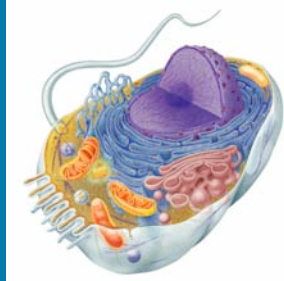


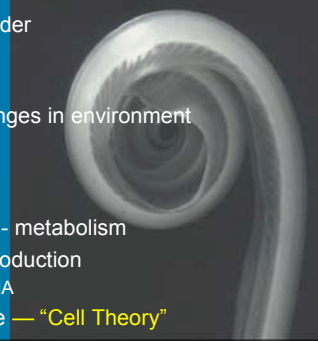
Biology: Levels of Organization

■ Cells: the basic units of life



What are the “Characteristics of Life”

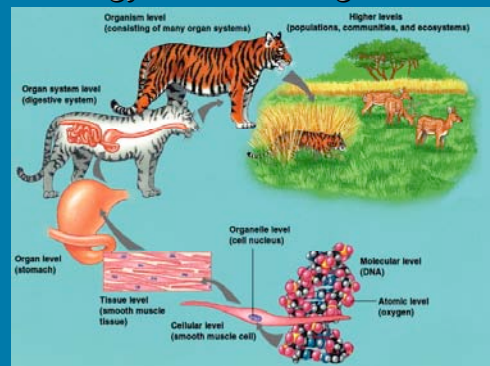
- Complexity & Order
- Regulation
 - Homeostasis
- Respond to changes in environment
 - Physiology
 - Behavior
 - Evolution
- Harness energy - metabolism
- Growth and reproduction
 - Inheritance - DNA
- Cellular structure — “Cell Theory”



The Cell Theory

1. The cell is the basic unit of life.
2. All organisms are constructed of cells.
3. All cells derive from previous cells.

Biology: Levels of Organization

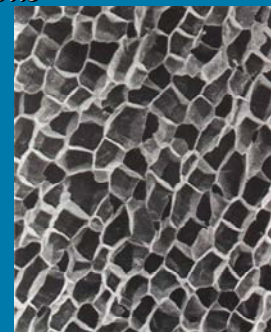


What does a cell need?

- Selective isolation from environment (plasma membrane)
- Energy (ATP)
- Instructions (DNA)
- Machinery to carry out instructions and regulate processes (proteins)
- Compartmentalization of incompatible or specialized activities (organelles)

Early views of cells

- Microscope invented ~1600
Cells identified 1665
- Cork tissue
 - first cells visualized
- “Cells” (“tiny rooms”)
 - surrounded by “walls”



Introduction to Cell Biology

Early views of cells

- Animal cells lack a cell wall
- Plasma membrane
- “Nucleus” (“center”)
 - filled with “chromatin” (“colored stuff”)
- “Cytoplasm” (“cell fluid”)

Modern views of cells

- Better microscopes and stains >1950's.
 - Electron microscope.
- “Cytoplasm” and “chromatin” much more complicated, structured, and dynamic than previously appreciated.

Cell Size Varies with Function

- Human nerve: up to 1 meter
- Human red blood cell: ~8 μm
- Bacteria: ~1 μm

The sizes of life

Two major types of cells

EUKARYOTIC CELL **PROKARYOTIC CELL**

Contrasting eukaryotic and prokaryotic cells in size and complexity

- Prokaryotic — Bacteria
 - No organelles
- Eukaryotic — Plant
 - Organelles present, including chloroplasts
 - Cell wall outside of plasma membrane
- Eukaryotic — Animal
 - Organelles present, but no chloroplasts nor cell wall
- Eukaryotic — Protists & Fungi
 - Organelles present
 - Cell types variations of plant/animal models

Cellular vs. molecular taxonomy


Prokaryotes — no nucleus, or other membranous organelles

ARCHAEA

EUBACTERIA

Two kingdoms of bacteria?

PROCESS SCIENTISTS USE TO ANSWER QUESTIONS ABOUT NATURE



Scientific method

- Observations
- Question
- Hypothesis
- Prediction
- Experiment

Reading the Scientific Literature

A Developmental Timing MicroRNA and Its Target Regulate Life Span in *C. elegans*

Michelle Boehm and Frank Slack*

The microRNA *lin-4* and its target, the putative transcription factor *lin-14*, control the timing of larval development in *Caenorhabditis elegans*. Here, we report that *lin-4* and *lin-14* also regulate life span in the adult. Reducing the activity of *lin-4* shortened life span and accelerated tissue aging, whereas overexpressing *lin-4* or reducing the activity of *lin-14* extended life span. Lifespan extension conferred by a reduction in *lin-14* was dependent on the DAF-16 and HSF-1 transcription factors, suggesting that the *lin-4*–*lin-14* pair affects life span through the insulin/insulin-like growth factor–1 pathway. This work reveals a role for microRNAs and developmental timing genes in life-span regulation.

Science [23 December 2005] 310 (5756): 1954–1957


Designing & conducting molecular biology experiments

You have been given a project to study the newly discovered aromatase-kinase H (AKH), a ~41 kDa protein. A colleague has isolated a ~1400-bp Xho I restriction fragment of human cDNA that molecular probes indicate contains the *akh* gene. Your assignment is to clone the gene to produce sufficient AKH for further study.

- Prepare a recombinant plasmid carrying the *akh* gene.
- Transfect *E. coli* bacterial cells with the recombinant plasmid.
- Verify the presence of the recombinant plasmid in the bacteria by RFLP & PCR.
- Verify the expression of the *akh* gene in the bacteria by purifying the AKH protein from transformed bacterial cultures.

Course Logistics

- Schedule
- Syllabus
- Objectives
- Lecture notes
- Student success
- Lab protocols
- Grading



<http://faculty.deanza.fhda.edu/heyerbruce/bio6B>