

BIO 221

Invertebrate Zoology I

Spring 2010

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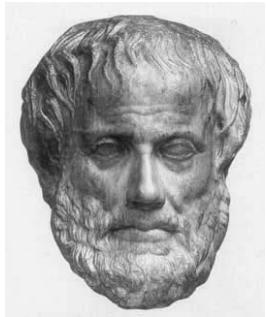
Lecture 9

Phylum **Cnidaria:** Hydroids, jellyfish, anemones, corals.

Historical Remarks

Aristotle (384-322 BC)

- a. Classified different groups according to body type.
- b. Identified the “radiate animals” as distinct from the “bilateral animals.”



Historical Remarks

Jean-Baptiste Lamarck
(1744-1829)

- a. Coined term ***Radiata***.
- b. Based on radial symmetry (following Aristotle).
- c. However, we will see that body symmetry can be somewhat misleading.



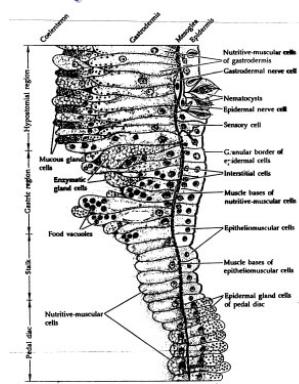
Historical Remarks

Coelenterata

- 3. More recent, but no longer used, although Conway Morris suggests that this term is still meaningful.



Phylum Cnidaria



See On Characteristics of the Phylum Cnidaria

1. Diploblastic metasoa with ectoderm and endoderm separated by a (primarily) ectodermally derived acellular mesoglea or partly cellular mesenchyme.
2. Possess radial or radial symmetry, often modified as biradial or quadriradial; primary body axis is oral-aboral.
3. Possess unique stinging or adhesive structures called cnidocytes that reside in and trigger by one cell, a cnidoblast. The most common cnidocytes are called nematocytes.
4. The ectodermally derived gastrovascular cavity (coelenteron) is the only "body cavity".
5. The digestive cavity (coelenteron) is a siphon or tube with a single opening, which serves as both mouth and anus.
6. With no head, no centralized nervous system, and no discrete gas exchange, excretory, or circulatory systems.
7. Nervous system is a simple nerve net(s), composed of naked and largely nonpolar neurons.
8. The musculature is formed of epitheliomuscular cells, derived from ectoderm and endoderm, and of endoderm; the muscle cells are the most primitive in the metazoans.
9. Exhibit alternation of asexual polypoid and sexual medusa generations; but there are many variations on this basic theme.
10. Typically have planula larvae (ciliated, motile, gastrula larvae).

Cnidarian Morphology



a. Body wall characteristic of Cnidaria:

1. Diploblastic
1. two cell layers - *epidermis*, *gasterodermis*
 - a. epidermis - columnar cells
2. thin layer of mesolamella (mesoglea if cellular)

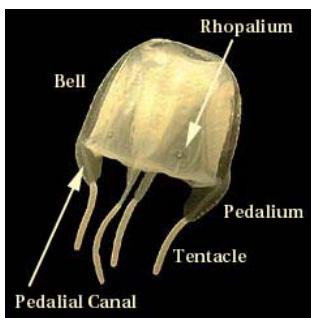
Cnidarian Morphology



c. Mesoglea - inner gel-like material.

1. Provides support, transport.
- d. No distinct internal organs; a nerve net; no coelom

Cnidarian Morphology



b. Sensory, muscular structures associated with food capture, contraction, extension.

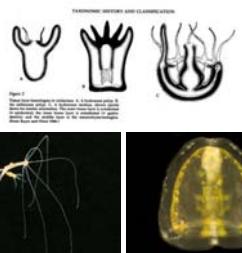
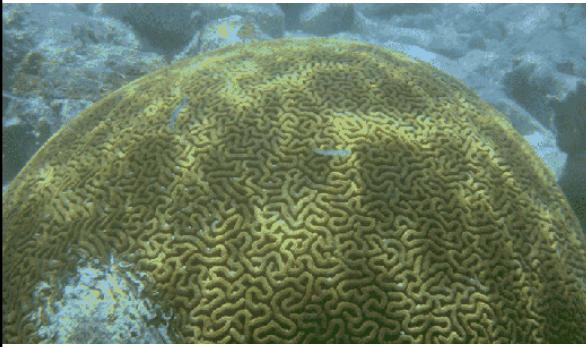
c. *gasterodermis* - inner digestive cells

1. mucous, digestive, absorptive cells
2. some contain *zoochlorellae* - photosynthetic algae.

