffusion or out of mouth

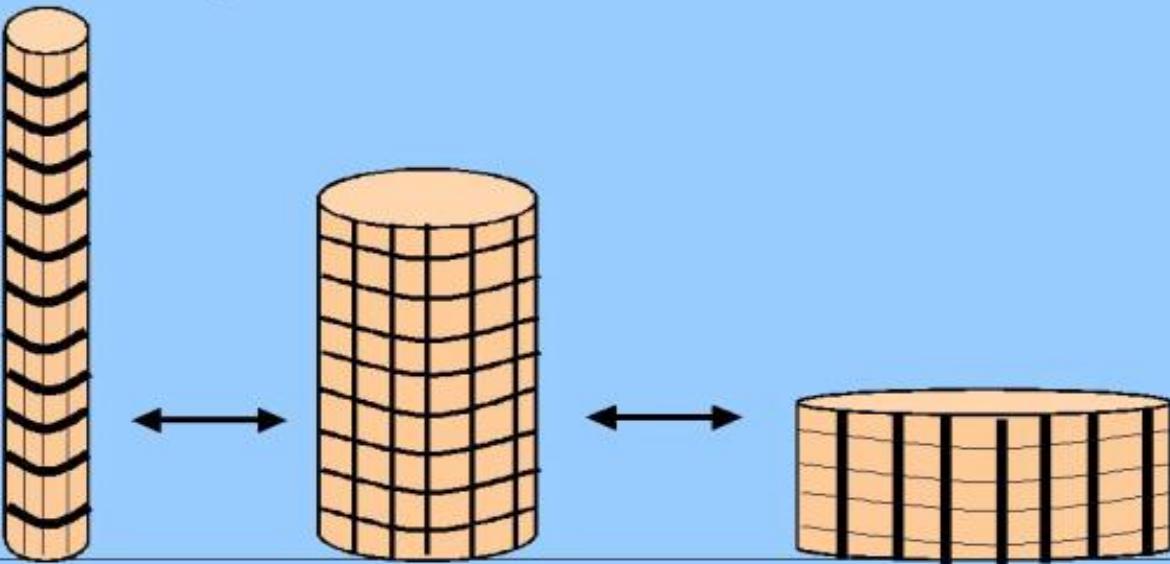


Cnidarian Skeletons

- Internal rods or spicules, external calcium carbonate or proteinaceous skeletons
- Hydrostatic skeleton
 - Muscles surrounding fluid-filled mass
 - Can control size and shape



Hydrostatic Skeleton



©2001, R. Fox, Lander University

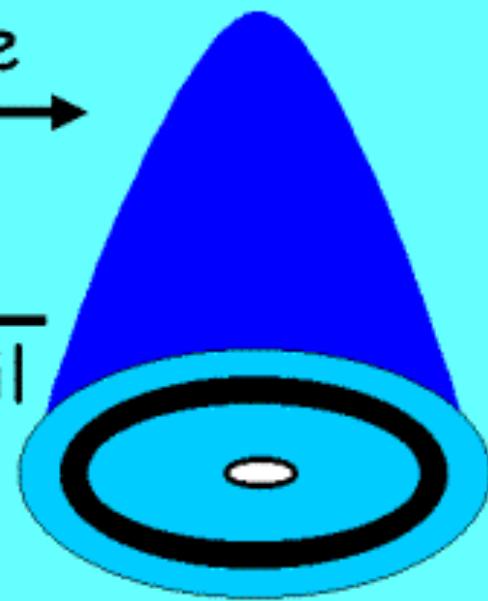
Medusa Locomotion

RELAXED



ring muscle

elastic recoil

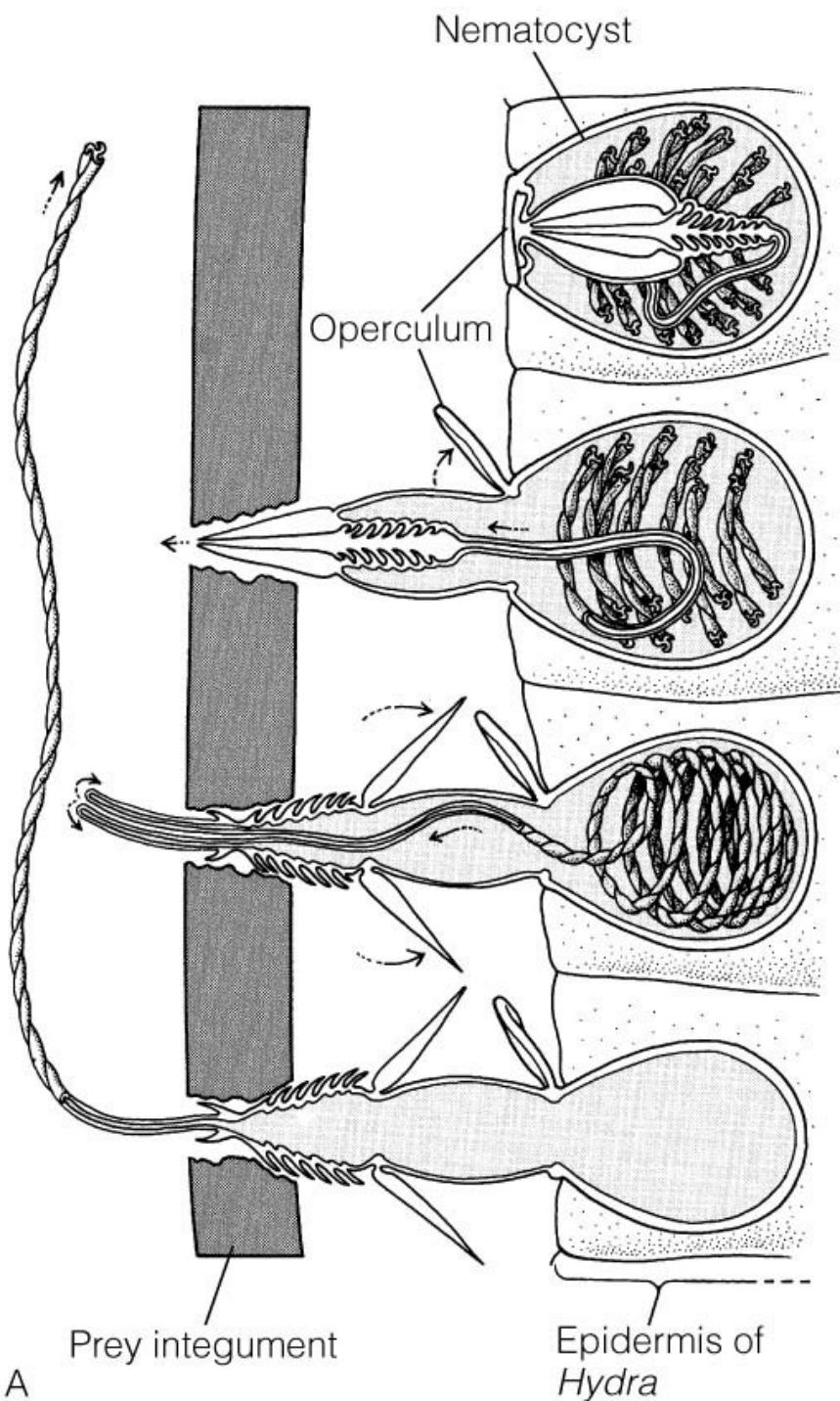


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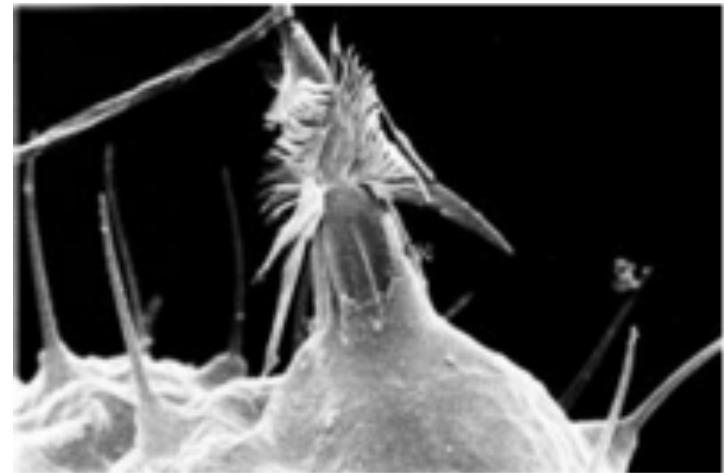
Cnidae (nettle/stinging thread)

