FISH270 Aquatic Ecophysiology

Today

- What is this class?
  - Why?
- Logistics and Details
- Biology

Instructors

FISH270

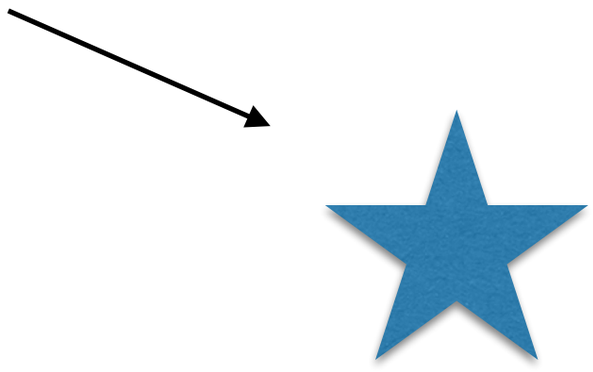
Q: What is the introductory biology series at UW?

The Introductory Biology Sequence is a three quarter long series including Biology 180, 200, and 220. The main topics covered in each course are as follows:

Biology 180: Evolution, Mendelian Genetics, Ecology, and Biodiversity

Biology 200: Molecular Genetics, Biochemistry, and Development

Biology 220: Animal and Plant Physiology



Biology 180: Evolution, Mendelian Genetics, Ecology, and Biodiversity

Biology 200: Molecular Genetics, Biochemistry, and Development

What is different?

This course will teach fundamental aspects of biological **form and function** with an emphasis on highlighting the profound **differences and similarities across taxa**. The first half of the course will focus on *primary physiological processes* including energy metabolism, thermal biology, osmoregulation, and immune function. During the second half of the course we will apply the *principles to specific case studies that are environment specific as we transition through terrestrial habitat, open ocean, coastal estuaries, polar and tropical ecosystems, and deep ocean*.

It will be different

Some things will be similar.

BIOLOGICAL SCIENCE
FIFTH EDITION
Freeman Quillin Allison

Textbook

What works and and has not…

Canvas

Objectives This class aims to provide you with an understanding of basic physiological process and the ability to apply this knowledge to understand how diverse taxa, ranging from prokaryotes to mammals, live in diverse and changing environments.

Specific goals are:

• Describe how essential life processes (growth, reproduction) work and the common and unique challenges organisms face in different environments.

• Discriminate similarities and difference across taxa at the physiological level.

• Develop quantitative reasoning and skills in physiology and in biology in general

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• Discriminate similarities and difference across taxa at the physiological level.

• Develop quantitative reasoning and skills in physiology and in biology in general

• Apply physiological principles to determine how a variety of organisms function in different aquatic environments.

• Synthesize scientific principles by effectively searching primary literature, collating information and presenting knowledge in a succinct fashion.

• Work collaboratively to reach solutions

• Assist the advancement of knowledge by evaluating peer contributions.

• Apply the use of microscopes and lab equipment in investigation in physiological experiments

Assessment

- Exams (3) – 45%
- Participation on Discussion Board 5%
- Question Sets – 5%
- Lab Worksheets - 20%
- Special Project – 5%
- Final Exam – 20%

Grading Scale

Late Policy: Assignments will not be accepted after due date.

Exams: Material on the exams will be from information presented in lecture, lab, and from the assigned readings. The three exams will consist of:

- Multiple choice

- Short answer

- Short essay

- Sketches / drawings

The final exam will be comprehensive

Participation on Discussion board should be at least 2 posts per week.

More Policies

- *Attendance* - Students are individually responsible for all information presented in lectures, and readings. No make-up exams will be allowed.
- *Academic Conduct* - Passing anyone else's scholarly work (which can include written material, exam answers, graphics or other images, and even ideas) as your own, without proper attribution, is considered academic misconduct. Anyone engaging in academic misconduct will not receive credit for the course.

If you anticipate or experience barriers to your learning or full participation in this course based on a physical, learning, or mental health disability, please immediately contact the instructor to discuss possible accommodations. A more complete description of the disability policy of the College of the Environment website. If you have, or think you have, a temporary or permanent disability that impacts your participation in any course, please also contact Disability Resources for Students (DRS) at:

206–543–8924 V / 206–543–8925 TDD / uwdss@uw.edu / http://www.uw.edu/students/drs.