Cnidarian Rhopalia



Cnidarian Morphology



For One Characteristics of the Phylum Cnidaria

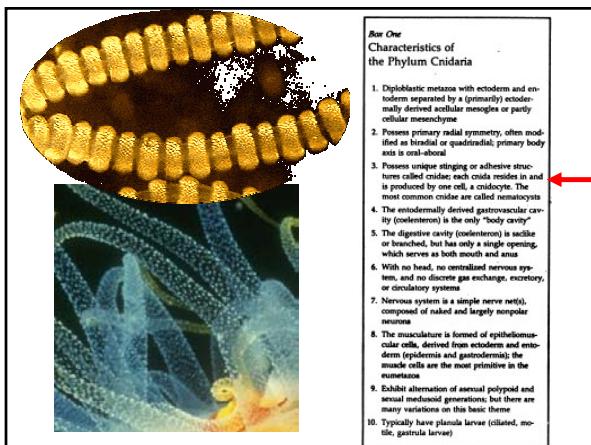
1. Diploblastic metazo with ectoderm and endoderm separated by a (primarily) ectodermally derived acellular mesoglea or partly cellular mesenchyme
2. Possess radial or bilateral symmetry, often modified as bilateral or quadrilateral; primary body axis is oral-aboral
3. Possess unique stinging organelles called cnidocytes, each cell modified in and its processes fused with a coenocyte. The most common cnidocytes are called nematocytes
4. The ectodermally derived gastrovascular cavity (coelenteron) is the only "body cavity"
5. The digestive cavity (coelenteron) is sac-like and, in the polyp stage, is the only opening, which serves as both mouth and anus
6. With no head, no centralized nervous system, and no discrete gas exchange, excretory, or circulatory systems
7. Nervous system is a simple nerve net(s), composed of naked and largely nonpolar neurons
8. The musculature is formed of epitheliomuscular cells, derived from ectoderm and mesoglea, and are unipolar (uniaxial); these muscle cells are the most primitive in the eumetazoans
9. Exhibit alternation of asexual polyp and sexual medusa generations; but there are many variations on this basic theme
10. Typically have planula larvae (ciliated, motile, gastrula larvae)



Cnidarian Morphology

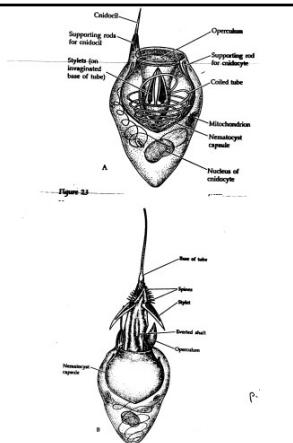


- b . Tentaculate with radial symmetry around mouth.
- 1. Note that radial symmetry *persists in different life stages.*
- 2. May be modified as biradial, quadriradial or septiradial symmetry.

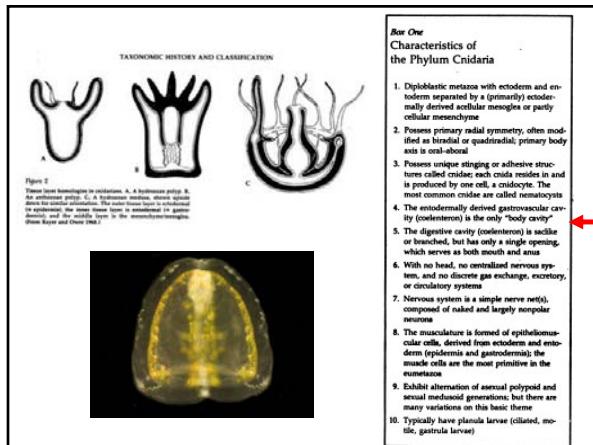


Cnidocytes

1. Cnidocytes - eversible cells, primarily on tentacles.
 - a. Trigger, nerves, cause discharge from tactile, coordinated or chemical stimulus.
 - b. Operculum pops off, inner nematocyst explodes out.
 - c. Barbed or with toxin, paralyzes, immobilizes prey.



