Outline

- Introduction
- Class organization, exams, grading
- What does it mean to be alive? What are the common characteristics of living organisms.
- What is unique about humans
- How do we organize the biological world
- How do we study biology? What is the scientific method, how do we set up an experiment.

Introduction

- I received my:
  - BS in Zoology at UC Davis
  - Masters in Ecology at UC Davis
  - PhD in Pharmacology and Toxicology at UC Davis

Internships

- Internships are a great way to find out if you really enjoy working in your chosen field.
- I wanted to be a veterinarian – until I worked at the UC Davis Vet School
  - Then I volunteered at UC Davis Raptor Center
  - I found my niche

My last summer as an undergraduate I did an internship with the National Park and UC Davis in Yosemite
I knew that I wanted to work as a field biologist with birds of prey.

When I graduated I went to work for the Peregrine Fund releasing young birds into the wild.

My work with the peregrine falcons led me back to UC Davis.

I received a masters degree from the Ecology Graduate Group – emphasis on toxicology.

But I still had many more questions, I needed more knowledge. My interest in metabolism increased.

Back to Graduate School for the PhD.

Advice: Get involved in internships or work in the field you are interested in.
Course Overview

- Bio 105 is an introduction to human biology
- In this class you will learn about the human body and how it functions.
- This is a preparatory class for human anatomy and physiology (A&P) courses.
- This class will not go into the same detail as the human A&P classes.
- Lecture attendance is critical for success in this course, most of the material that you are required to master is given in lecture.
- Come to lecture prepared. Read the assigned chapter before lecture.
- Review material after each class, concentrate on the "important concepts".
- Make a study guide for yourself from the important concepts after each lecture – think of this as your homework.
- Come to office hours if you have questions.

Exams

- There are four midterm exams and one comprehensive final exam.
- There will be two lab practical exams.
- There will be pop quizzes given. The quizzes will not be announced ahead of time. They are given at the start of class or lab. There is no make up for missed quizzes (Come to class and lab on time)
- Exams will cover: The lectures and reading

Early Exams

- If you need to take the exam early, contact me as soon as possible.
- In order to take an early midterm you must receive written approval from both the division chairperson and myself. Early midterms will only be allowed in rare cases.
- In order to take an early final you must receive written approval from the Office of Instruction and myself.

Late Exams

- If you have to miss an exam, you must contact me before the exam. If you have a documented medical excuse, you may make up the exam.
- But you must contact me before the scheduled exam. If you don’t contact me before the scheduled exam you will receive zero points for the exam.
- There will be no make up exams for the final, you will receive zero points if you miss the final.
- There are no make ups for the lab practicals

Exams

- If you miss any of the exams and don’t contact me before the end of the scheduled exam you will receive zero points for the exam.
- You may leave a message for me on my phone, or the biology dept phone number or email me.
Missed Exams

- If you miss the exam, and you have contacted me before the start of the exam, you may take a make up exam.

- The make up exam will be given the last week of class.

Cheating

- Cheating will not be tolerated.

- If you cheat you will receive a zero for the exam, an official report will be submitted to the VP of Student Services.

- During exams, all packs, bags, phones, notes, jackets, hats, etc will be left at the front of the class. If you have notes or a cell phone with you at your desk during an exam you will receive a zero for the exam.

- If you copy answers from another student you will be given a zero for the exam.

- A second act of academic dishonesty will result in a zero for the course. I consider lying to be an act of academic dishonesty.

- Plagiarism is a form of academic dishonesty, you may not copy information from the web, books, papers, etc. Read many sources of information and summarize the information in your own words.

Grading

- In general the course will be graded on a straight 90, 80, etc, this means:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>90 and above</td>
</tr>
<tr>
<td>B</td>
<td>80 and above</td>
</tr>
<tr>
<td>C</td>
<td>70 and above</td>
</tr>
<tr>
<td>D</td>
<td>60 and above</td>
</tr>
</tbody>
</table>

Lab

- There will be 2 exams given in the laboratory, covering the material.