JOURNEY

Let me know if issues arise…

PLAN

Week	Topic	Text / Specific	Labs
1	• Intro – Basics Central dogma • Intro - Environmental challenges for living organisms • Intro - Environmental challenges for living organisms	Ch1 58-67, Ch 16 Ch42 842-853 Ch52 1059-1081	Diversity (size and scale)
2	• Bioenergetics • Bioenergetics • Energy acquisition - primary production and oxygen	Ch5 Ch44 882-885 Ch10	Environment (Field trip) -what challenges do organisms have in this environment
3	• Thermal Biology • Osmoregulation • EXAM	Ch56 Ch42 854-859 Ch43 861-870	Energy - red light versus blue light (calculations, quantitative and math, loss of energy to environment take home free energy calculations) or salinity
4	• Digestion and excretion • Sensory systems • Circulation and gas exchange	Ch44 886-897 Ch467 Ch45	Sensory (chemotaxis in prokaryotes, oysters sense and change allocation of energy, anemones, comparative eyes, cuttlefish color change perhaps in a sessile or motile organisms
5	• Defense • Reproduction • Reproduction	Ch51 1037-1054 Ch50	Reproduction - compare on land and sea, asexual reproduction, fertilization and dilution, growth curve asexual and sexual reproduction, macro (plants)
6	Case studies: Land (dessication, waste) Case studies: Land (reproduction) EXAM		Waste excretion (land) - assays on three different samples - what habitat originated from, who excreted this - a CSI forensic lab
7	Case studies: Open Ocean (photosynthesis) Case studies: Open Ocean (nutrients) Case studies: Open Ocean (sensory)		Photosynthesis (open ocean) - energy or oxygen from different wavelengths of light, phytoplankton versus macroalgae
8	Case studies: Coastal Estuaries (anoxia) Case studies: Coastal Estuaries (development) Case studies: Coastal Estuaries (algae grass)		Temperature - polar versus tropical, taxonomically related comparative analysis, Q10, pores in ice, anemones with symbionts, bleaching,
9	Case Studies: Polar and Tropical (temp, salinity) Case Studies: Polar and Tropical (membranes) Case Studies: Polar and Tropical (prokaryote growth)		Nutrient limitation - what do bacteria need to grow
10	Case Studies: Deep Ocean (chemoautotrophs) Case Studies: Deep Ocean (pressure) EXAM		Bioluminescence - organisms responding to the environment

Topics

- Bioenergetics
- Thermal Biology
- Osmoregulation
- Digestion and excretion
- Sensory systems
- Circulation and gas exchange
- Defense
- Reproduction