Cubozoan Cnidae



Cnidarian Morphology

Gastrovascular Cavity (GVC)

a. Central cavity for digestion, transport of materials.



b. Relatively thin tissues permits efficient nutrition, waste removal.



TAXONOMIC HISTORY AND CLASSIFICATION

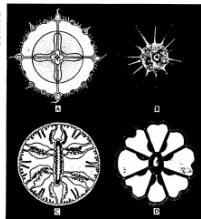


CHAPTER EIGHT / PHYLUM CNIDARIA

Figure 2

Coelenteron radial symmetry. B. Quadrilateral coelenteron, longitudinal section of a hydroid polyp. C. Radial coelenteron, longitudinal section of a hydrozoan polyp. (After Anderson; from Seaver and Dohle 1988.)

www



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Characteristics of
the Phylum Cnidaria

1. Diploblastic metazoa with ectoderm and endoderm separated by a (primarily) ectodermally derived cellular mesoglea or partly cellular mesenchyme
2. Possess primary radial symmetry, often modified as bivalval or quadrivalval; primary body axis is oral-aboral
3. Possess unique stinging or adhesive structures called cnidocytes; each cnida inside it is produced by a single cnidocyte. The most common cnidocytes are called nematocysts
4. The endodermally derived gastrovascular cavity (coelenteron) is the only "body cavity"
5. The digestive cavity (coelenteron) is saclike and unlined, but has only a single opening, which serves as both mouth and anus
6. With no head, no centralized nervous system, and no discrete gas exchange, excretory, or circulatory systems
7. Nervous system is a simple nerve net(s), composed of naked and largely nonpolar neurons
8. The musculature is formed of epitheliomuscular cells, derived from ectoderm and endoderm (not mesoglea and gammaroderm); these muscle cells are the most primitive in the eumetazoa
9. Exhibit alternation of asexual polypoid and sexual-sessile/greenish forms; but there are many variations on this basic theme
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Cnidarian Morphology



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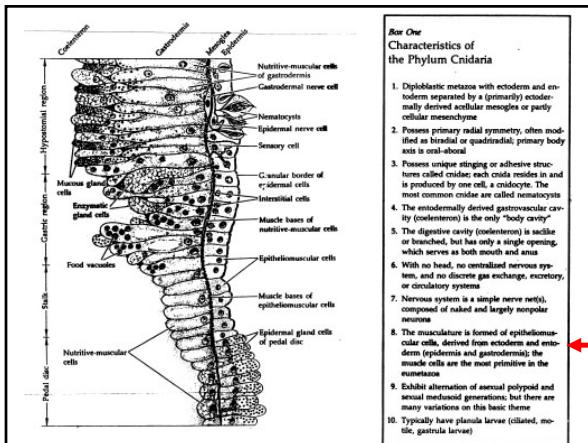
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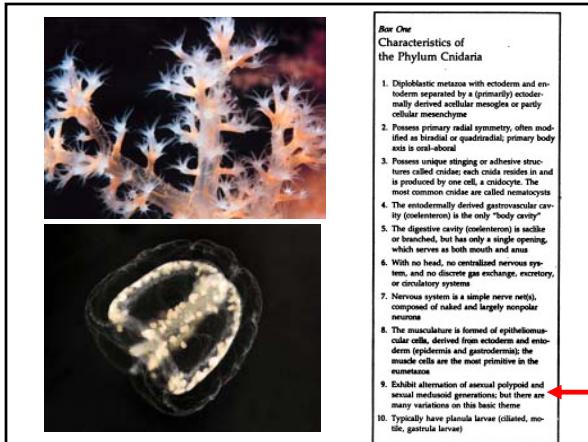
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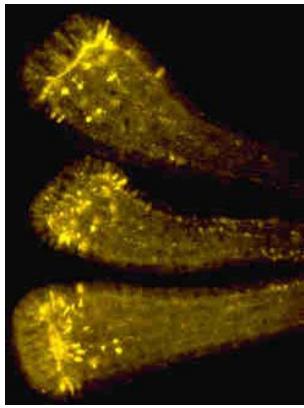
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Box One
Characteristics of the Phylum Cnidaria

