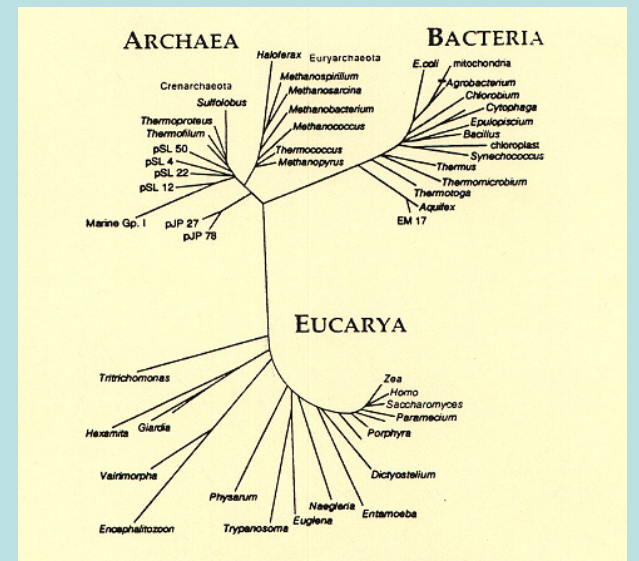
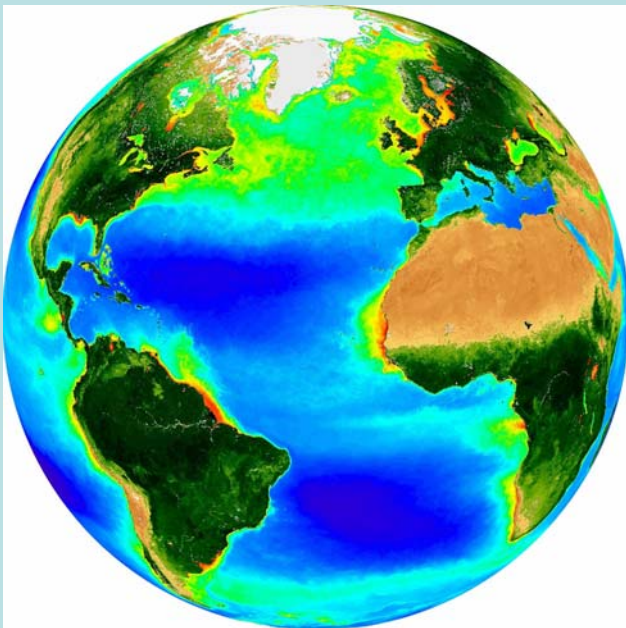


# Marine Microplankton Ecology

Ocean 626

Fall 2007



# The who's

- **Matthew Church** (Assistant Professor)-time/space variability in ocean microbes
- **Grieg Steward** (Assistant Professor)-ecology of marine bacteria and viruses
- **Dave Karl** (Professor)-microbial control of ocean biogeochemistry
- **Phil Boyd** (Professor, University of Otago)-ocean carbon cycling, plankton physiology
- **Karen Selph** (Specialist)-nano- and microzooplankton dynamics
- **Mike Rappé** (Assistant Researcher, HIMB)-microbial diversity