You need to read

You need to ask questions

You need to contribute knowledge

Aquatic Environment

Topics

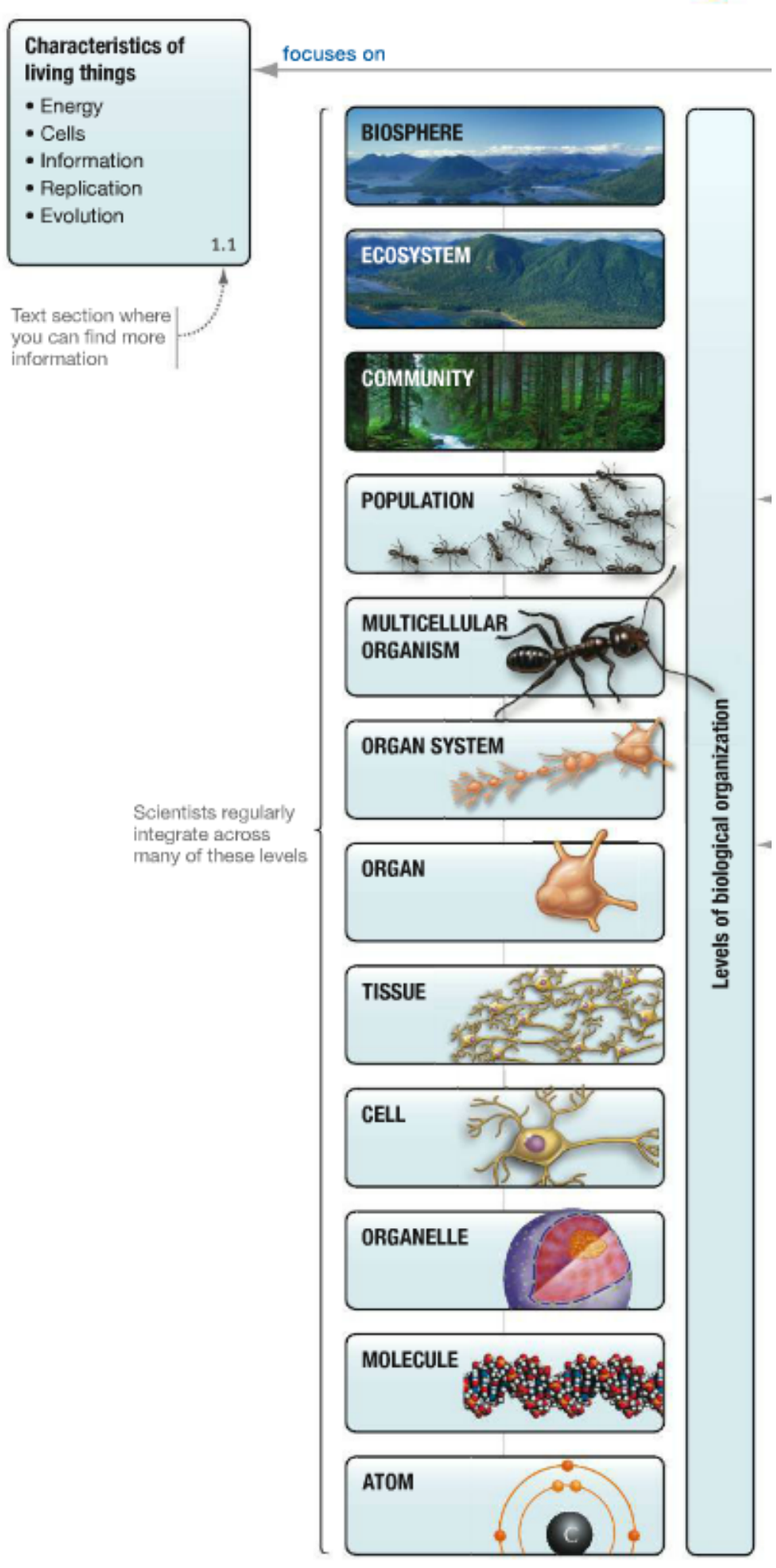
- Bioenergetics
- Thermal Biology
- Osmoregulation
- Digestion and excretion
- Sensory systems
- Circulation and gas exchange
- Defense
- Reproduction

Aquatic Environment

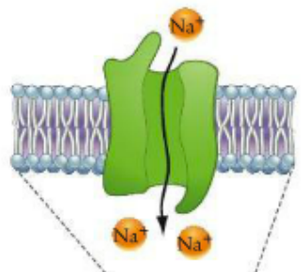
How does the vary

Organization

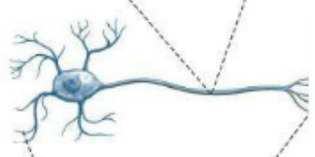
Big Picture


Characteristics of living things
• Energy
• Cells
• Information
• Replication
• Evolution
1.1
focuses on
Text section where you can find more information
BIOSPHERE
ECOSYSTEM
COMMUNITY
POPULATION
MULTICELLULAR ORGANISM
ORGAN SYSTEM
ORGAN
TISSUE
CELL
ORGANELLE
MOLECULE
ATOM
C
Scientists regularly integrate across many of these levels
Levels of biological organization

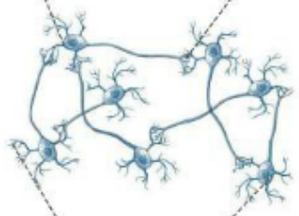
Big Picture



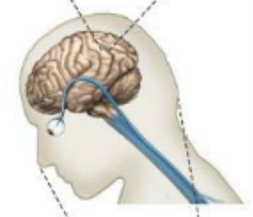
Atomic and molecular levels:
Membrane protein in neurons regulates flow of ions.



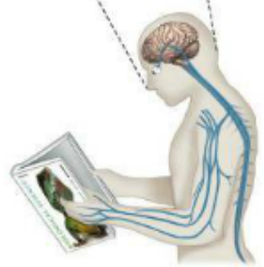
Cellular level:
Electrical signal travels down length of neuron.



Tissue level:
Electrical signals travel from cell to cell in nervous tissue.



Organ level:
Nervous tissue and connective tissue in brain aid in sight, smell, memory, and thought.

