Biol 102

Dr. Kelly C. Kissane

Course Introduction

- Instructor: Kelly C. Kissane
- Office: Natural Sciences
- E-mail: Kissanek@wou.edu
- Website: www.wou.edu/~kissanek
- Office Hours:
- E-mail is the absolute best way to reach me, I checked it many, many times a day.
- Make a habit of checking the website. I will be adding new games, info, and other class-related items often.

Course introduction

- Lectures:
  - Attendance not taken, but absences can hurt your grade. Any extra credit award in class cannot be made up.
- Labs:
  - **Mandatory.** Three missed labs results in a failing grade, no matter how well you are doing in lecture.
  - Labs will begin next week. Make sure you know what section you are in.
- Required Text:
  - Biology - Life on Earth (Audesirk2 & Byers - 8th Ed.)
  - Laboratory Manual (BI 102) – found in the bookstore only.

Course introduction

- **Grading**

2 midterms = 100 points each	200
1 cumulative final	150
Laboratory = 125 points	125
3 journal assignments = 20 points each	60
TOTAL POINTS POSSIBLE =	**535**

- **Exam format:**
  - Multiple choice/ True False — Matching (with figures)
  - Short answer — One or two short essay
- **Grading scale**
  - 100 - 90% = A — 69 - 60% = D
  - 89 - 80% = B — < 59% = F
  - 79 - 70% = C

Journal Assignments

- Journal assignments = 3 due, 20 points each.
- Choose an article or program item that is **relevant** to 102 topics (check with me if you are not sure!)
  - Cells
  - Metabolism
  - Genetics
- 1 or 2 pages in length (don't go over 2 pages).
- Choose news or magazine articles, or a television program.
  - Appropriate programs include:
    - House, Grey's Anatomy, Bones, Law and Order series, CSI series, Nature (PBS), and the Discovery Channel.

Journal assignments

- **Journal format (20 points each)**
- **All sections must be present for full credit**
  - A. Description of the article or program topic
  - B. Paragraph on why this topic interested you
  - C. Conclusions on how the topic was presented
  - *A well-written assignment with no spelling or grammatical errors will receive a bonus of 2 points*

Course Introduction

- What is the content of BI 102?
  - ❖Unit 1: The Life of a Cell Chapters 1-8
    - Biological Molecules (Chapters 2 & 3)
    - Cell Structure / Function (Chapters 4 & 5)
    - Cell Physiology (Chapters 6 - 8)
  - ❖Unit 2: Inheritance Chapters 9-13
    - DNA / Gene Expression (Chapters 9 & 10)
    - Cell Reproduction (Chapter 11)
    - Inheritance (Chapter 12)
    - Biotechnology (Chapter 13)

How can I get an A?

- 1) Come to class, participate in the extra credit activities.
- 2) Read the book before lecture
- 3) Check the website for games and other activities (this will help kinesthetic learners!)
  - ❖http://www.quia.com/pages/biol102.html
- 4) Do your BEST in lab (It's **23%** of your grade!)

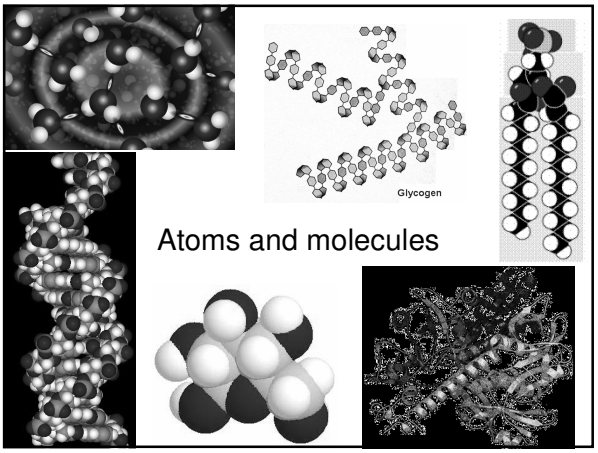
How can I get an A?

- 5) Turn in the journal assignments on time.
  - ❖Five points will be deducted for each day it's late.
- 6) Seek understanding of concepts. Ask questions!
  - talk to your professor, in class or during office hours.
  - visit the tutoring center (x88501)
  - start a study group
  - PLTL (Peer-Leader Teaching Lesson)

Any questions?