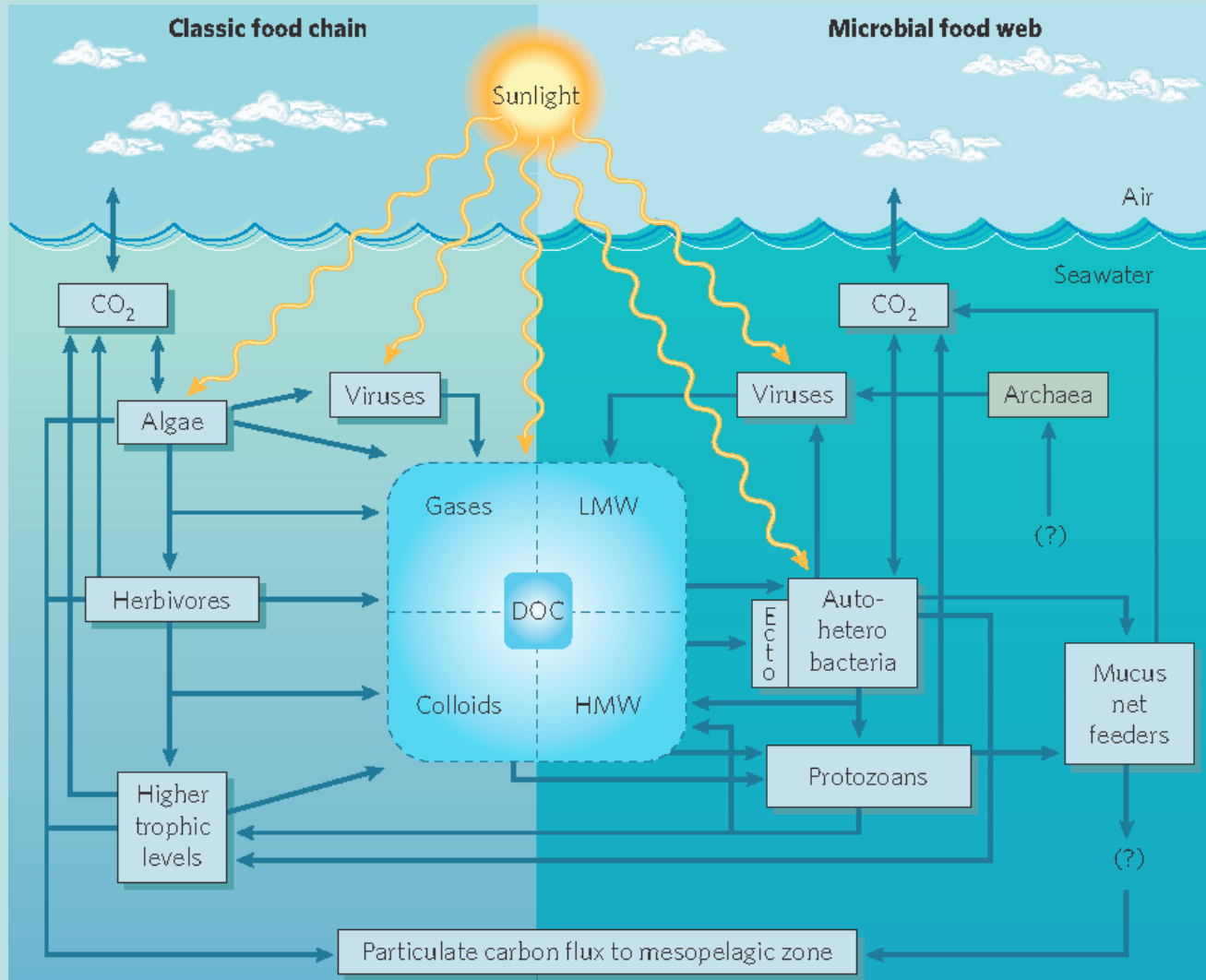
# The where's

- Tuesday and Thursday 9:00-10:15 AM  
Marine Science Building 307  
2 lectures per week
- Tuesday 3:00-4:15 PM  
Marine Science Building 315 or various 6<sup>th</sup> floor  
laboratories

# The what's

- Graduate level course required by the BOD.
- 4 credits
- Grading and requirements:
  - Come to class and participate (20%)
  - Mid-term and final exam (25% each)
  - Oral and written presentation (15% each)

# Microbes are the engines of the sea



**In the open sea,  
planktonic  
microorganisms  
regulate  
pathways and  
fluxes of  
material and  
energy**

# What's in a word?

- *Ecology*-derived from the Greek word *oikos* meaning house. First coined by Ernst Haeckel in 1866 “the comprehensive science of the relationship of the organism to the environment.”
- Ecologists study patterns in nature beyond the organism, for example diversity and complexity of species assemblages, examining the flow of energy and nutrients through a community.
- **Functional ecology:** how populations are maintained (*e.g.* competition, predation, cooperation); also termed population biology or population ecology
- **Historical ecology:** how populations came to be the way that they are (*e.g.* biogeography)