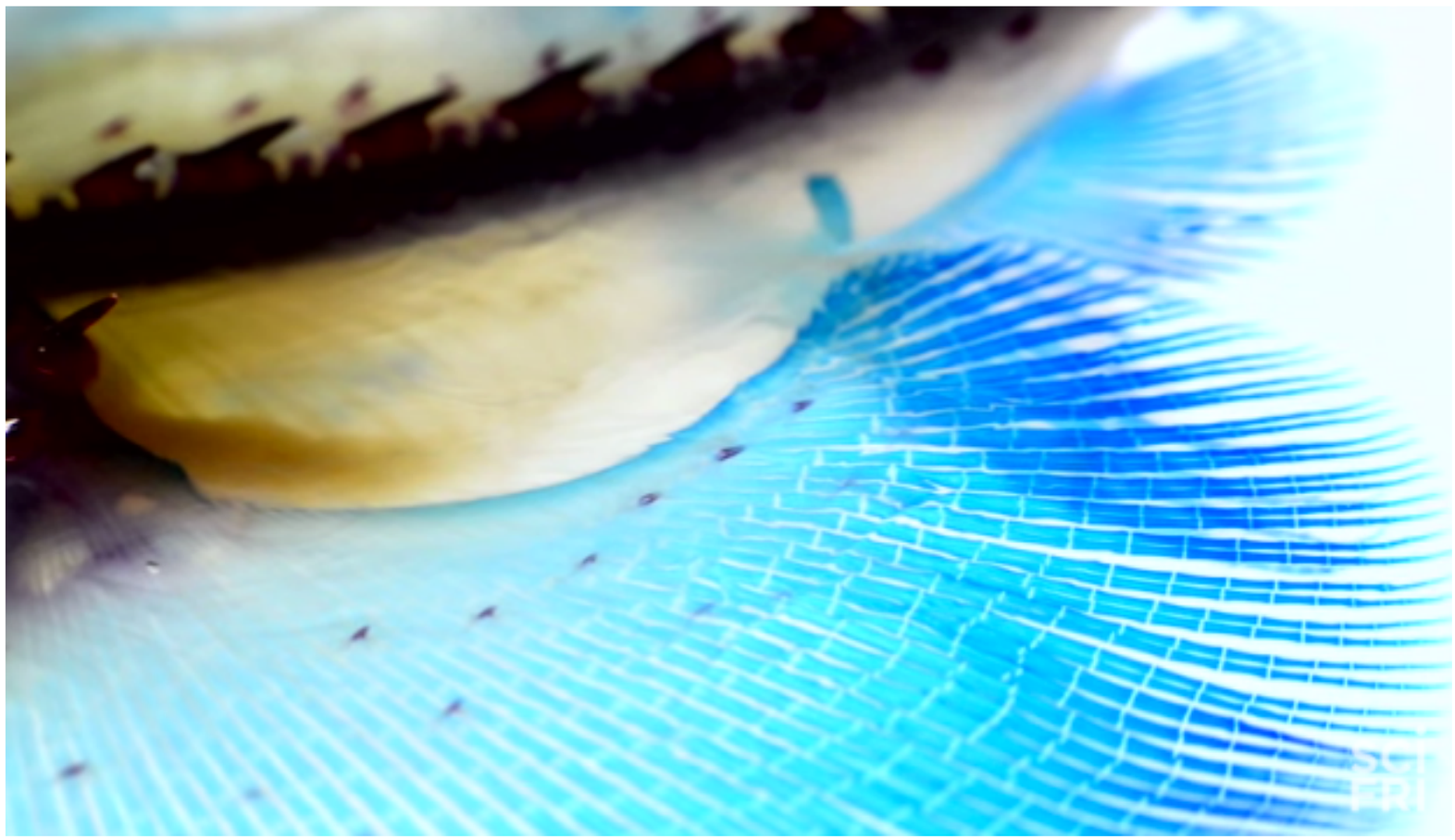


Organ system level:
Brain and nerves send signals throughout the body to control breathing, digestion, movement, and other functions.

Organism level:
Nervous system coordinates the functions of other systems to support life.

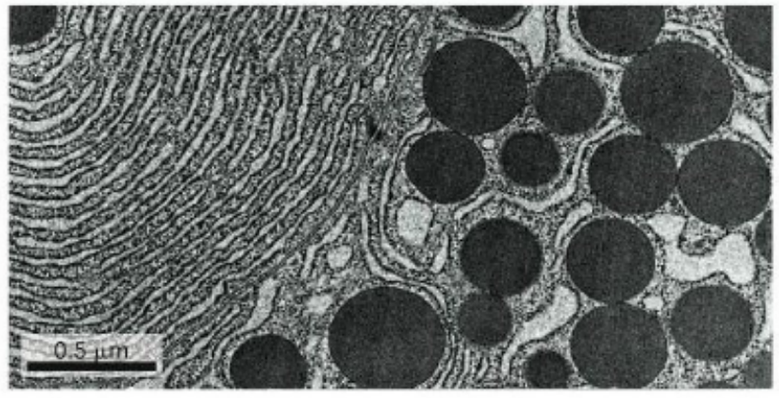
FIGURE 42.8 Biologists Study Anatomy and Physiology at Many Levels. The levels of organization within an organism are not independent of each other. Instead, they are tightly integrated.