- Secreted within cells called **cnidoblasts**; most complex intracellular secretion products known
- 3 major categories of cnidae:
 - **Spirocysts** – anthozoans (corals/sea anemones)
 - **Ptychocysts** – tube anemones
 - **Nematocysts** – most common and well studied (over 30 types; many types in a single species)



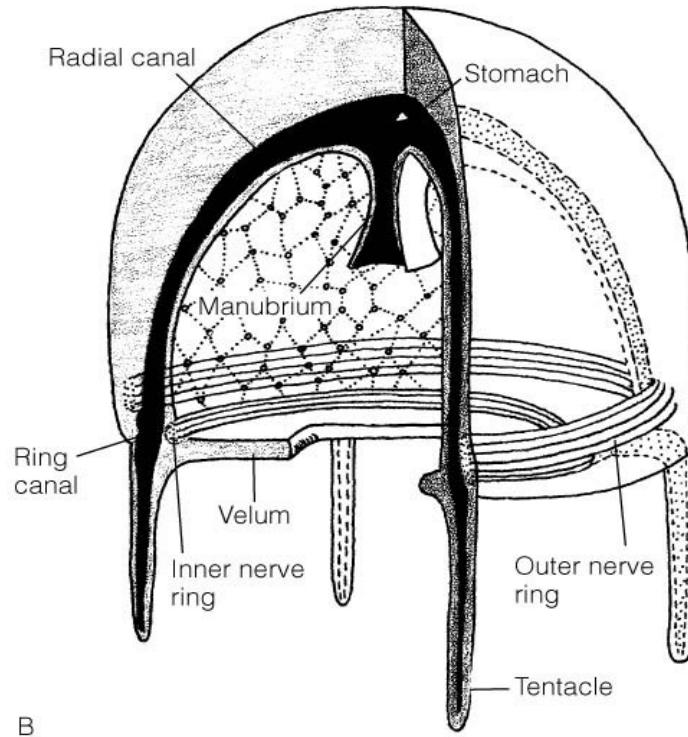
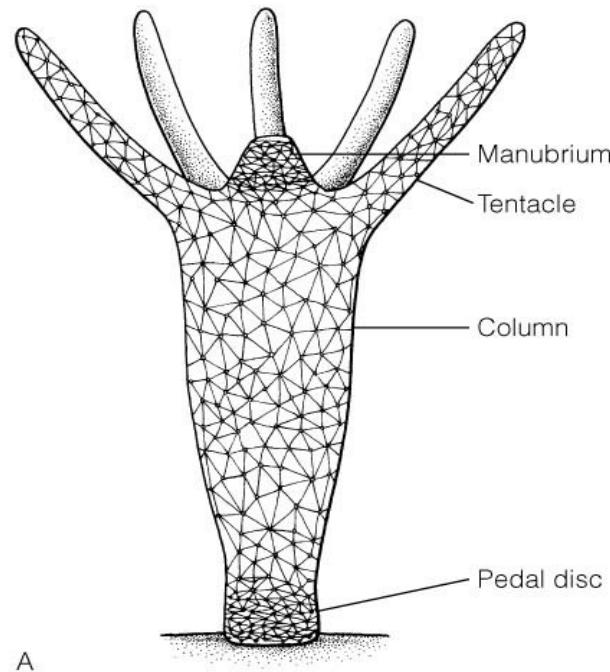
Cnidae con't.

- Stimulation is independent of the nervous system and is generally
 - Chemical (produced by prey or predator)
 - Tactile (contact with the nematocyst)
- **FUNCTION:** food collection, defense, and locomotion
- Generally, nematocysts are species specific; important in species identification



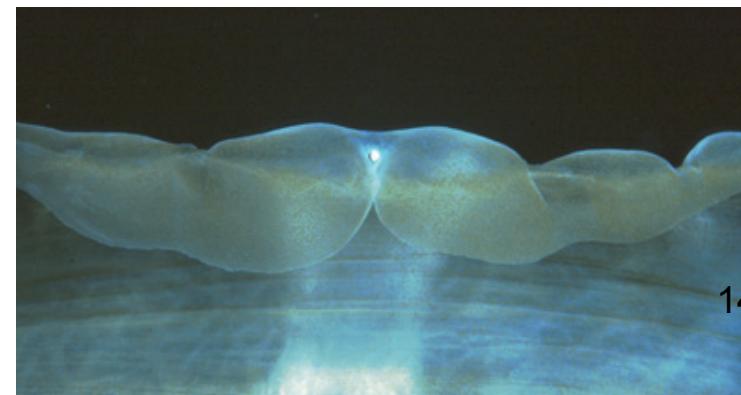
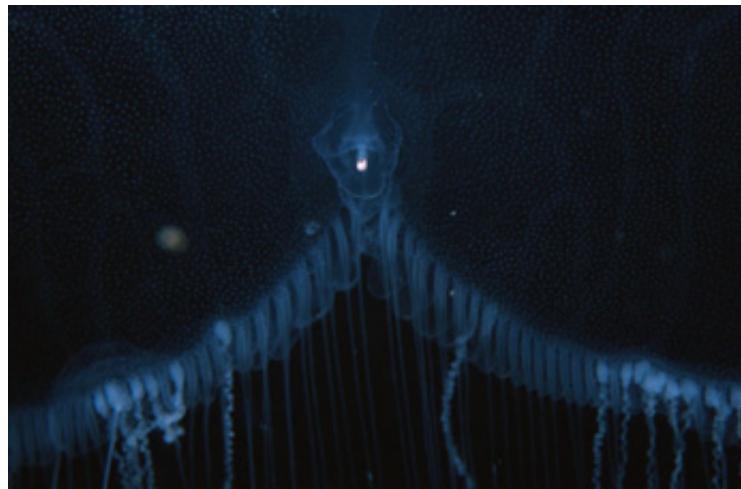
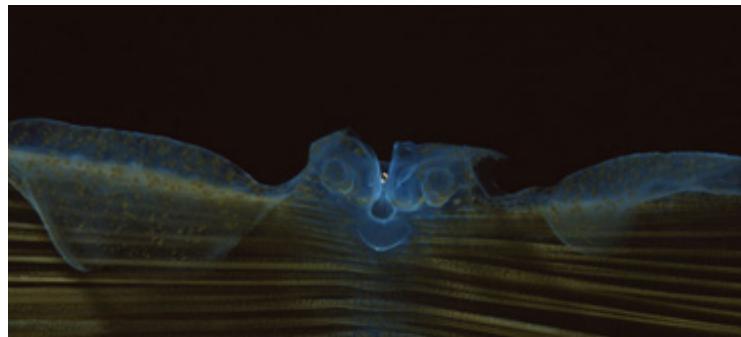
The Cnidarian Nervous System

- No ganglia – not a true CNS
- Nervous system is a “nerve net”
- At each cross the two neurons communicate
 - Stimulation radiates away from source of contact