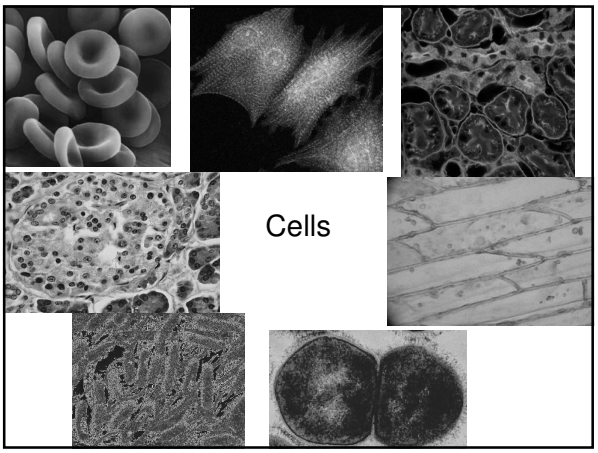
An Introduction to Life

- Levels of organization
  - Atoms/Molecules
  - Cells
  - Tissues
  - Organisms
  - ❖Other levels not covered in biol102:
    - Organs
    - Organ systems
    - Species
    - Populations
    - Communities
    - Ecosystem
    - Biosphere



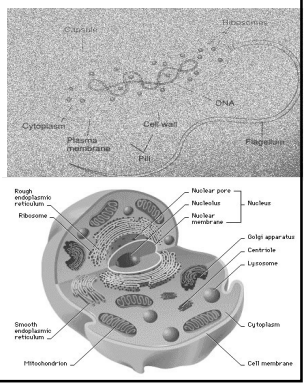
Macromolecules and DNA

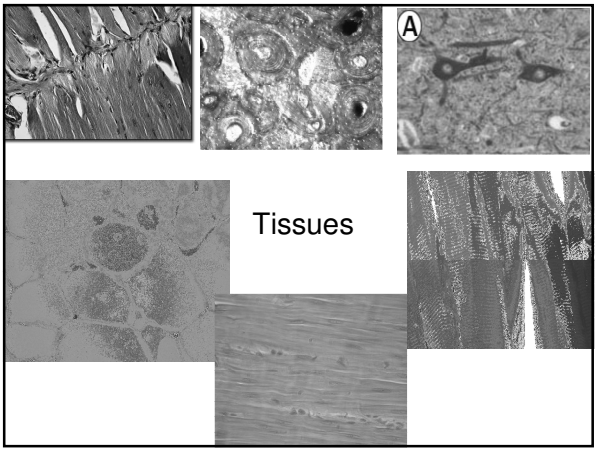
- Molecules are comprised of atoms
- Important molecules we will discuss in the later chapters:
  - ❖Carbon – the basis of all organic matter.
  - ❖Water – why is water important to life?
  - ❖Carbohydrates
  - ❖Lipids
  - ❖Proteins
  - ❖DNA



Cell

- Cell
  - ❖Smallest living unit
- Types of cells vary widely among organisms.
  - ❖Prokaryotes & protists
    - ➢Bacteria, paramecium
  - ❖Eukaryotic
    - ➢Animals, plants, fungi





Tissues

- Tissues are groups of similar cells with a similar function
  - ❖Muscle
  - ❖Connective tissue
  - ❖Adipose tissue
  - ❖Bone tissue
  - ❖Cardiac tissue
  - ❖Brain tissue

How life is connected to each other

Overview of life's unity

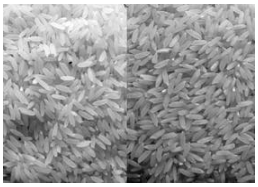
- DNA
- Energy
- Energy and Life's organization
- Life's responsiveness to change

DNA

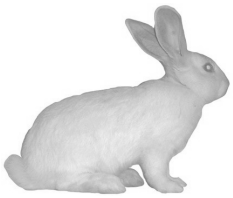
- All living organisms use DNA in some capacity.
  - ❖"semi-living" organisms, like viruses, use DNA or RNA to reproduce.
- DNA is used by most organisms to produce amino acids.
  - ❖Enzymes
  - ❖Muscles
  - ❖Collagen/keratin

Genetic code

- All living organisms use the same genetic code
  - ❖The nucleotides A, C, G, T

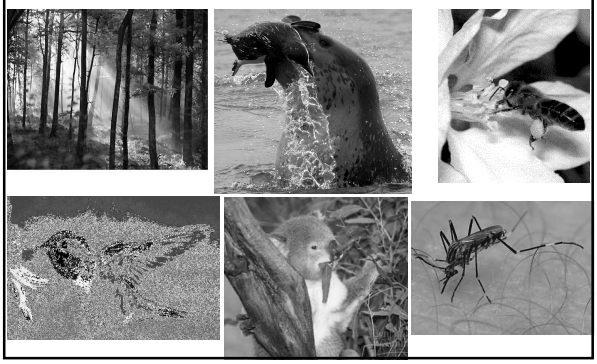


Golden rice (left) has had beta-carotene precursors transferred from daffodils.