Form and Function

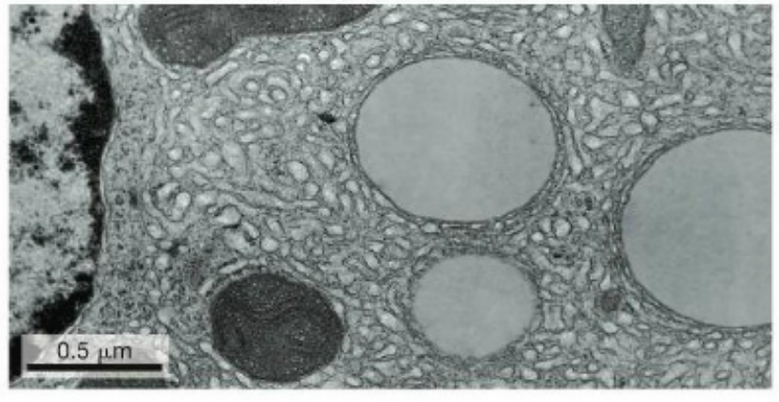


https://www.youtube.com/watch?v=haopSRCuPdo

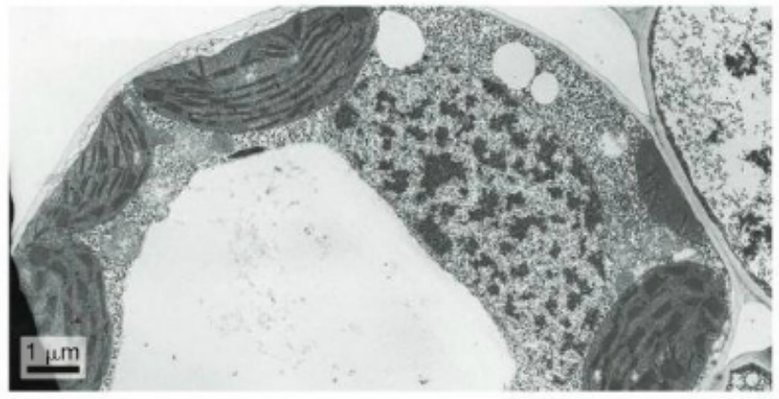
(a) Animal pancreatic cell: Exports digestive enzymes.



(b) Animal testis cell: Exports lipid-soluble signals.



(c) Plant leaf cell: Manufactures ATP and sugar.



(d) Brown fat cells: Burn fat to generate heat in lieu of ATP.

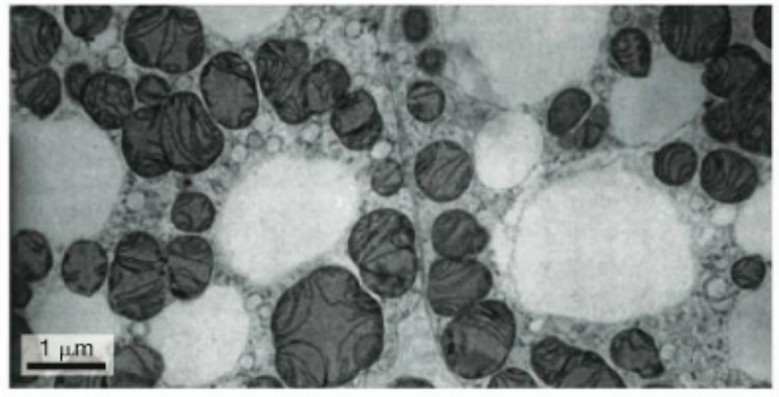


FIGURE 7.16 Cell Structure Correlates with Function.

Biology Review

Theories

- Two theories form the framework for modern biological science:
  - **The cell theory**
    - What are organisms made of?
  - **The theory of evolution by natural selection**
    - Where do organisms come from?