# Microbes and biogeochemistry

- **Biogeochemistry** is the study of how living systems control the composition of the Earth's crust, atmosphere, and oceans.
- In the sea, **microbes** control elemental cycling; as a result, the study of microbial ecology is inherently linked to the study of biogeochemistry.
- By understanding the **ecology of microbes**, we gain understanding of **biogeochemical** dynamics in the sea.

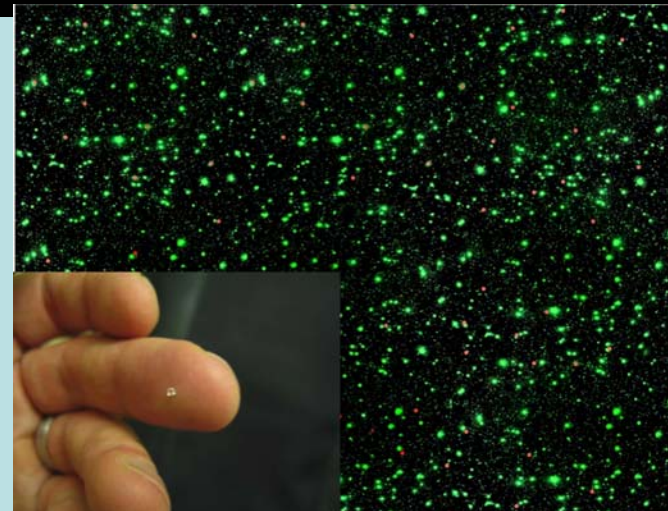
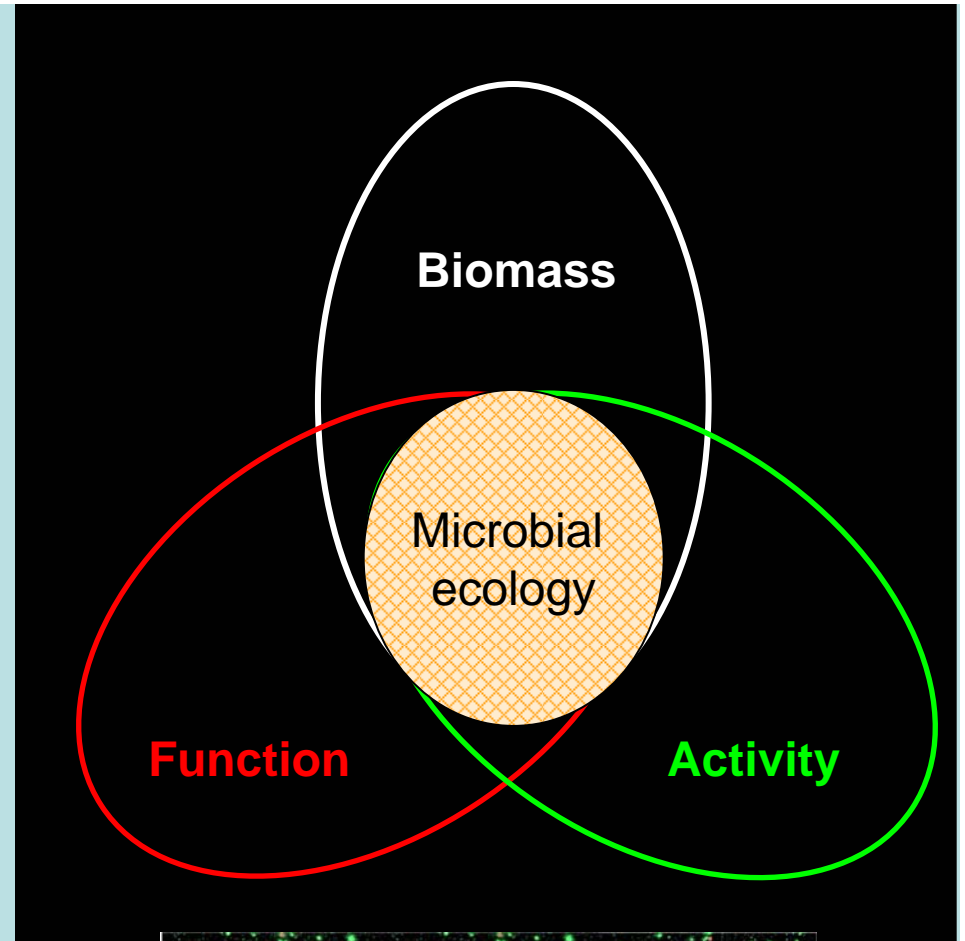
# What is microplankton ecology?