Cnidarian Sensory Organs

- Sensory organs in the Cnidarians include:
 - Statocysts – balance organ
 - Ocelli – light receptor
 - Sensory lappets – touch receptor
 - Statocysts and ocelli are contained within club-shaped structures called **rhopalia**
- * Characteristic of Scyphozoans



Cnidarian Reproduction

- Gametes originate from undifferentiated epithelial cells
- No specialized ducts for carrying out gametes
 - Gametes shed into the gut leave by the mouth or pores in the tentacles
- Most Cnidarians are dioecious
 - Separate sexes
- Others are hermaphroditic
- Reproduction and life cycles in Cnidarians vary greatly

Cnidaria Development & Primitive Lifecycle

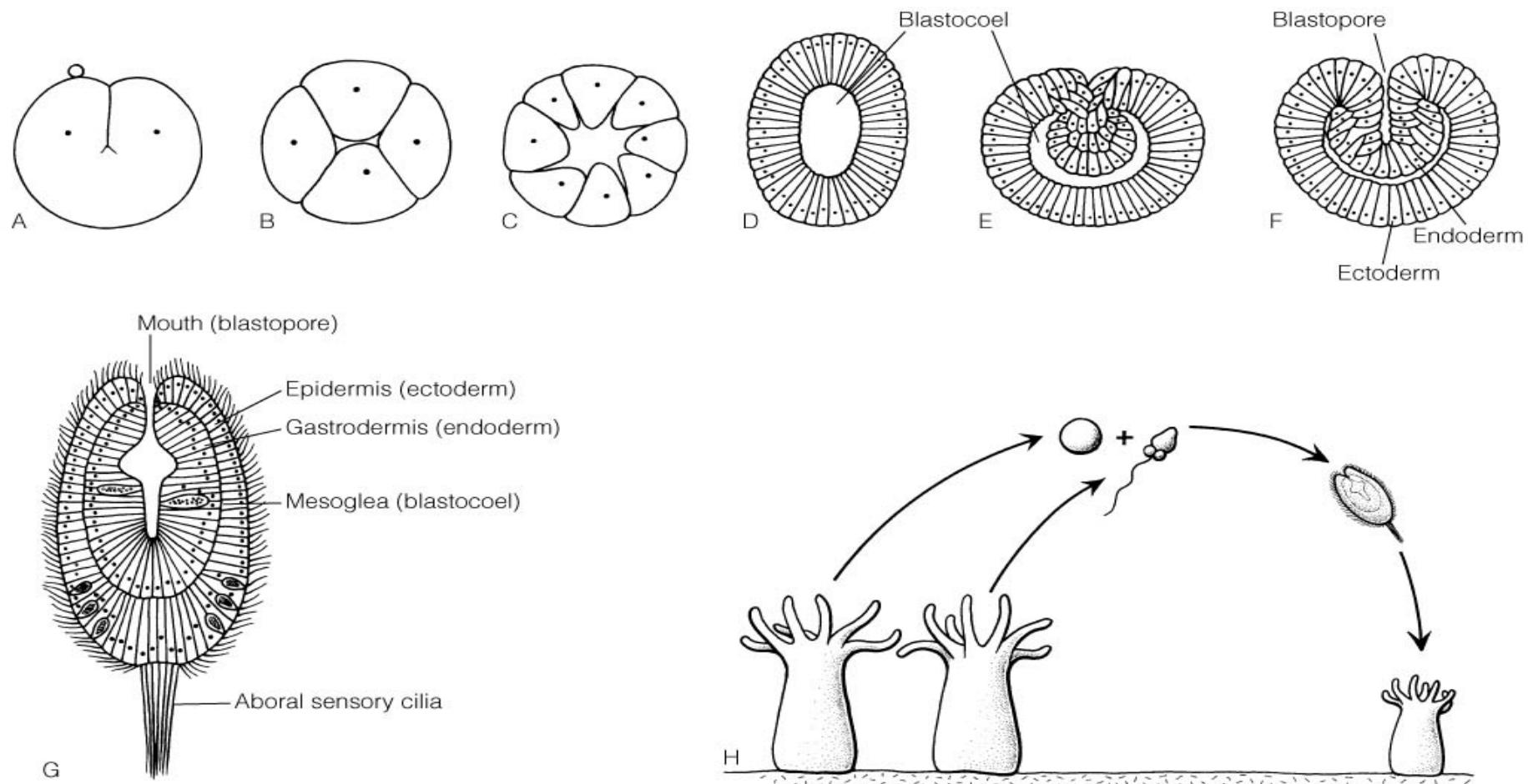
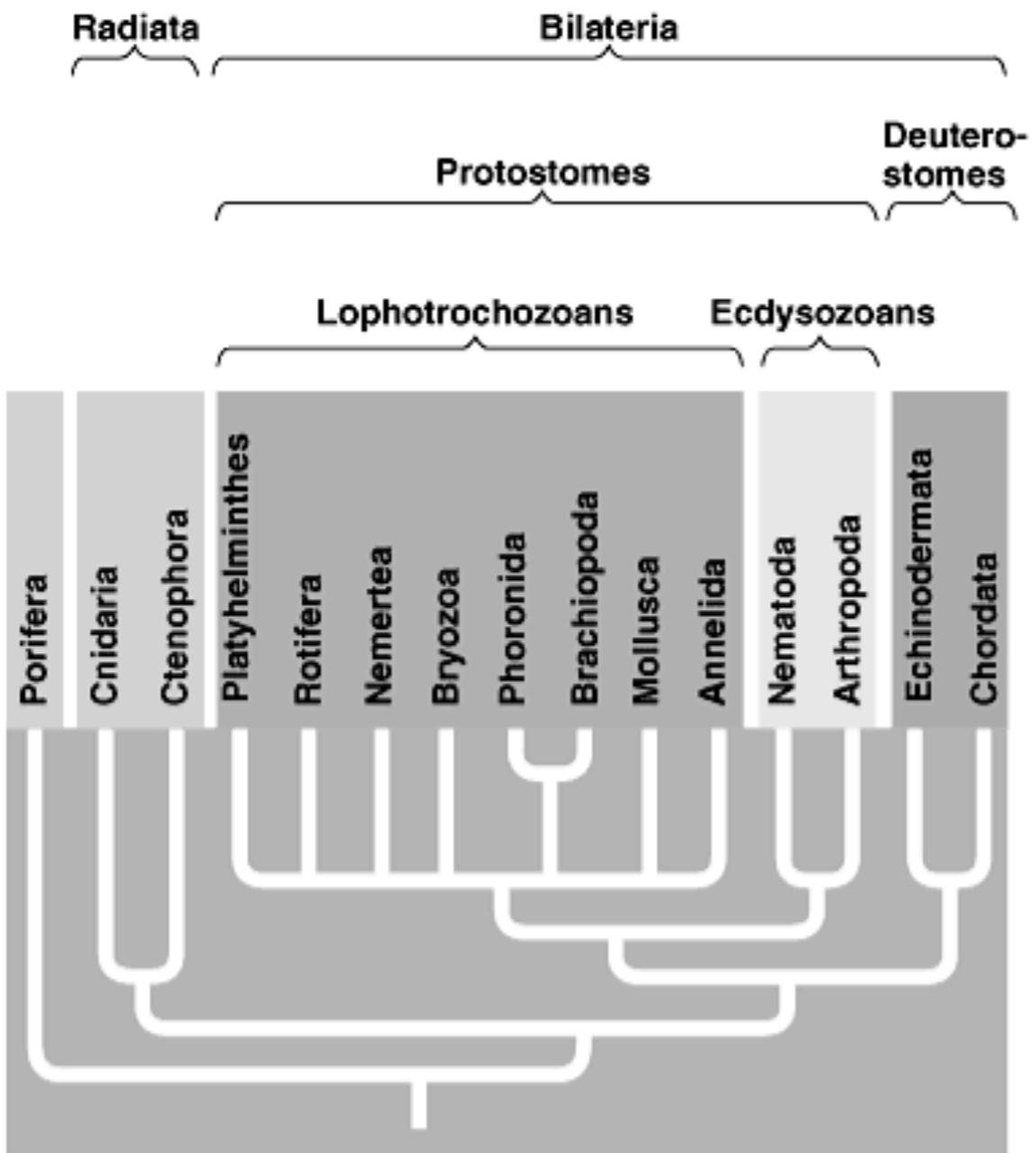
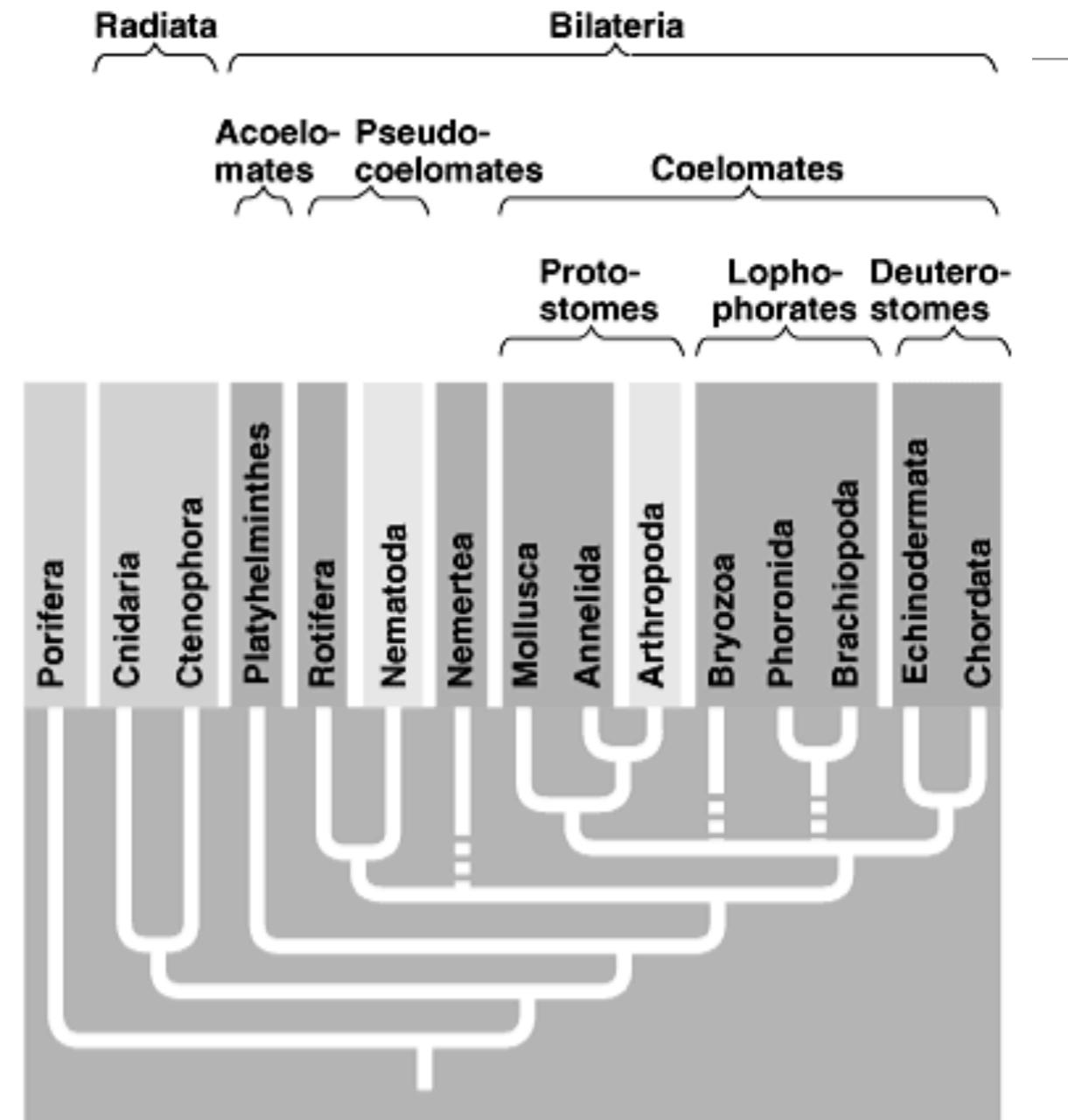