The Cell Theory

- In the late 1660s, Robert Hooke and Anton van Leeuwenhoek were the first to observe cells
- A **cell** is a highly organized compartment
  - Bounded by a plasma membrane
  - Containing concentrated chemicals in an aqueous solution
- The **cell theory** states that
  - **All organisms are made of cells** (pattern)
  - **All cells come from preexisting cells** (process)

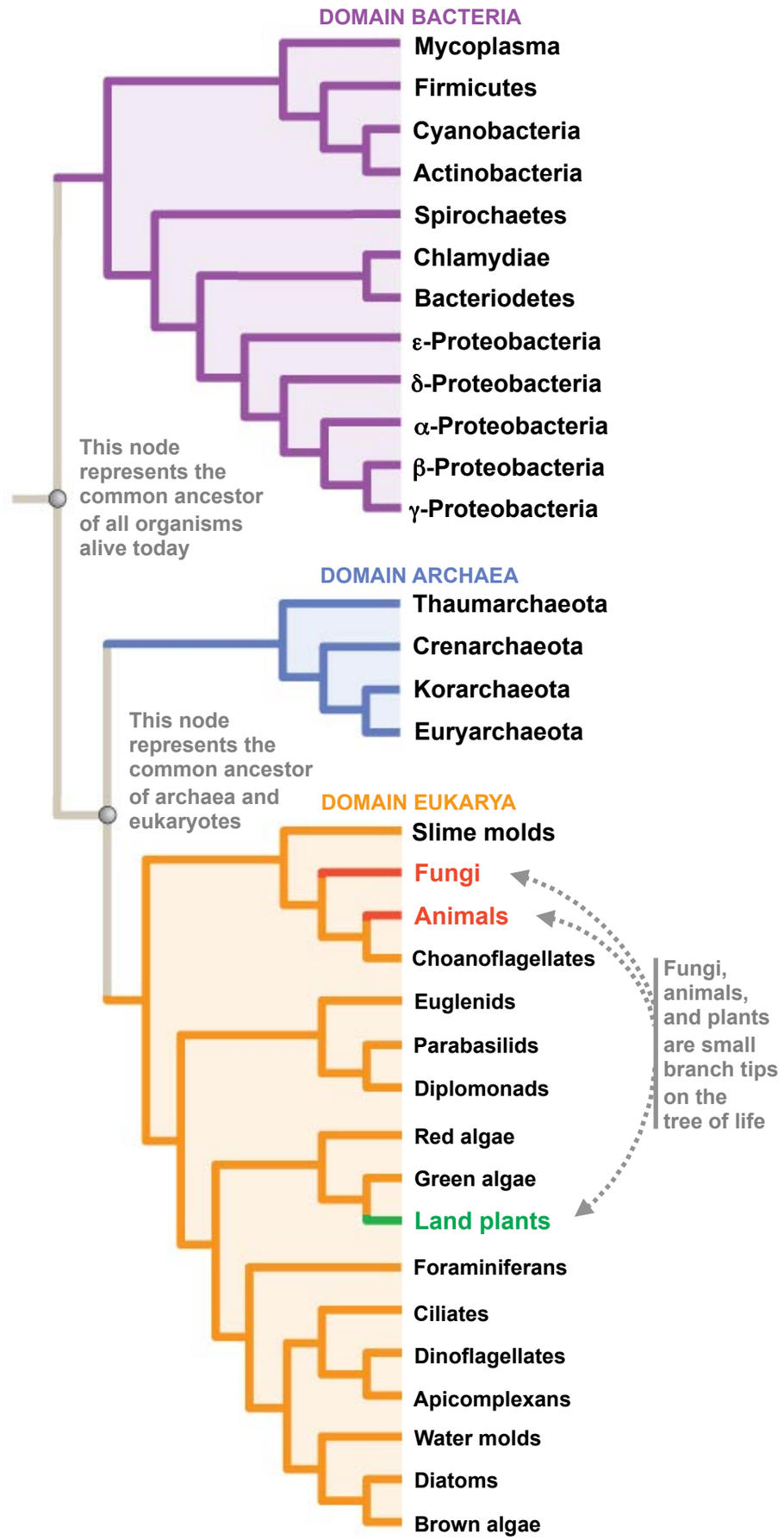
The Tree of Life

- The cell theory and the theory of evolution by natural selection
  - Imply that all species come from preexisting species
  - And that all species, past and present, trace their ancestry back to a **single common ancestor**
- **Speciation** is
  - A divergence process in which natural selection has caused populations of one species to diverge to form new species

