Bio 20 Marine Biology – Exam 2 Outline

The Diversity of Life (Chapter 4)

I. Classifying Living Things (Taxonomy)

Watch the Amoeba Sisters Classification
A. Why classify?
   1. Need to give a universally accepted name to each organism in order to better study them.
   2. Need to organize & sort the millions of life forms into groups in order to better study them.
   3. Need to group organisms according how closely “related” they are to each other in order to better study them. “Related”, in this context means that they share a common evolutionary history.

B. Binomial Nomenclature- organisms are identified biologically by two names, their genus name and their species name (Latin or Greek) (in italics or underlined). An organism’s genus and species name is its “scientific name”.
   1. A genus is a group of very similar species (but do not usually interbreed)
      Ex. Canis familiaris, Canis lupis, Canis latrans

C. Biological Classification
   1. Taxa are arranged in a hierarchy that extends from the most general classification down to the most specific
   2. All members of a group (taxon) have certain common characteristics and are thought to share a common ancestry
   3. Species that are very closely related, are grouped into the same genus.
   4. Genera with similar histories can be grouped together into a larger group called family
   5. Process continues to sort organisms into progressively larger groups
Prokaryotes:
I. Domain Bacteria
   A. Heterotrophic Bacteria

B. Autotrophic Bacteria

1. Cyanobacteria (blue-green algae)

   a. Importance of cyanobacteria?

Read “Symbiotic Bacteria – The Essential Guests” p. 90 and answer the following:
1. Describe what symbiotic bacteria is, what bioluminescence is, and how they are related to each other.

2. State the name of the toxin, produced by symbiotic bacteria, that is found in pufferfishes and other marine animals. Also, state how we are trying to use this toxin to our advantage.
II. Domain Archaea (Archaebacteria)

Eukaryotes:

III. Domain Eukarya
   A. Protists

1. Plant-like Protists: Unicellular Algae
   Know the main characteristics of diatoms and dinoflagellates. How are they similar and how do they differ?
   a. Phylum Bacillariophyta – Diatoms

   b. Phylum Dinophyta – Dinoflagellates

Red Tides

Zooxanthellae
Read p. 96 “The Bay of Fire”, p. 333 “Must Have Been Something I Ate”, and p. 342-343 “Red Tides and Harmful Algal Blooms” and answer the following:
1. Why are dinoflagellates in such high concentration in Bahia Fosforescente?

2. What is ciguatera, what causes it, and how does one get it?

3. What are red tides, are they associated with tides, and are they always red?

4. How do HABs affect humans and other organisms?

5. How are humans affecting the occurrence of HABs?

Importance of unicellular algae (phytoplankton) like diatoms and dinoflagellates?
- Perform more than 95% of the photosynthesis in the ocean
- Produce nearly half of the world’s primary production and nearly half of the oxygen in our atmosphere
- What level of the food chain do they make up?

Read the online article “The Ocean’s Invisible Forest” and answer the following:
1. How much carbon dioxide do phytoplankton draw out of the atmosphere and oceans through photosynthesis compared to trees, grasses, and land plants combined?

2. Briefly describe how the global carbon cycle has fallen out of balance.

3. State two advantages and two disadvantages of fertilizing the ocean.
2. Animal-like Unicellular Protists - Protozoans “first animals”

Read p. 97-98 “Protozoans: The Animal-Like Protists” and state the following information about foraminiferans and radiolarians below: 1) What their shells are made up of, 2) What they use to capture food with, and 3) Where they tend to be found in the ocean.