FIGURE 7-14, page 124: Cnidaria: development, larva, and life cycle. A-F, Embryonic development. G, Longitudinal section of an anthozoan planula. H, The presumed primitive life cycle.



(a) Tree based on molecular comparisons



(b) Tree based on body-plan grades

Cnidarian Asexual Reproduction

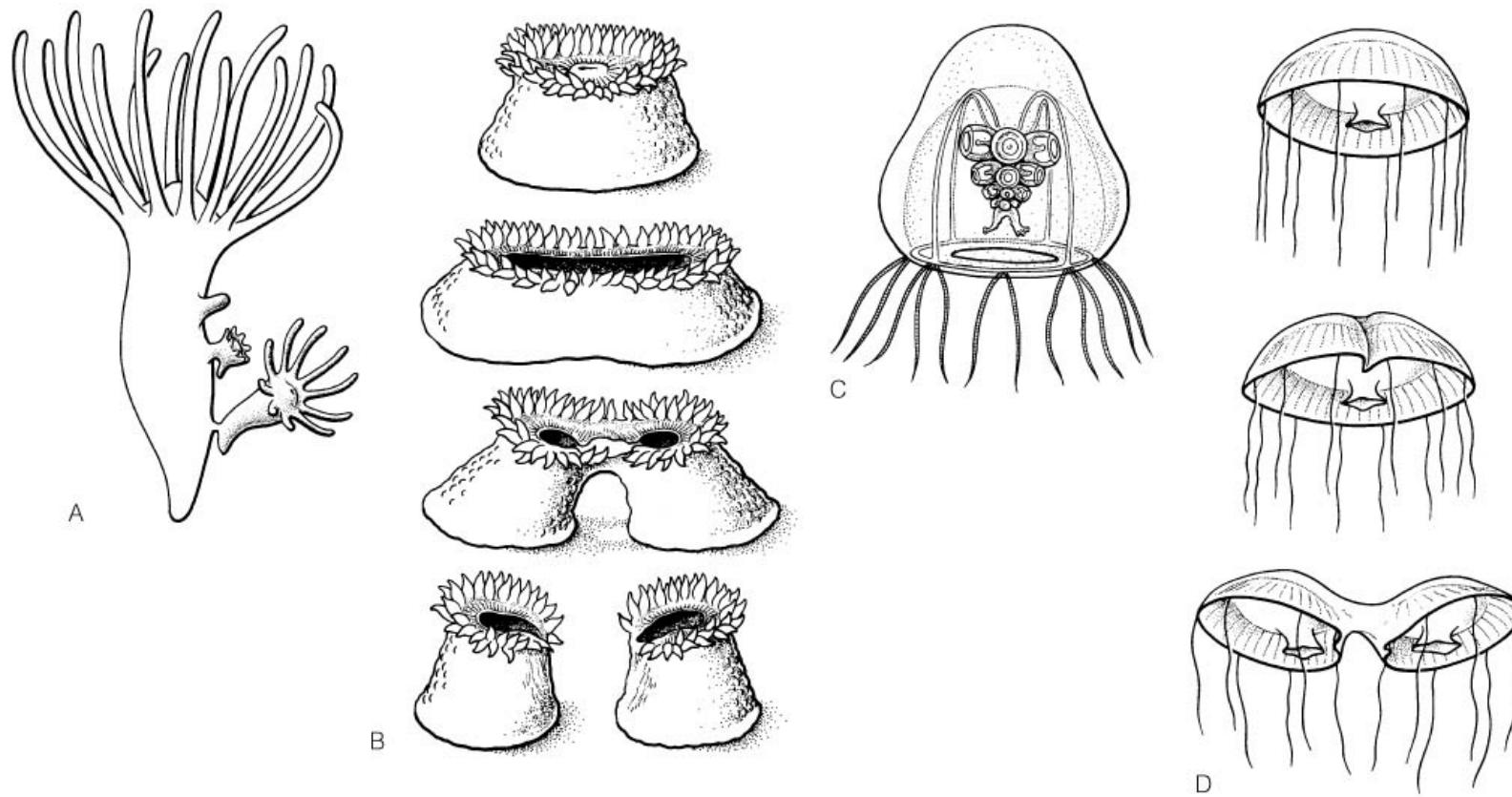
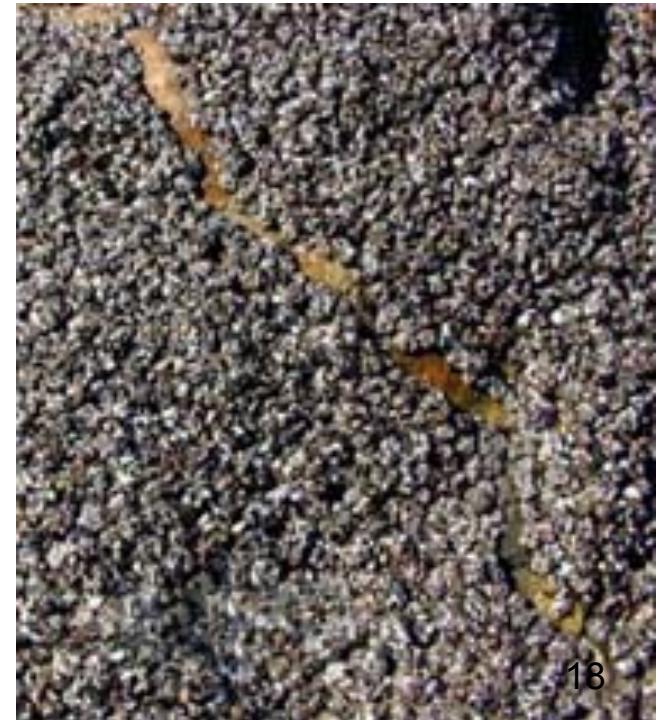