The Tree of Life

- The **tree of life** is
  - A family tree of organisms that describes the genealogical relationships among species with a single ancestral species at its base
- **Phylogeny** is
  - The actual genealogical relationships among all organisms

Figure 1.5



Interpreting the Tree of Life

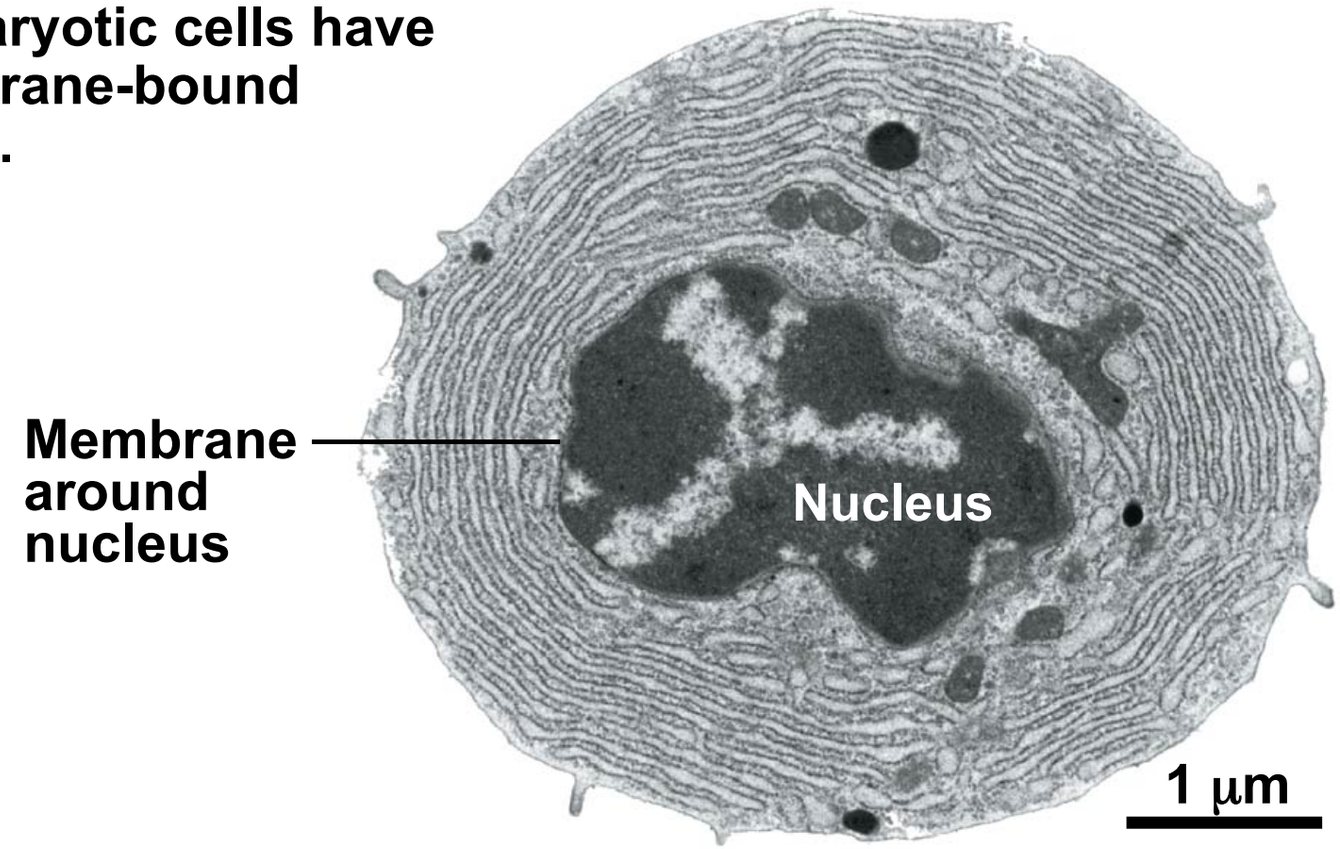
- The tree of life indicates three major groups of organisms:
  - The **eukaryotes**
    - **Eukarya**
  - Two groups of **prokaryotes**
    - **Bacteria** and **Archaea**