a. Phylum Granuloreticulosa – Foraminiferans

b. Phylum Polycystina – Radiolarians
<table>
<thead>
<tr>
<th>Group</th>
<th>Distinguishing Features</th>
<th>Photosynthetic Pigments</th>
<th>Major Food Reserves</th>
<th>Major Cell-Wall or Membrane Components</th>
<th>Significance in the Marine Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viruses</td>
<td>Non-cellular parasites of all organisms</td>
<td>None</td>
<td>None</td>
<td>Capsid of protein, sometimes lipids</td>
<td>Infect all marine organisms, release dissolved organic matter (DOM) from destroyed cells</td>
</tr>
<tr>
<td>Bacteria</td>
<td>Prokaryotic, unicellular, some form colonies</td>
<td>Chlorophyll a, pheophytins, carotenoids in cyanobacteria; bacteriochlorophyll in other photosynthetic bacteria</td>
<td>Variety of types</td>
<td>Cell wall of peptidoglycan containing muramic acid, chains of amino sugars and amino acids in cyanobacteria</td>
<td>Essential role in nutrient cycles; autotrophs (especially cyanobacteria) and heterotrophs (including decomposers); nitrogen fixers; components of detritus, some cause diseases, symbiotic in many organisms, some produce blooms</td>
</tr>
<tr>
<td>Archaea</td>
<td>Prokaryotic, unicellular</td>
<td>Bacteriorhodopsin in light-capturing archaea</td>
<td>Variety of types</td>
<td>Cell wall made up of variety of compounds but no muramic acid</td>
<td>Autotrophs and heterotrophs, nitrogen fixers</td>
</tr>
<tr>
<td>Dinoflagellates</td>
<td>Eukaryotic, unicellular, some form chains, mostly planktonic</td>
<td>Chlorophyll a, c, carotenoids</td>
<td>Cleopelmarin, oil</td>
<td>Cell membrane secretes fustule of silica, peptin</td>
<td>Important primary producers, frustules are components of siliceous sediments</td>
</tr>
<tr>
<td>Diatom</td>
<td>Eukaryotic, unicellular, two flagella, mostly planktonic, some bottom-dwelling</td>
<td>Chlorophyll a, c, carotenoids</td>
<td>Starch, oil</td>
<td>Cell membrane secretes cellulose plates (thecae)</td>
<td>Primary producers, symbiotic with other organisms as protists, dinoflagellates, some cause diseases (Pfiesteria)</td>
</tr>
<tr>
<td>Silicoflagellates</td>
<td>Eukaryotic, unicellular, two flagella, planktonic</td>
<td>Chlorophyll a, c, fucoxanthin</td>
<td>Starch</td>
<td>Cell membrane secretes silica skeleton</td>
<td>Primary producers, dinoflagellates, are components of siliceous sediments, some produce blooms</td>
</tr>
<tr>
<td>Cocolithophorids</td>
<td>Eukaryotic, unicellular, one or two flagella, planktonic</td>
<td>Chlorophyll a, c, carotenoids</td>
<td>Starch</td>
<td>Cell membrane secretes calcium carbonate plates</td>
<td>Important primary producers, plates are components of calcareous sediments, some produce blooms</td>
</tr>
<tr>
<td>Cryptophytes</td>
<td>Eukaryotic, unicellular, usually two flagella, planktonic</td>
<td>Chlorophyll a, c, carotenoids, phycobilins</td>
<td>Variety of types</td>
<td>Cell membrane made up mostly of protein</td>
<td>Important primary producers</td>
</tr>
<tr>
<td>Foraminifers</td>
<td>Eukaryotic, unicellular, usually two flagella, planktonic</td>
<td>None</td>
<td>Variety of types</td>
<td>Cell membrane secretes calcium carbonate shell (test)</td>
<td>Heterotrophs, shells are components of calcareous sediments</td>
</tr>
<tr>
<td>Radiolarians</td>
<td>Eukaryotic, unicellular, usually colonial, mostly planktonic</td>
<td>None</td>
<td>Variety of types</td>
<td>Cell membrane secretes silica shell</td>
<td>Heterotrophs, shells are components of siliceous sediments</td>
</tr>
<tr>
<td>Clitores</td>
<td>Eukaryotic, unicellular, planktonic and bottom-dwelling</td>
<td>None</td>
<td>Variety of types</td>
<td>Cell membrane made up mostly of lipids</td>
<td>Heterotrophs, some associated with marine animals</td>
</tr>
<tr>
<td>Fungi</td>
<td>Eukaryotic, unicellular or multicellular, mostly bottom-dwelling</td>
<td>None</td>
<td>Variety of types</td>
<td>Cell wall of cellulose, chitin, and other compounds</td>
<td>Decomposers, many cause diseases, symbiotic with algae or cyanobacteria in lichens</td>
</tr>
</tbody>
</table>
Multicellular Primary Producers: Seaweeds & Plants (Chapter 6)

I. Domain Eukarya
   A. Protists
      Plant-like Protist: Multicellular Algae (Seaweeds, Macrophytes, or Macroalgae)

1. General Structure: Fig. 6.1 (remember, seaweeds lack true leaves, stems, roots)
   Know the name, location, and function of each structure:
   a. Blades
   b. Pneumatocysts (Air Bladders)
   c. Stipe
   d. Holdfast

2. Types of seaweeds (depends on pigments) (Table 6.1).
   Know the main characteristics of the three phyla of seaweeds.
   a. Phylum Chlorophyta - Green Algae
NOXIOUS SEAWEED FOUND IN SOUTHERN CALIFORNIA COASTAL WATERS
Look up these web sites regarding an invasive green alga: http://www.pbs.org/wgbh/nova/algae/ and http://www.westcoast.fisheries.noaa.gov/habitat/aquatic_invasives/caulerpa_taxifolia.html (open the pdf file under “Resources” at bottom of site) and answer the following:

1. a. State the scientific name and phylum of the invasive alga that this website describes. Don’t forget to underline or italicize scientific names!

   b. Describe its native habitat and growth form.