FIGURE 7-13, page 123: Cnidaria: clonal (asexual) reproduction.
A, Budding (polyp). **B, Longitudinal fission (polyp).** **C, Budding (medusa).** **D, Longitudinal fission (medusa).**

© 2004 Brooks/Cole-Thomson Learning

Cnidarian Asexual Reproduction

- Local example: *Anthopleura elegantissima*
 - Aggregate sea anemone
 - Undergoes binary fission
 - Split apart into two anemones
 - Clones of each other



Starting to
divide in
the
laboratory



2 hours
later



3 days
later



Taxonomy of Phylum Cnidaria

- Four Main Classes
 - Anthozoa
 - Subclass Hexacorallia (= Zoantharia)
 - Subclass Octocorallia (= Alcyonaria)
 - Hydrozoa
 - Scyphozoa (Staurozoa?)
 - Cubozoa
- *Myxozoa & Polypodiozoa: microscopic parasites - intermediate between cnidarians and bilaterian animals

Class Anthozoa

- Members of this class include:
 - Sea anemones, soft corals, hard corals, and sea pens



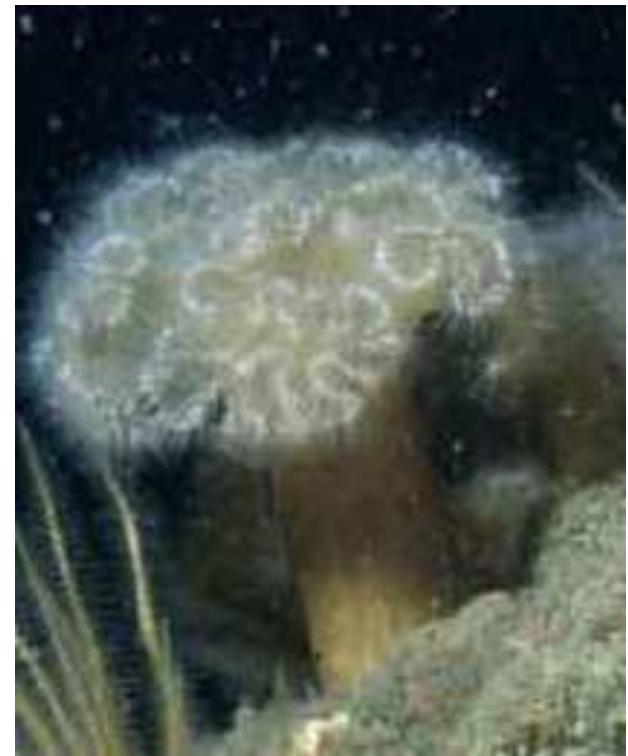
Anthozoan Characteristics

- No medusa
- Reproduce sexually or asexually
 - Gonads derived from the gastrodermis
 - Hermaphroditic or dioecious
 - Asexual reproduction highly developed
 - Fission
 - Pedal laceration



Anthozoan Characteristics

- Solitary or colonial
- Most carnivores, some suspension feeders (cilia/mucus)
- Some have symbionts



Filter feeding *Metridium*

Aggregating anemone, *Anthopleura elegantissima* have algal symbionts

Subclasses of Anthozoa

- Subclass Hexacorallia (=Zoantharia)
 - Sea anemones, stony (true) corals
 - Can be solitary or colonial but never polymorphic
 - Almost all carnivores
 - Tentacles and septa usually in multiples of 6 (hexa)
 - Skeleton when present usually external



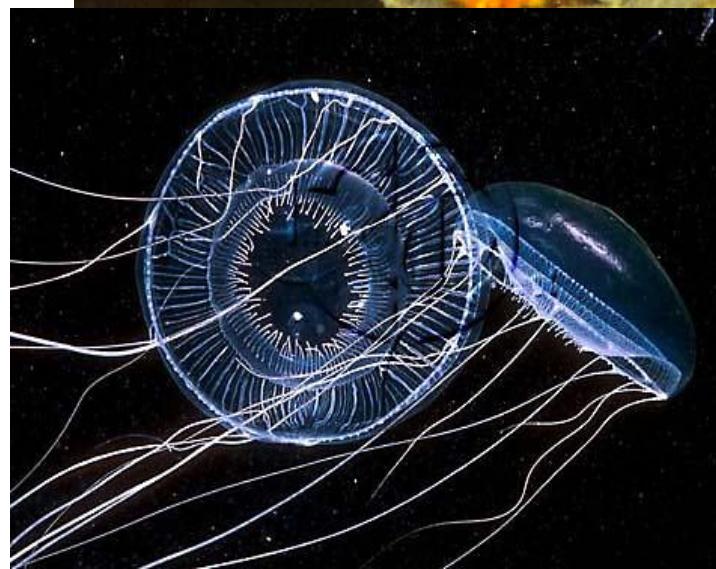
Subclasses of Anthozoa

- Subclass Octocorallaria (=Alcyonaria)
 - Soft corals and relatives
 - 8 branched feather-like tentacles per polyp
 - Pinnate – lateral outfoldings called pinnules
 - Only 8 septa
 - All colonial & polymorphic
 - Skeleton when present is internal
 - Spicules, tubes, or rods in the mesoglea