Activities, growth, biomass, diversity

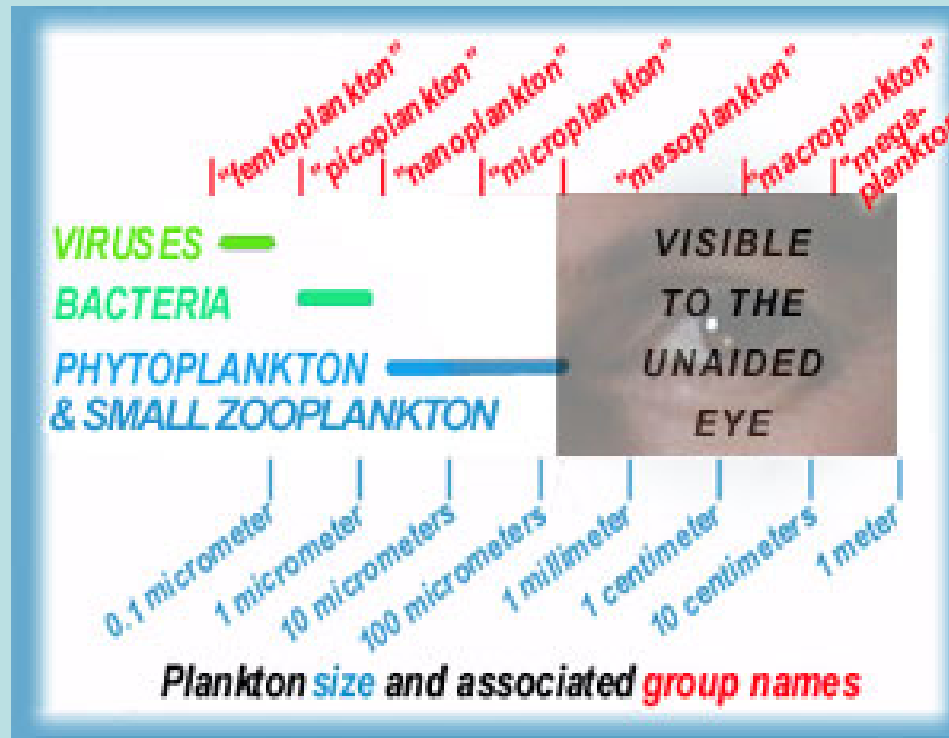
- How many and at what rate?
- Distributions and patterns
- Diversity
- Physiological controls

Food web dynamics

- Elemental fluxes and energy flow
- Transfer efficiency
- Food web control (top down versus bottom up)







## Characteristic lengths of plankton

< 0.2 μm Femtoplankton (viruses)