2. How did this alga initially get introduced into the Mediterranean?

4. How does this alga affect ecosystems after it has become established in a new area?

5. How did this alga initially get introduced into southern California waters?

6. State two specific reasons why this alga can be a threat to southern California waters.

Read the online article “Biologists Score Rare Victory Under the Sea” and describe how biologists were able to win the battle against Caulerpa taxifolia in southern California.
b. Phylum Phaeophyta - Brown Algae

Kelps: most complex & largest of all brown algae
- mostly found below low tide level (subtidal) & in temperate climates
  Ex. Nereocystis (Bull Kelp) (stipe up to 30 m = almost 100 ft.)
  Ex. Macrocystis (Giant Kelp) = largest of the kelps
  - as long as 100 m (330 ft.), can grow 20 in. per day

c. Phylum Rhodophyta - Red Algae

What are coralline algae and why are they important?

3. Seaweeds are economically important! Check out this website:
   http://www.oilgae.com/algae/use/use.html

a. Read p. 109 “Economic Importance” and answer the following:
   1. In general, what are phycolloids?

   2. State the following information about each phycocolloid below: 1) The type of algae (i.e. green, red, brown) that is the source for each phycocolloid and 2) The general uses of each phycocolloid.
   - Algin
   - Carageenan
   - Agar
Algae Fuel!
In the search for alternatives to gasoline, are algae the answer? Watch this video
https://www.youtube.com/watch?v=74BeCt-NdKQ and read p. 112 “Marine Algae as Biofuels” to find out and answer the following questions:

1. Photosynthesizing algae produce oxygen, sugar, and what other product which can be converted into biodiesel (biofuel)?

2. What are the two major disadvantages of producing corn based ethanol as biofuel?

3. State the advantages of producing algae for biofuel.

4. State the disadvantages of producing algae for biofuel.

B. Kingdom Plantae

Know the three types of plants that are successful in the oceans and coastal areas, where they are found, and how they differ from each other.

1. Seagrasses
Ex. surfgrass (*Phyllospadix*), eelgrass (*Zostera*), turtlegrass (*Thalassia*)

2. **Salt Marsh Plants**

Ex. cordgrasses (*Spartina*), pickle weed (*Salicornia*) (Fig. 12.7 and 12.8)

3. **Mangroves**

What do these plants provide to an ecosystem?

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### Table 6.1 Most Important Characteristics of Seaweeds and Marine Plants

<table>
<thead>
<tr>
<th>Group</th>
<th>Distinguishing Features</th>
<th>Photosynthetic Pigments</th>
<th>Major Food Reserves</th>
<th>Major Cell-Wall Components</th>
<th>Significance in the Marine Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green algae</td>
<td>Eukaryotic, unicellular and multicellular; mostly bottom-dwelling</td>
<td>Chlorophyll a, b, carotenoids</td>
<td>Starch</td>
<td>Cellulose, calcium carbonate</td>
<td>Primary producers; calcareous algae are important sources of calcareous deposits in coral reefs</td>
</tr>
<tr>
<td>Brown algae</td>
<td>Eukaryotic; multicellular; bottom-dwelling</td>
<td>Chlorophyll a, c, carotenoids (fluorescein and others)</td>
<td>Laminarin, oil</td>
<td>Cellulose, alginites</td>
<td>Primary producers; dominant components of kelp forests</td>
</tr>
<tr>
<td>Red algae</td>
<td>Eukaryotic; multicellular; bottom-dwelling</td>
<td>Chlorophyll a, phycobilins (phycocyanin, phycoerythrin), carotenoids</td>
<td>Starch</td>
<td>Alginate, cellulose, calcium carbonate</td>
<td>Primary producers; coralline algae are important sources of calcareous deposits in coral reefs</td>
</tr>
<tr>
<td>Flowering plants</td>
<td>Eukaryotic; multicellular; bottom-dwelling</td>
<td>Chlorophyll a, b, carotenoids</td>
<td>Starch</td>
<td>Cellulose</td>
<td>Dominant primary producers in seagrass beds, salt marshes, and mangrove forests; nursery grounds for many species; help stabilize soft bottoms, protect coast from turbulence</td>
</tr>
</tbody>
</table>
Marine Animals Without a Backbone (Chapter 7)

I. Kingdom Animalia: broken up into smaller categories called “Phyla” (plural) or “Phylum” (singular)

2 major groups
   1. Vertebrates
   2. Invertebrates

Know the main characteristics of each phylum, subphylum, and class and know the main organisms that are found within each group. Use your invertebrate assignments to help you.