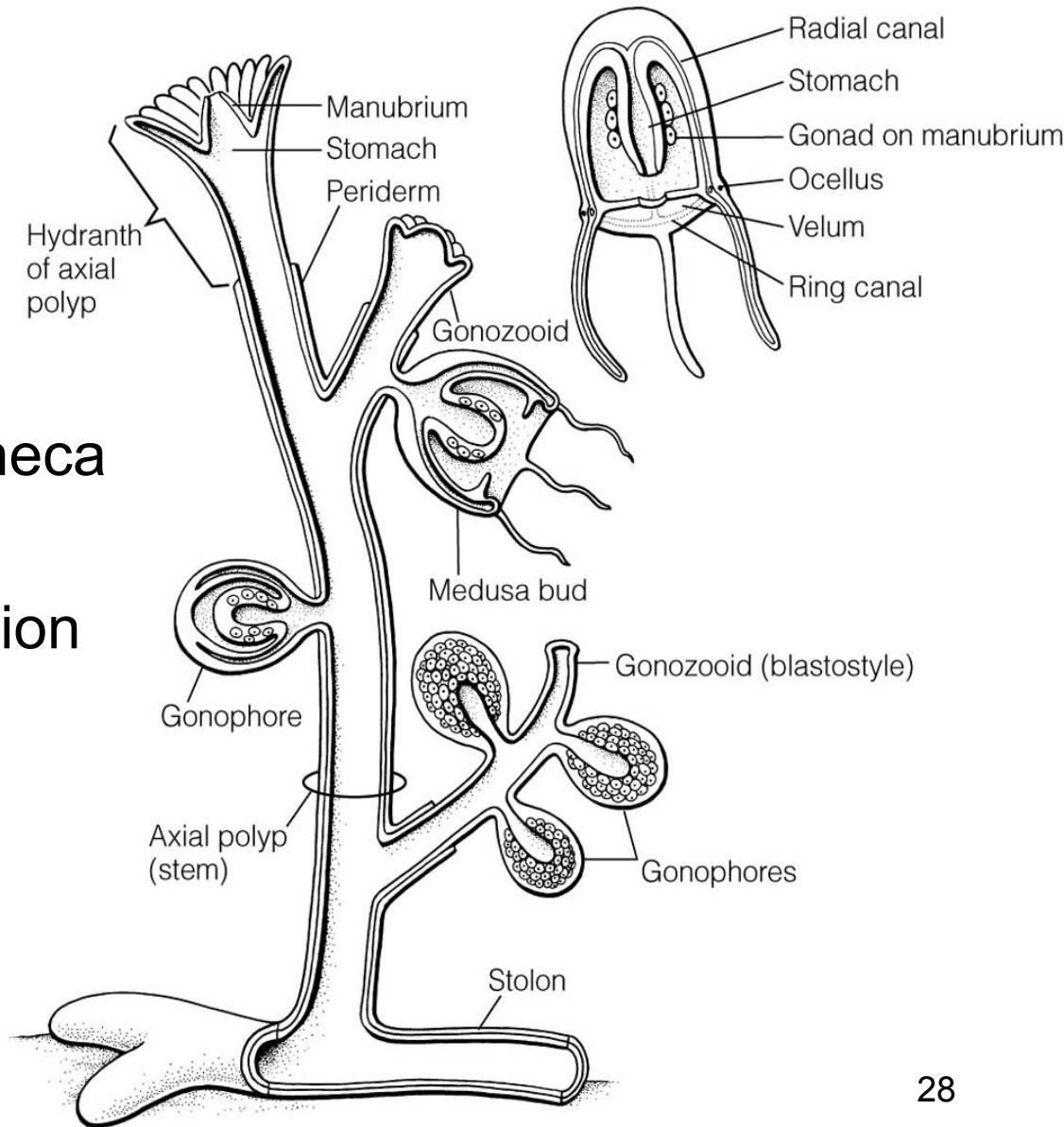
Class Hydrozoa

- Members of this class include:
 - Hydroids, Siphonophores, & Hydrocorals
 - 3,000 living species
- Have both polyp and medusa stage
 - Multiple stages at once
 - Some only one stage
- Gastrodermal tissue **lacks** cnidae (only epidermis)
- No cells found within mesoglea

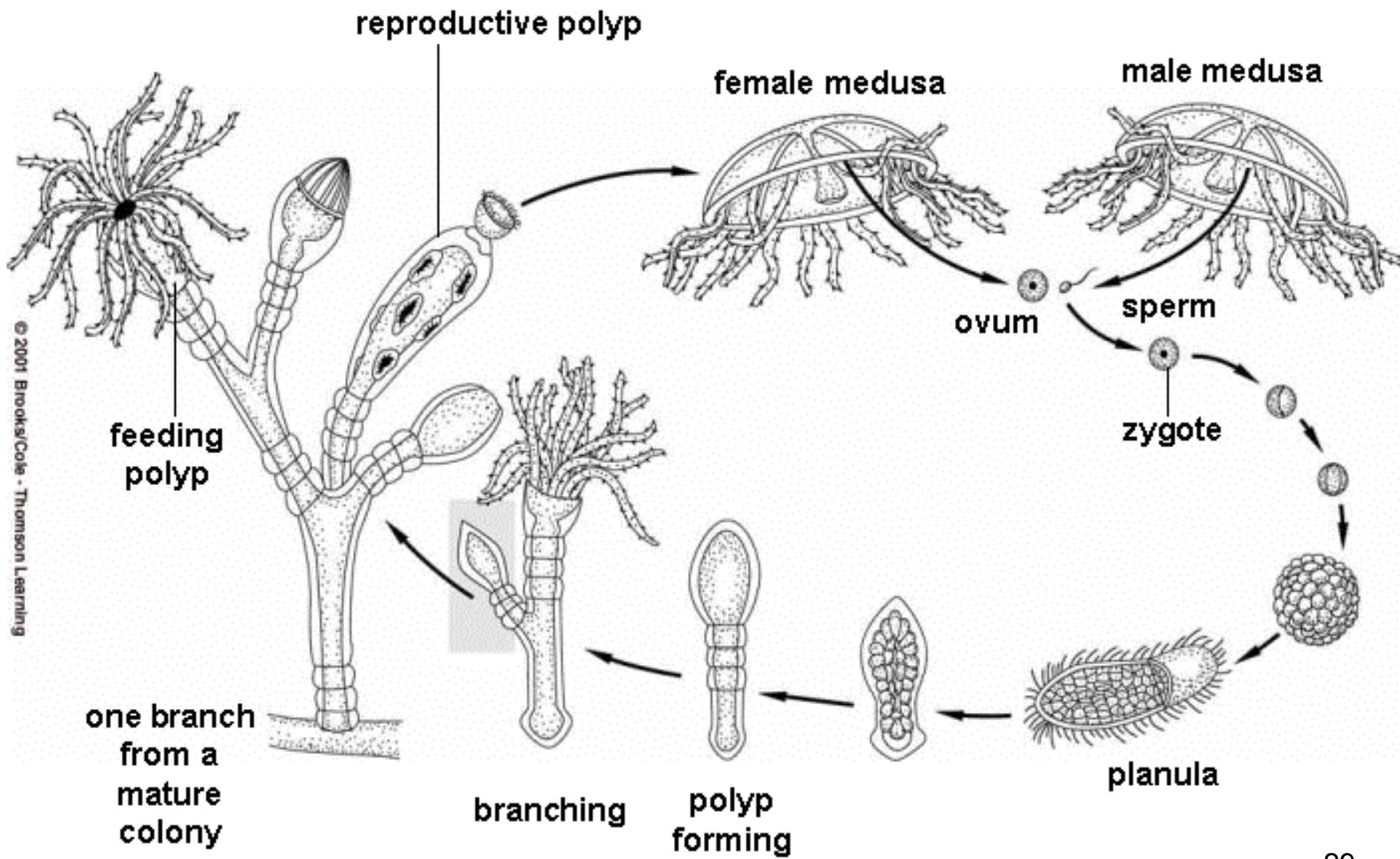


Hydrozoan Morphology

- **Polyp** parts to note:
 - Stolon
 - Gastrozooid -feeding
 - Hydranth
 - cup surrounding hydranth – Hydrotheca
 - Thecate/Athecate
 - Gonozoooid -reproduction
 - Medusoids
 - Dactylzoooid –defense
- **Medusa** parts to note:
 - Velum