Alba had a jellyfish gene for fluorescence incorporated in her genome.

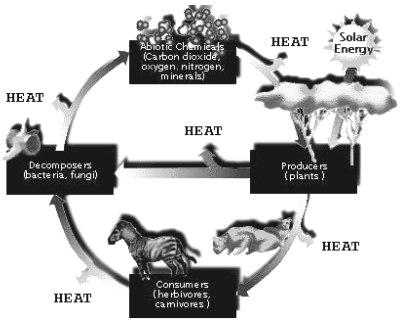
Energy utilization



Energy

- Maintaining life requires energy
  - ❖Even in death, energy is required to decompose.
- Metabolism
  - ❖The process of how cells acquire and uses energy
- Living things often acquire energy through eating other organisms.
  - ❖Plants, however, can produce their own food with sunlight.

Energy flow in life



Response to environment

Responding to change

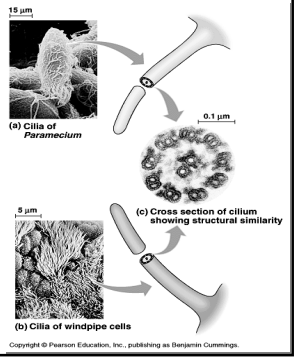
- All things respond to the environment
  - ❖But only living things can make responses to change by using receptors.
- Receptors detect stimuli in environment.
  - ❖Living things respond to the stimuli to create changes to bring the body back homeostasis.
- Homeostasis: the normal operating condition of an organism.

Receptors

- Types of receptors:
  - ❖Mechanical receptors sense physical pain
  - ❖Biochemical receptors sense changes in blood chemistry
    - ➢Example/ rising/lowering blood sugar levels
  - ❖Thermoreceptors sense hot and cold
  - ❖Photoreceptors respond to light

Unity of diverse life forms

- Unity is most evident at the molecular & cellular levels
  - ❖Example:
    Cilia in protists & mammals are very similar in architecture.



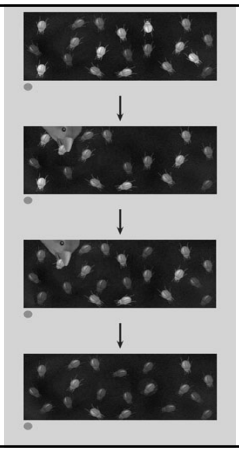
Evolution: the unifying theory of biology

- Definition of evolution: Change in gene frequencies in a population over time.
  - ❖Example 1: Antibiotic resistance in *Staphlococcus aureus*. From 1943 – present, S. aureus went from highly sensitive to penicillin to highly resistant to most antibiotics.
  - ❖Example 2: American Amish population have seen increase in several genetic conditions in their 300 year history.

Evolutionary view

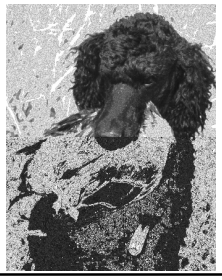
- Mutations create trait variations in populations
  - ❖Example: Red hair vs black hair.
  - ❖The ultimate source of genetic variation.
- Variations are passed down to future generations
  - ❖Usually due to adaptive fitness of one trait over another.
    - ➢Black rabbits more easily seen in the snowy north results in genes coding for black pigments being less frequent over the generations.
- Natural selection
  - ❖The process when environmental differences results in changes of the gene frequencies in a population of organisms.

- Fig. 1-21:
  Natural selection at work.



Man also drives evolution

- Artificial selection is the selection of a genetic trait over others by human breeders, not nature.



Artificial selection

- Sometimes artificial selection goes wrong…
  - ❖Just like natural selection can go wrong!

Valuable silver fox coloring, but skittish and aggressive

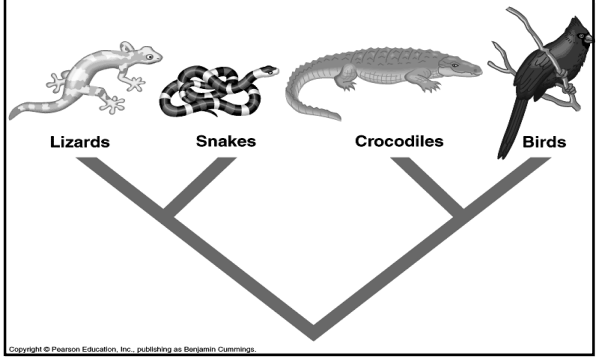
Tame silver fox, but spotted. Not valuable for furs.