A. Phylum Porifera “pore bearers”

B. Phylum Cnidaria

   1. Cnidarians occur in one of two basic forms:
       a. Polyp
       b. Medusa

Read “The Case of the Killer Cnidarians” p. 125 and know the following:
   1. What type of cnidarian is known to be the most toxic, even more toxic than the Portuguese man-of-war?

C. Phylum Ctenophora
D. Phylum Platyhelminthes

E. Phylum Annelida

1. Class Polychaeta

F. Phylum Mollusca

1. Types of Molluscs:
   a. Class Gastropoda
   b. Class Bivalvia
   c. Class Cephalopoda
Read p. 136 “The Octopus Complex Brain” (found in 9th and 10th textbook editions only) and answer the following:
1. List four ways in which the octopus brain is similar to the vertebrate brain.

G. Phylum Arthropoda

1. Subphylum Crustacea

H. Phylum Echinodermata

1. Types of Echinoderms:
   a. Class Asteroidea

b. Class Ophiuroidea

c. Class Echinoidea

d. Class Holothuroidea
I. Phylum Hemichordata

J. Phylum Chordata – made up of 3 major groups, two that lack a backbone

1. Subphylum Urochordata

2. Subphylum Cephalochordata

3. Subphylum Vertebrata
Table 7.1 Some of the Most Important Characteristics of the Major Animal Phyla

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Representative Groups</th>
<th>Distinguishing Features</th>
<th>General Habitat</th>
<th>Significance in the Marine Environment</th>
<th>Level of Organization</th>
<th>Symmetry</th>
<th>Segmentation</th>
<th>Body Cavity</th>
<th>Digestive Tract</th>
<th>Respiratory Exchange</th>
<th>Circulatory System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porifera</td>
<td>Sponges</td>
<td>Collar cells (hesionized)</td>
<td>Benthic</td>
<td>Filter feeders</td>
<td>Asymmetrical</td>
<td>No</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Body surface</td>
<td>None</td>
</tr>
<tr>
<td>Cnidaria</td>
<td>Anthozoa, sea anemones, corals</td>
<td>Nematocysts</td>
<td>Benthic, pelagic</td>
<td>Predators, passive suspension feeders</td>
<td>Tissue</td>
<td>No</td>
<td>None</td>
<td>Incomplete</td>
<td>Incomplete</td>
<td>Body surface</td>
<td>None</td>
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<td>None</td>
<td>Incomplete</td>
<td>Incomplete</td>
<td>Body surface</td>
<td>None</td>
</tr>
<tr>
<td>Ctenophora</td>
<td>Ctenophora</td>
<td>Ctenophora</td>
<td>Mostly pelagic</td>
<td>Predators</td>
<td>Tissue</td>
<td>No</td>
<td>None</td>
<td>Incomplete</td>
<td>Incomplete</td>
<td>Body surface</td>
<td>None</td>
</tr>
<tr>
<td>Arthropoda</td>
<td>Arthropoda</td>
<td>Arthropoda</td>
<td>Mostly pelagic</td>
<td>Predators, many paracriners</td>
<td>Tissue</td>
<td>No</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Body surface</td>
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<td>None</td>
<td>Body surface</td>
<td>None</td>
</tr>
<tr>
<td>Annelida</td>
<td>Annelida</td>
<td>Segmentation</td>
<td>Mostly pelagic</td>
<td>Predators, deposit feeders, passive suspension feeders</td>
<td>Tissue</td>
<td>No</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Body surface</td>
<td>None</td>
</tr>
<tr>
<td>Spidra</td>
<td>Spiders</td>
<td>Locomotory system</td>
<td>Benthic</td>
<td>Filter feeders</td>
<td>Tissue</td>
<td>No</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Body surface</td>
<td>None</td>
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<tr>
<td>Echinodermata</td>
<td>Echinodermata</td>
<td>Echinodermata</td>
<td>Mostly pelagic</td>
<td>Predators</td>
<td>Tissue</td>
<td>No</td>
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</table>

*Oocyte (fertilization)