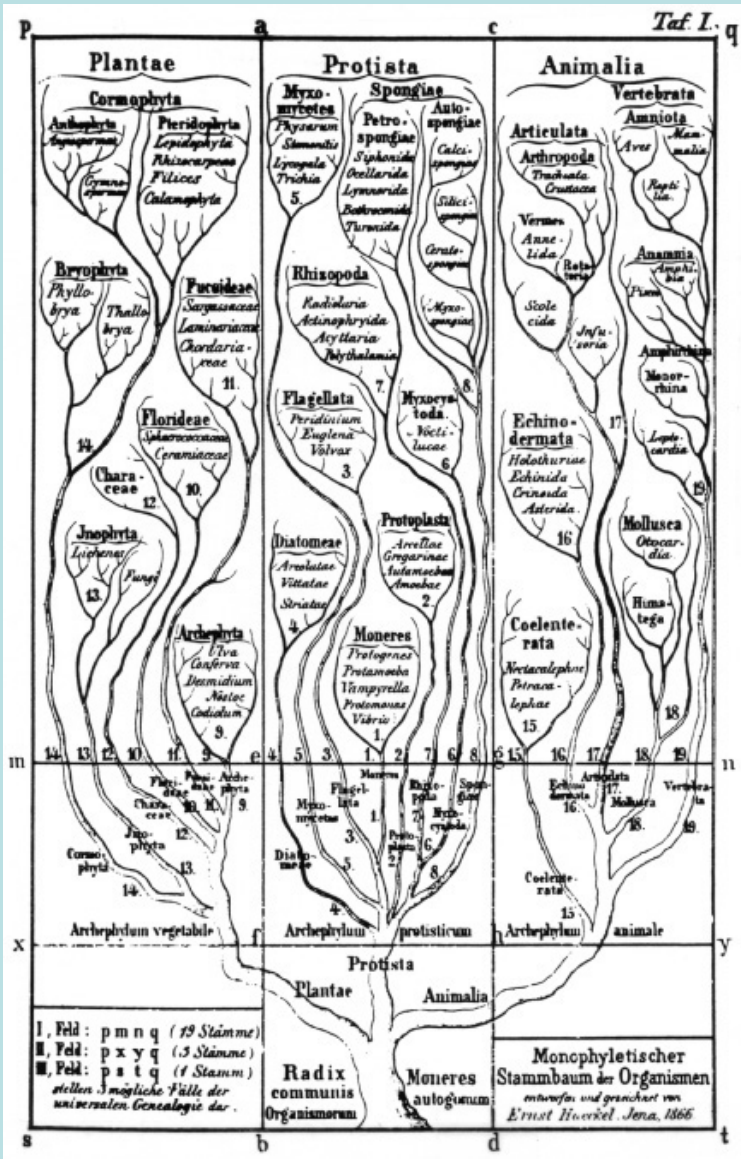
0.2–2 μm Picoplankton (Eubacteria, Archaea, very small eukaryotes)

2–20 μm Nanoplankton (diatoms, dinoflagellates, protozoa)