Selection for friendly behavior also selected genes that code for spotted coats!

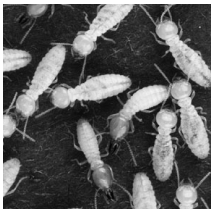
Selection and evolution

- Evolution: Change in gene frequencies over time.
- Molecular view: accumulation of mutations change organisms to the point where they diverge.
  - ❖**Closely** related species: Few differences between their genomes.
  - ❖**Distantly** related species: Many differences between their genomes.

Molecular data indicates surprising relationships



Molecular data indicates surprising relationships



Termites, long believed to be a separate insect order, are now considered highly specialized wood roaches.

Nature of biological inquiry

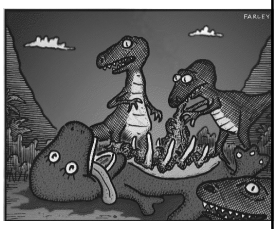
- The Scientific method
  - ❖Observation
    - ➢Observe an aspect of nature
  - ❖Hypotheses
    - ➢Develop a hypothesis based on the observation
  - ❖Make a prediction based on the hypothesis
    - ➢An if-then statement indicating what you would find if your hypothesis is true.
  - ❖Experiment to test hypothesis
    - ➢Develop an experiment for prediction to see if it is true

Nature of biological inquiry

- Devise new hypotheses/tests if your original experiment fails to accept your original idea.
- Repeat tests to see if your hypotheses are robust.
  - ❖Good hypotheses can withstand many different types of tests = also known as repeatability.
    - ➢Cold fusion: A good hypothesis?
- Make conclusions based on all of the tests results.

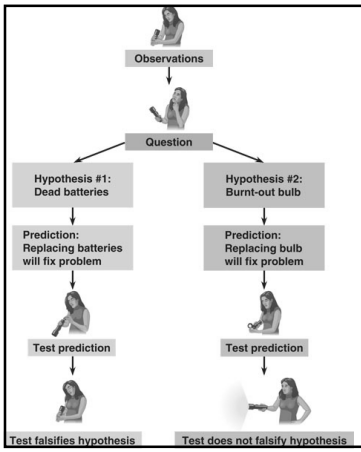
Scientific theory

- Scientific theory
  - ❖Scientific theory is based on hypotheses that still stand after many tests.
  - ❖Scientific theory must be tested. Untestable ideas are not scientific, but speculative.
    - ➢Example/ Dinosaurs spoke English



Power of experimental tests

- Experimental test have the following components:
  - ❖Variable to be tested
  - ❖Experimental group
    - ➢Group that tests the variable
  - ❖Control group
    - ➢Group that does NOT test the variable



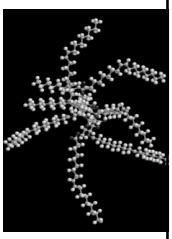
Hypotheses can never be *proved* to be correct.

3rd hypothesis of flashlight problems

Evil flashlight fairies destroy flashlights.

Real life example: Olestra

- What is Olestra?
  - ❖A fat replacement that cannot be digested by humans.
- Normal lipids: Glycerol molecule with 3 fatty acid chains (triglyceride)
- Olestra: Sucrose molecule with 6 – 8 fatty acid chains.
  - ❖Large molecule cannot pass through the intestinal wall.
- Has the same taste and mouthfeel as normal lipids.



Real life example: Olestra

- Observation: People who ate Olestra fat replacement later had cramps
- Hypothesis: Olestra causes cramps.

Prediction: People who ate Olestra laced chips will develop cramps.

Test:

Variable: ?
Experimental group: ?
Control group: ?

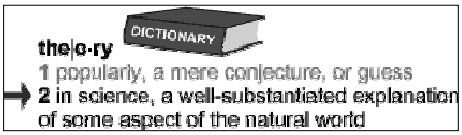
Olestra test

- Variable = Presence of olestra.
- Experimental group = eats olestra laced chips.
- Control group = eats chips with normal fat.
- Conclusions: based on your data.

Bias in testing

- One reason why it is better to repeat your tests is because of errors that can bias your results.
  - ❖Sampling error: when data taken from a sample differs from the data taken from the entire population.
    - ➢This error is most prominent when sample sizes are small.
    - ➢Most researchers attempt to obtain as many individuals as feasible for this reason.

Theories in Science



How does it differ from a hypothesis?

- **Much broader in scope**
- **Generates hypotheses**
- **Supported by much larger body of evidence**

Examples?

- Examples of theories?
- Examples of hypothesis?

Any questions?

Next Class

- We will be starting Chapter 2: Atoms, molecules, and life.
- No lab this week.