1. Diploblastic metazo with ectoderm and endoderm separated by a (primarily) ectodermally derived acellular mesoglea or partly cellular mesoglea.
2. Possess primary radial symmetry, often modified as biradial or quadriradial; primary body axis is oral-aboral.
3. Possess unique stinging or adhesive cnidocilia; cnidae (cnidocilia) are in and are produced by a cell, a cnidocyte. The most common cnidae are called nematocysts.
4. The endodermally derived gastrocoel muscular cavity (coelenteron) is the only "body cavity".
5. The digestive tract (coelenteron) is a sac-like structure, but has only a single opening, which serves as both mouth and anus.
6. With no head, no centralized nervous system, and no discrete gas exchange, excretory, or circulatory systems.
7. Nervous system is a simple nerve net(s), instead of naked and largely unpolar neurons.
8. The musculature is formed of epitheliomuscular cells, derived from ectoderm and endoderm (not from mesoglea); the muscle cells are the most primitive in the metazoa.
9. Exhibits alternation of asexual (parthenogenetic) and sexual (meiotrophic) generations but there are many variations on this basic theme.
10. Typically have planula larvae (ciliated, motile, gastrula larvae).



Metagenesis

Polymorphic body forms associated with life cycle.

Polyps

1. Polyp - sessile form, often vegetative.



National Undersea Research Center—University of Connecticut

Polyps

1. largely sessile
 - some can creep, somersault, etc.
2. Have a *longitudinal* axis
 - a. Oral end
 - b. Aboral end
 - c. Tentacles surrounding the mouth



Medusa

Medusa means "sovereign female wisdom."

In Sanskrit it's *Medha*, Greek *Metis*.



Medusa

Was one of the Gorgons; sisters that caused men to turn to stone.

Perseus slew Medusa and used her head as a weapon.



Medusae

Medusa - motile form, often sexual.

1. specialized for swimming - some are more or less attached.



Medusae

2. have a shorter longitudinal axis
- a. mouth often with oral arms.

3. body wall also diploblastic
- a. highly thickened

meosglea - forms bell.



Medusae

4. GVC is divided into radial canals.

5. Tentacles oriented around the bell

6. sensory, muscular system associated with swimming.

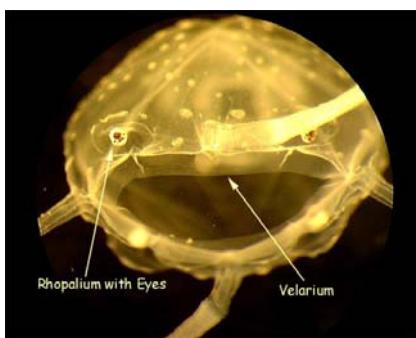


Medusae

- a. Contraction around bell margin
- 1. *velum* - structure associated with rapid swimming
- 2. present or absent in different groups.



Cubozoan Velarium



Medusae

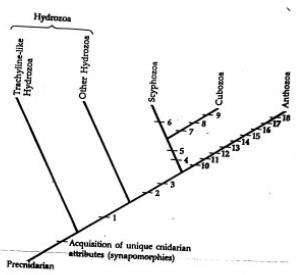
- b. Rhopalia
- a. statocysts - maintain balance in water
- b. ocelli - light sensitive organs



Cnidarian Rhopalia



A Cnidarian Phylogeny



1. Four main classes (even though most sources consider 3)
 - a. stem group - possess basic structural organization of other more advanced metazoa
 - b. have radiated into many habitats - yet body plan has been retained.