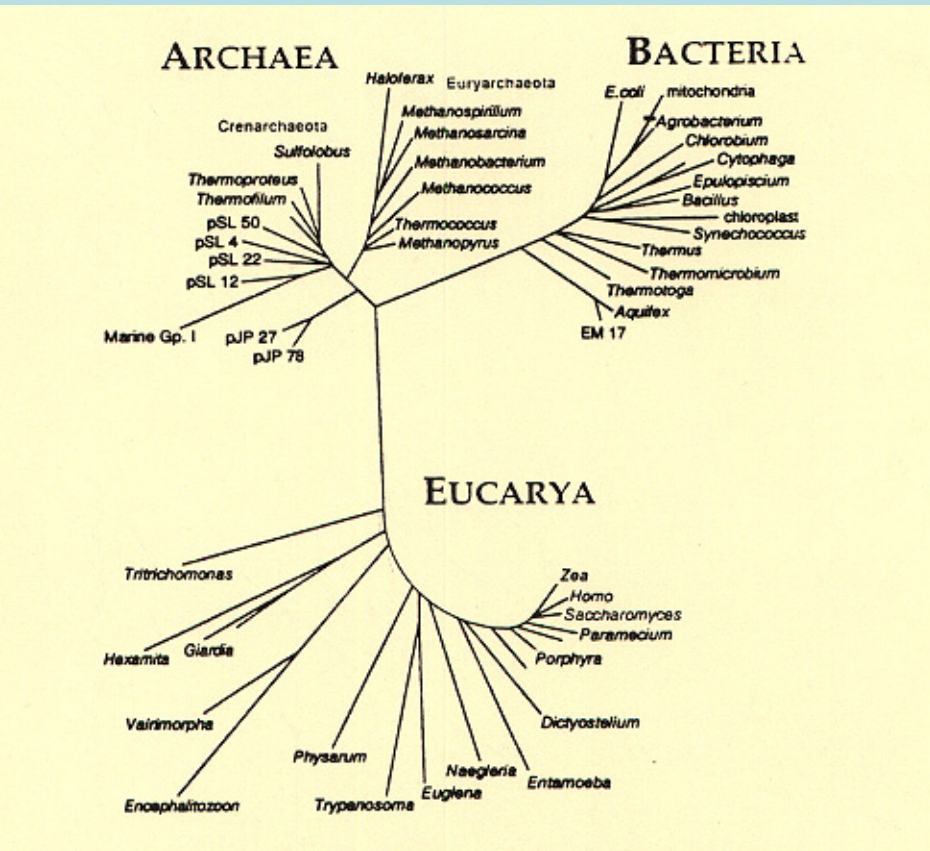
20–200 μm Microplankton (diatoms, dinoflagellates, protozoa, copepod nauplii, etc.)

0.2–20 mm Mesoplankton (mostly zooplankton)

2–20 cm Macroplankton



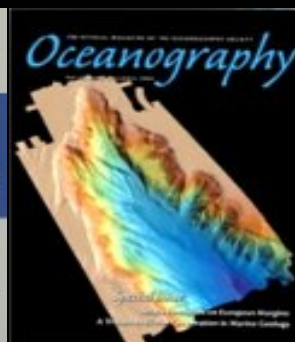
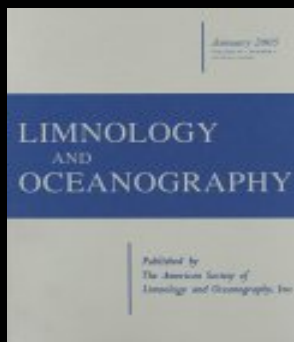
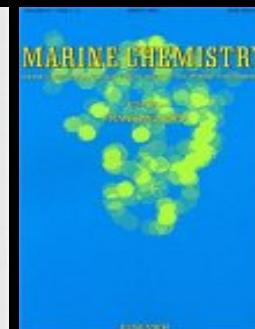
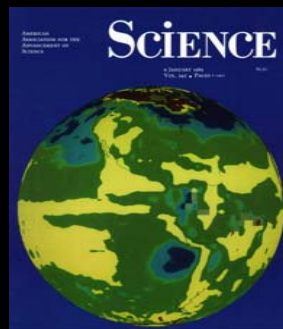
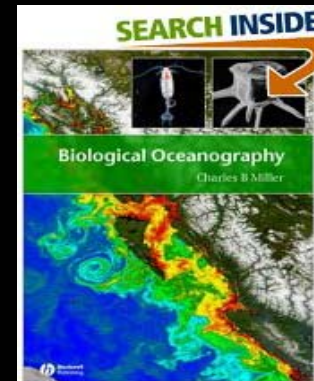
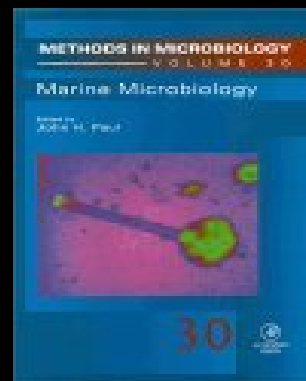
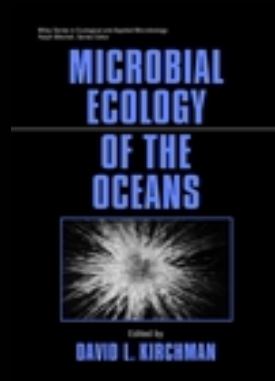
Haeckel 1866



