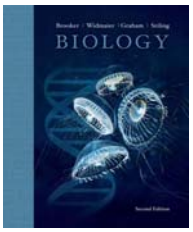
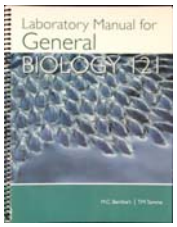
Biology 121 - Introduction

- Biology website: http://biology.missouristate.edu
- Bio 121 lecture: http://courses.missouristate.edu/ChrisBarnhart/Bio121/
- Syllabus and course policy statement.
- Textbook, lab manual

Brooker 2nd edition
MSU bookstore with software, e-book $230 (ouch! But used for 122 also). You can get it much cheaper used from Student Book Exchange and especially Amazon. I will not use Connect.



121 Lab Manual
MSU bookstore or Student Book Exchange ~$20



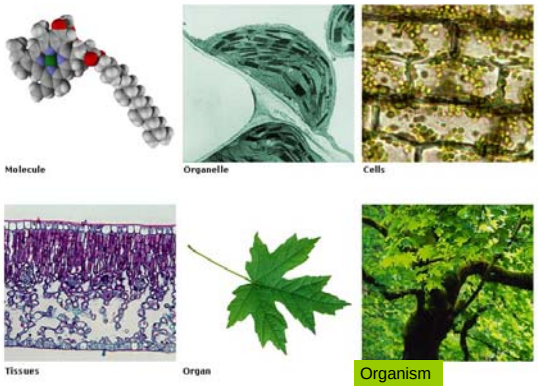
Tutoring

- Tutoring will be available for Bio 121 students from Bear Claw (Center for Learning And Writing).
- Bear Claw is free and located in the Meyer Library Center on the first floor. If you need help make an appointment.
- **Telephone:** (417) 836-6398 (main)

Bio 121
Section 999 F/12

Buckner, Joshua	FR	Animal Science-BS
Hart, Victoria	FR	Animal Science-BS
Reed, Ashley	FR	Animal Science-BS
Curtis, Chandler	SO	Art and Design-BSED-Preadm
Meinders, Alex	FR	Biology/Wildlife Biology-BS
Driscoll, Katharine	FR	Biology-BS
Snow, Jack	FR	Biology-BS
Wood, Elizabeth	FR	Biology-BS
Powderly, John	SR	Cell & Molecular Bio-BS
Done, Christopher	JR	Computer Science-BS
Lepper, Heather	FR	Criminology-BS
York, Clary	FR	Exercise & Mov/Prepr-BS-Preadm
Lee, Amy	SO	Marketing/Adv & Pro-BS-Preadm
Grigsby, Allison	JR	Mathematics-BSED
Evans, Josie	JR	Music/Instrumental-BME-Preadm
Moore, Jessie	FR	Nursing/4-Yr Gen-BSN-Preadm
Schwarz, Kaitlyn	FR	Nursing/4-Yr Gen-BSN-Preadm
Bell, Ian	SO	Undeclared-BS
Bowen, Christina	FR	Undeclared-BS
Kimbrough, Katie	FR	Undeclared-BS

Hierarchical organization of life



Hierarchical organization of life

- Subatomic particles
- Atoms — Chemistry, Physics
- Molecules
- Organelles

The boundary of "life"

- Cells — Cell Biology, Physiology

Hierarchical organization of life
continued

- Tissues
- Organs & organ systems
- Organisms

Physiology, Behavior

- Populations & species
- Communities
- Ecosystems

Evolutionary Biology, Ecology

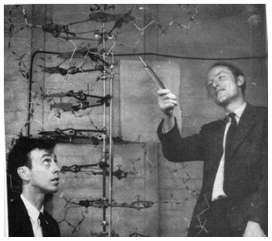
Emergent properties

- Each level of organization has new properties not present at lower levels

Reductionism

- To understand a complex phenomenon, “reduce” it to its parts- study it at lower levels of the hierarchy.

Reductionism- example



- Inheritance
- Watson and Crick (1953) structure of DNA
- Inheritance explained by chemistry & physics

Definition of life / living organisms

Life is a property of living organisms

Organisms consist of one or more cells, complex chemical systems bounded by membranes

Organisms require energy and materials from the environment.

- Metabolism
- Autotrophy, Heterotrophy

Definition of Life, continued

Responsiveness to environment
movement, gene expression, and…

Homeostasis

- Dynamic equilibrium
- Maintained by regulatory mechanisms and expenditure of energy
- Examples of homeostasis…

Growth & reproduction

- increase in size
- increase in number

Definition of Life, continued

Organisms consist of a genome (RNA or DNA) and a proteome (proteins that control the chemical processes).