The Theory of Evolution by Natural Selection

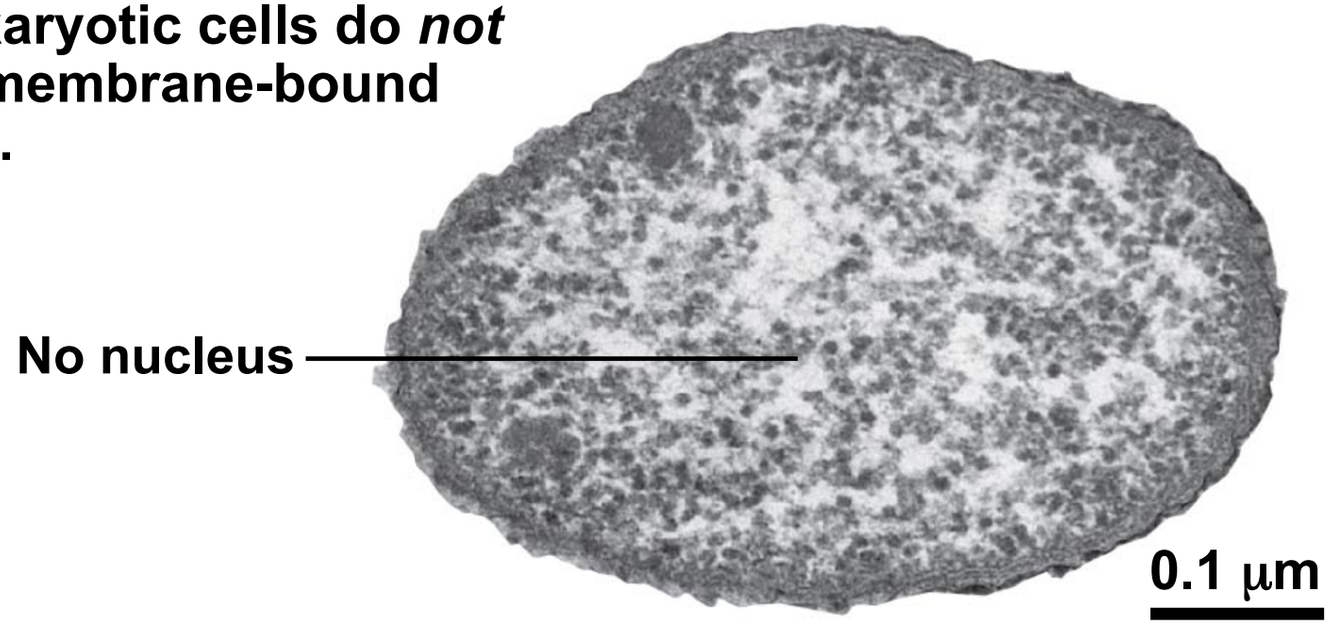
- In 1858, Charles Darwin and Alfred Russel Wallace made two claims regarding the natural world:
- All species are related by **common ancestry** (pattern)
  - Characteristics of species can be modified from generation to generation
    - **Descent with modification** (process)

Figure 1.6

(a) Eukaryotic cells have a membrane-bound nucleus.



(b) Prokaryotic cells do *not* have a membrane-bound nucleus.



Interpreting the Tree of Life

- The Tree of life shows
  - Fungi and animals are more closely related to each other than either is to plants
- Traditional classification schemes were often inaccurate
- *The location of certain branches on the tree is hotly debated, and the shape of the tree will continue to change as databases expand*

Central Dogma

https://www.youtube.com/watch?v=bk7PW1FKMTI

Building Blocks

A unified vision of the building blocks of life

Jamey D. Marth

To the Editor:

From the discovery of DNA to the sequencing of the human genome, the template-dependent formation of biological molecules from gene to RNA and protein has been the central tenet of biology. Yet the origins of many diseases, including allergy, Alzheimer's disease, asthma, autism, diabetes, inflammatory bowel disease, Lou Gehrig's disease, multiple sclerosis, Parkinson's disease and rheumatoid arthritis, continue to evade our understanding. Expectations that defined variation in the DNA blueprint would serve to pinpoint even multigenic causes of these diseases remain unfulfilled. Studies of distinct populations have implicated different genes, and those genes that are identified contribute to disease in a small fraction of the individuals diagnosed[1–3]. The genetic parts list seems insufficient to account for the origin of many grievous illnesses. Environmental factors including diet and microorganisms are also origins of disease. For example, type 2 diabetes, which affects hundreds of millions of people, is linked to a high-fat diet[4], and this mechanism of disease onset is common to diverse species. When disease arises from a cellular response to a pathogen or environmental stimulus, genomics alone is unlikely to provide all the answers. This view is underscored by the observation that surprisingly similar numbers of genes exist in even the most divergent of life forms. Moreover, while the genome provides the framework and basic instruction upon which the cell develops