N. Pace's Tree of Life (1997)

By applying novel technologies, microbial ecologists have opened the door to radical new views of the world and revealed the astounding breadth of diversity of organisms in the marine environment

# The reading list

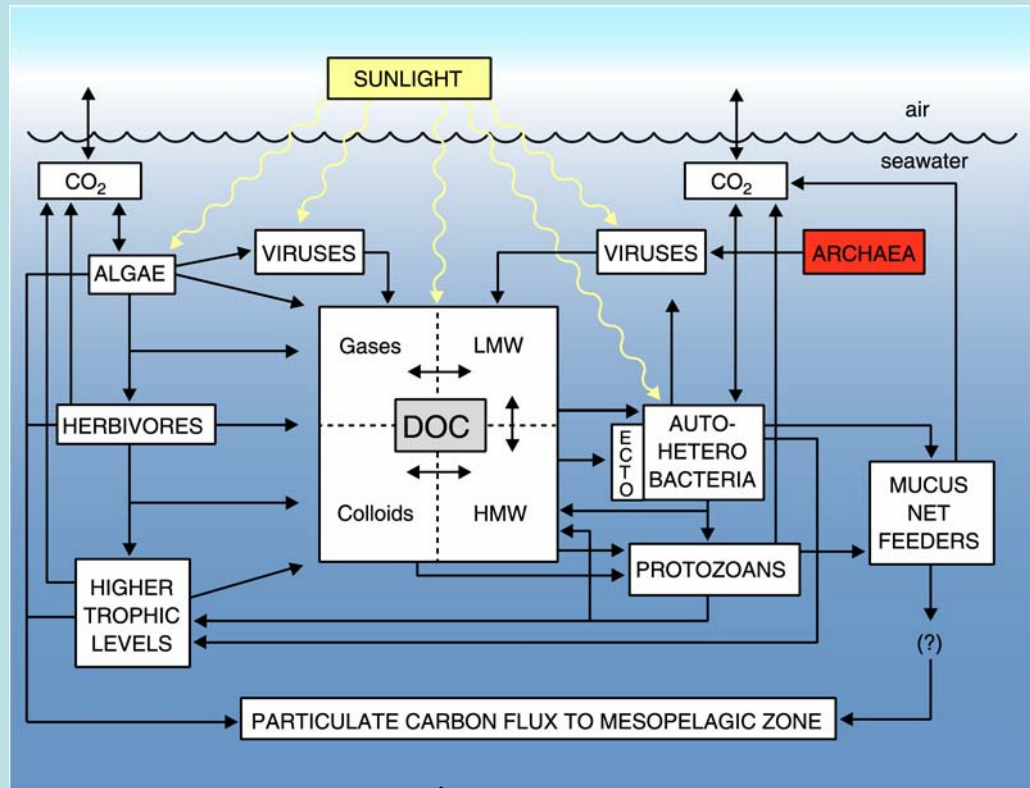
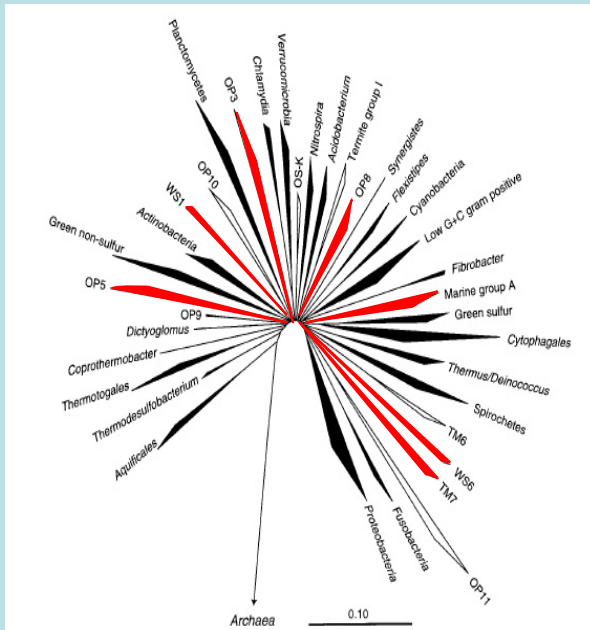