Obelia Life Cycle (Hydrozoan)



Hydrozoan Taxonomy

- Order Hydrodia – hydroids & hydromedusae
- Order Siphonophora – Portuguese man-of-war, Siphonophores
- Order Hydrocorallina – fire coral



*Millepora
platyphylla*



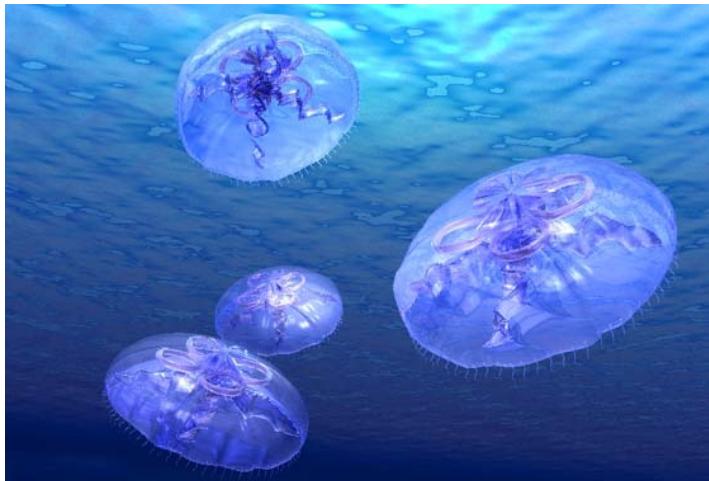
Aglantha digitale



Physalia physalis

Class Scyphozoa

- Members of this class include:
 - True jellyfish
 - 200 species



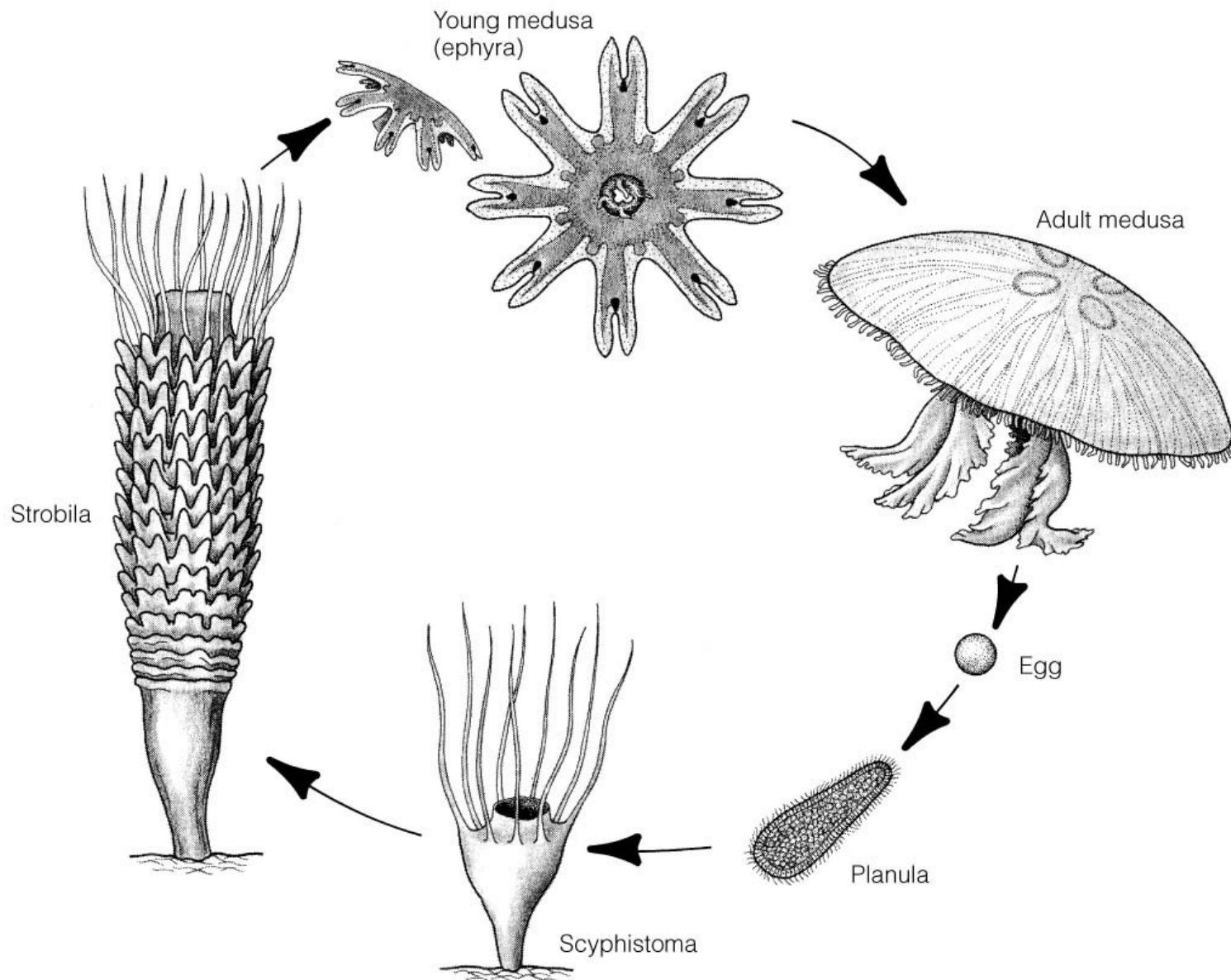
© EE Ruppert & RS Fox

- Mostly medusae
 - Small polyp-like asexual stage seen in some groups

Class Scyphozoa

- Characteristics of the Schyphozoan medusae:
 - **Medusoid** morphology
 - No velum
 - Edges of mouth drawn out into long muscular cylinder - **manubrium**
 - Gonads are gastrodermal in the GVC
 - Feed using cnidae on tentacles, few use cilia and mucus
 - **Rhopalia** on margins of swimming bell
 - Asexual replication by **strobilation**