Populations of organisms evolve- the genome

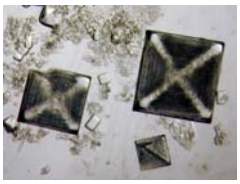
Some properties of life (also see Brooker page 3)

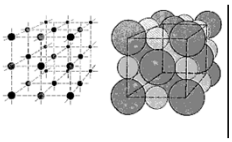
Complexity, homeostasis, growth & reproduction, energy & materials, responsiveness, evolution

Life vs. non-life

Crystals

- Example: sodium chloride, NaCl
- Organized chemical structure, with intrinsic pattern
- Growth and "reproduction"

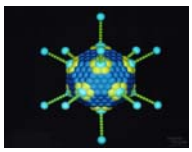


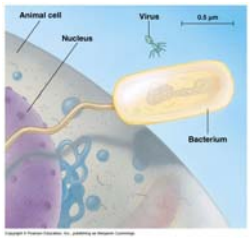


Life vs. non-life

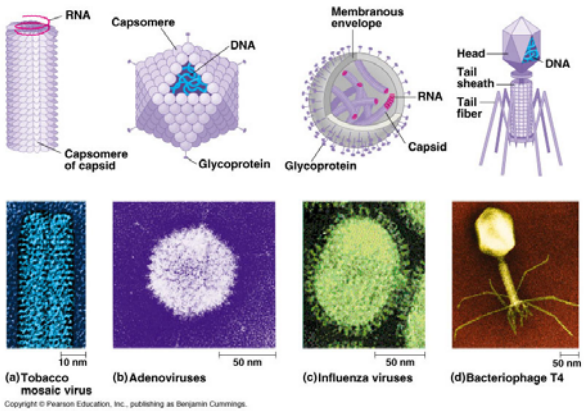
Viruses

- Complex biochemical structures
- Genetic information DNA, RNA
- Produced by cells
- Obligate parasites
- Not alive. Why not?



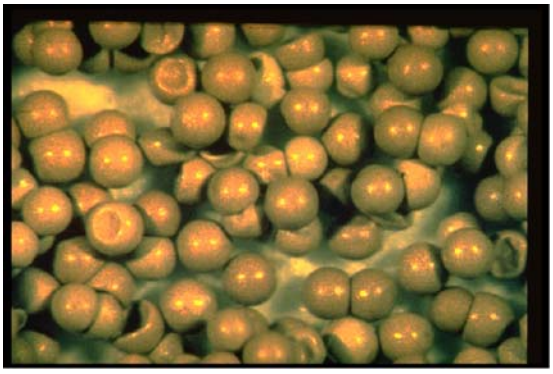


Viral structure



Life vs. non-life

- Cryptobiosis in brine shrimp

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Definition of Science

1. Scientific method – a process for obtaining objective knowledge
2. Scientific literature – the information gathered by this method

Scientific Method

1. Ask question or make an observation
2. Propose hypothesis = a possible answer or explanation that makes testable predictions.
3. Make and test predictions based on logical consequences of the hypothesis.

Example of hypothesis testing:

Question: what is the shape of the earth?
Hypothesis:
Prediction:
Test of the prediction:

Conclusion: do the observations support or refute the hypothesis?

Scientific Method, continued

4. Important: try to disprove hypotheses, not prove them.
5. Communicate results
   - Prepare detailed description of context, methods, & results of the work
   - Verbal or poster reports at professional meetings
   - Submit manuscript to technical journal for peer-review & publication

Scientific Method, continued

5. Peer review
   - Formal critique by other professional scientists precedes publication
6. Publication in the primary literature

Scientific Literature

1. Primary literature = original research reports in technical journals
   - Periodicals published by professional societies to present original research
   - Peer-reviewed
   - Examples of journals: *Science (AAAS), Neuroscience, Conservation Biology, Copeia. 4,429 different life-science journals are indexed in Biological Abstracts*

Scientific Literature, continued

1. Secondary literature
   - Review articles, textbooks
   - "Popular" science books and magazines examples: *Discover*, *Scientific American*, *Audubon*.
   - Less well documented, editorial review vs. peer review
   - Derived from primary literature

Science as a way of knowing

- Science deals only with objective (natural) knowledge
- Objective knowledge depends on the external world- not on internal conviction.
- Subjective knowledge includes values, and morality- good and evil, beauty, love

Science as a way of knowing

- Both subjective and objective knowledge are important!
- Science cannot make value judgements
- Science cannot prove or disprove existence of supernatural (i.e. God)
- Why or why not?

Galileo Galilei 1564-1642.

- First to use a telescope for astronomy.
- Supported Copernicus' heliocentric theory.
- Aggressively promoted belief that man could learn truth from the natural world as well as from Scripture.
- Convicted of heresy and imprisoned- formally pardoned by the Pope in 1992 (!)

Quotes from Galileo

"God equally admirably reveals himself to us in Nature's actions as in the Scripture's sacred dictions."

"I think that in the discussion of natural problems we ought not to begin at the authority of ...Scripture, but at sensible experiments and necessary demonstrations. For, from Divine Word, Scripture and Nature doth alike proceed."