# General Course Outline

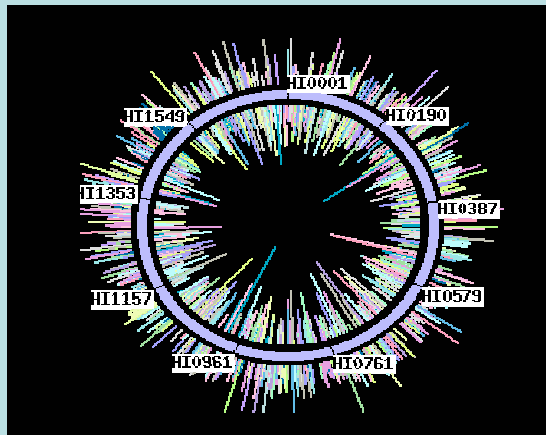
- **Weeks 1-2:** Introduction, classification of life, bioenergetics
- **Weeks 3-4:** Diversity, biomass, and primary production
- **Weeks 5-6:** Bioelemental cycles and food web controls
- **Weeks 7-8:** Top down controls of food webs
- **Week 9:** Viruses in marine food webs  
-MID TERM EXAM DUE OCT. 25
- **Weeks 10-11:** Time and space variability in microbial dynamics
- **Week 12:** Molecular ecology of the sea
- **Weeks 13-14:** Contemporary topics in microbial oceanography
- **Week 15:** Organisms as model systems
- **Week 16:** Future directions in microbial oceanography
- -FINAL EXAM DUE DEC. 11

# Food webs

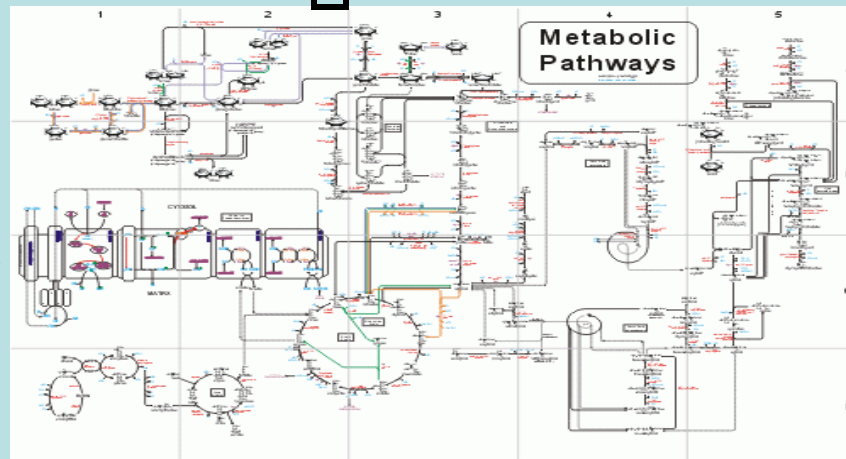
## Phylogeny



## Genomes



## Metabolic pathways



# Things we hope you learn in this course

- Appreciation of the importance of ocean microbes to the health of the biosphere
- Understanding of some of the processes that control microorganisms growth in the sea
- General sense of how microbes, nutrients, and energy sources are distributed in the sea
- How microbial oceanographers measure growth, biomass, and diversity
- Understanding of the ecology and biogeochemistry of some of the prominent types of marine microbes