Generic Scyphozoan Life Cycle



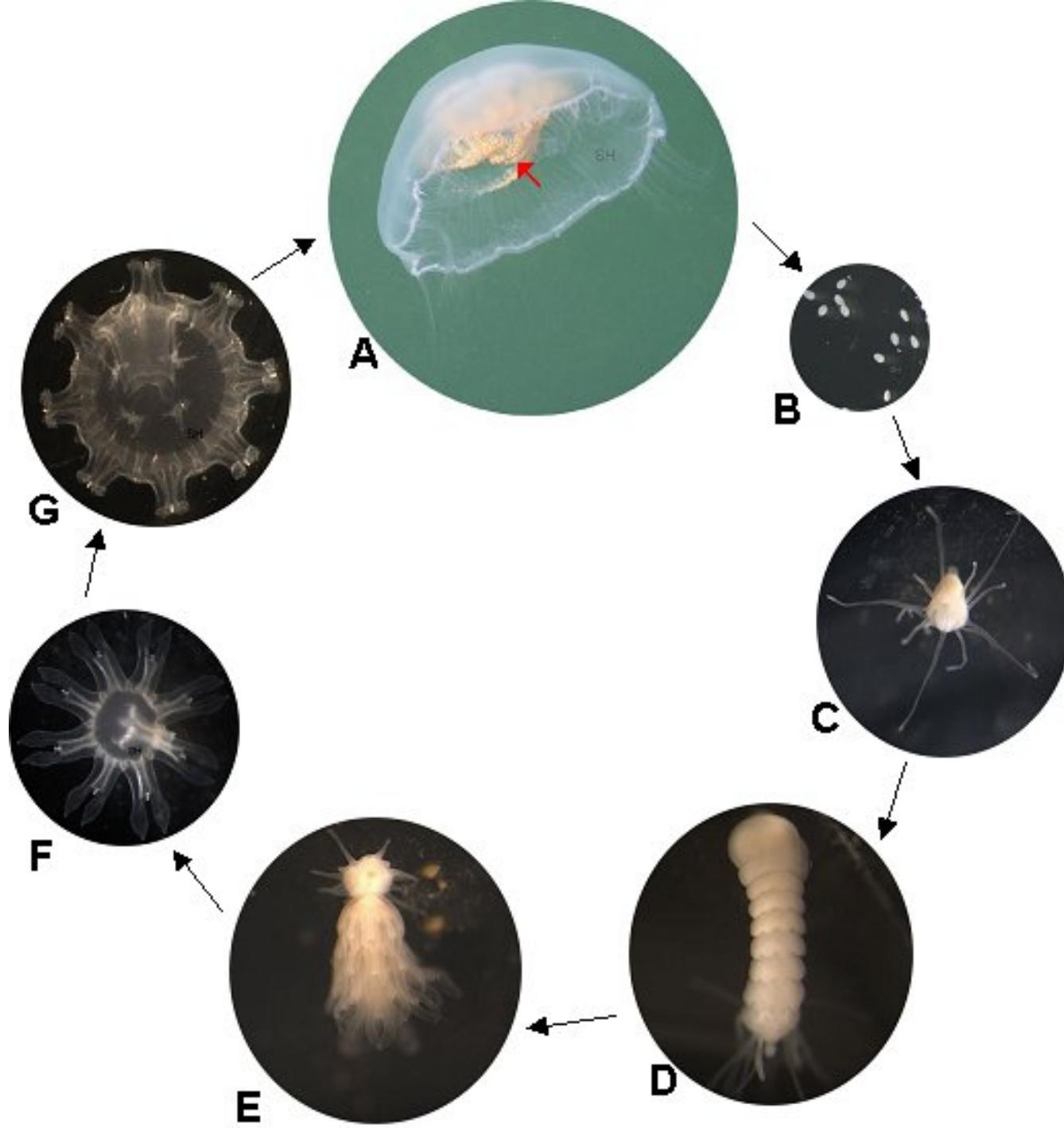


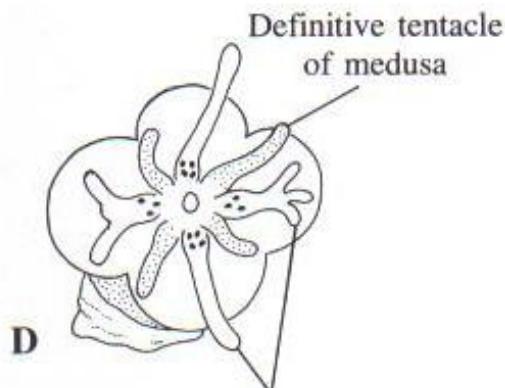
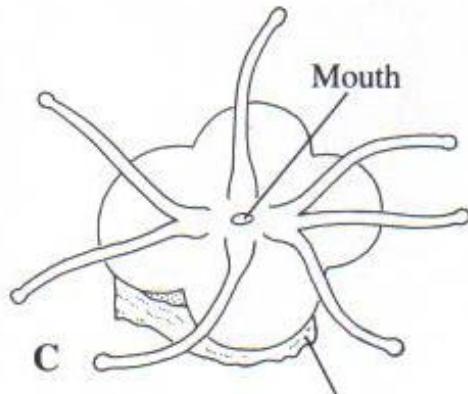
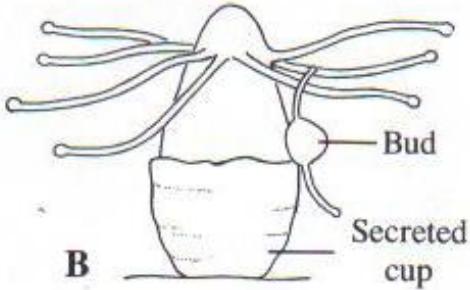
Fig. 1. Life cycle of the moon jellyfish *Aurelia aurita*. **A** Mature female medusa (30 cm in diameter) carrying **planula larvae** (red arrow) in brood pouches in the oral arms. **B** released, free-swimming **planulae** (0.2-0.3 mm). **C** Polyp (1-3mm). **D** Beginning **strobilation**. **E** Advanced **strobilation**. **F** Young **Ephyra** (3-5mm). **G** Ephyra, 4 weeks after release (8-10mm).

Class Cubozoa

- Members of this class include:
 - Box Jellies
- Characterized by:
 - Tall square bell
 - Solid tentacles
 - w/ either four of them or four groups of them
 - Lots of complex eyes
 - Efficient in orientation
 - Nasty nematocysts with neurotoxins
 - Range from Indian Ocean to Coral Sea



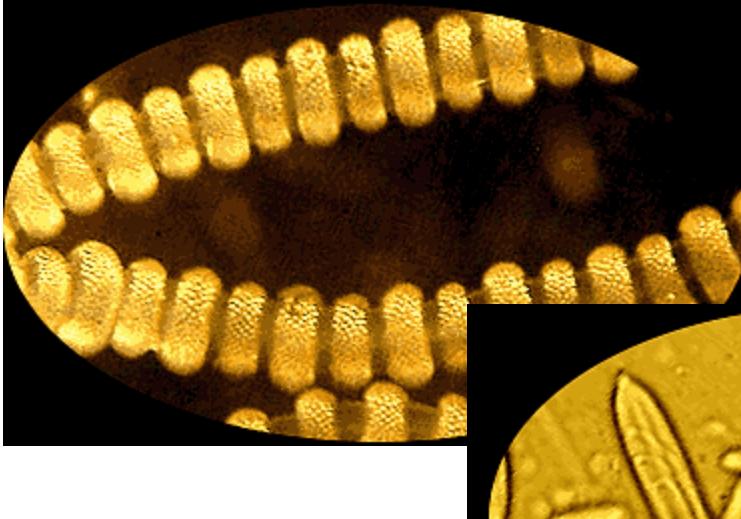
Cubozoan Life Cycle



Polyp tentacles (as these regress, their basal portions, which contain masses of dark pigment, develop into rhopalia)



Tripedalia cystophora



Review: Defining Characteristics of Cnidarians

- possess complex intracellular organelles called **cnidae**
- **Planula larvae** - free-swimming, flattened, ciliated, bilaterally symmetric larva
- All have basic **radial symmetry**
- **Diploblastic** – possess 2 layers of living tissue (epidermis and gastrodermis) with **mesoglea** inbetween
- All have tentacles around the mouth
- A **single** opening to the digestive system

MINI ASSIGNMENT FOR NEXT LECTURE

	Anthozoa	Cubozoa	Hydrozoa	Scyphozoa
Medusa stage				
Polyp stage				
Location of Gonads				
Skeleton type				
velum in medusa stage				
Stage w/sexual reproduction				
cnidae				43

Questions?