- You can not make up a missed lab exam. If you have a documented, legitimate medical excuse I will average your score without the exam.

- Attendance for the labs will be used to evaluate a student whose grade is on the border between two grades.

- Occasionally laboratory time may be used to cover material that will be covered in the class exam.

Lab

- You are expected to read the labs before coming to labs.

- There will be pop quizzes at the start of the labs to test your knowledge of the labs prior to the start of the lab.
How many midterm lecture exams are there?
1. One
2. Two
3. Three
4. Four

Is the final comprehensive?
1. Yes
2. No

Can you take an exam early?
1. Yes
2. No
3. Yes if you contact me early

Can you take an exam late?
1. Sure – no problem
2. No possible way
3. Yes, if you contact me before the scheduled exam

When can you take the make-up exam?
1. As soon as you can
2. At an arranged time
3. By the next class or the last week of class

Can you make up missed quizzes
1. Yes
2. No
3. Yes, with a medical excuse
Is it alive?

- Sounds like an easy question to answer.
- Usually we can look at something and know if it alive.

But sometimes it is not as easy to tell

Looking closer you see signs of life

Characteristics Humans they Share with Other Living Things

1. Contain biological molecules including:
   - Proteins, nucleic acids, carbohydrates and lipids

Characteristics Humans they Share with Other Living Things

2. Cellular
   - Cells are the smallest unit of life
   - Some organisms are composed of only one cells (unicellular)
   - Other organisms are composed of many cells (multicellular)
### Characteristics Humans they Share with Other Living Things

#### 3. Reproduce
- Simple one celled animals may reproduce asexually by dividing in half – producing two identical cells.
- More complex multi-celled organisms may reproduce sexually, when genetic material is combined to produce a unique individual organism.

#### 4. Acquire and use energy - Metabolism
- Metabolism is all the chemical reactions that occur in a living organism.
- Through metabolism, organisms obtain energy from nutrients and use this energy to grow and development.

#### 5. Respond to environment
- Living organisms detect stimuli and respond to it. This can include movement.

#### 6. Maintains Homeostasis
- **Homeostasis** is the relatively constant and self-correcting internal environment of living organisms.
Characteristics Humans they Share with Other Living Things

7. Populations of living organisms evolve and have adaptive traits
   - Adaptive traits are those traits that help you survive and reproduce
   - Members of the population that have adaptive traits survive better than members that lack those traits

Which of the following is not necessarily a characteristic of life?

1. respond to environmental changes
2. cellular
3. multicellular
4. reproduction

Characteristics unique to Humans

Levels of Biological Organization

- Atom = Smallest unit of an element
  - Example = Hydrogen
- Molecule = Two or more atoms bonded together
  - Example = Water (H₂O)
- Organelle = Membrane-bound internal compartment in cells for specialized functions
  - Example = Golgi Apparatus
- Cell = Smallest unit with the capacity to live and reproduce independently or as part of a multicelled organism
  - Example = Endothelial cell
- Tissue = Organized collection of cells that function together in a specialized activity
  - Example = Endothelial layer
- Organ = Combination of tissues that function together
  - Example = Kidney
• Organ System = multiple organs and tissues working together for a common function, example = digestion system

• Multi-celled Organism = Individual consisting of interdependent cells typically organized into tissues, organs, and organ system.
  • Example = Humans

• Population = A group of individuals of the same species, living together in the same area
  • Example = Humans living in Napa

• Community = Populations of all species living together in the same area
  • All the species living in Napa (includes all plants, animals, etc)

• Ecosystem = The community and its physical environment
  • Example = The species living in Napa and the water, soil, and sunlight.

• Biosphere = All regions of the Earth’s crust, water, and atmosphere with all the living species.

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Community

• Populations of all species living together in the same area are called a **community**
  • Example: All the species living in Napa (includes all plants, animals, etc)

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Ecosystem

• The community and its physical environment is called the **ecosystem**.
  • Example = The species living in Napa and the water, soil, and sunlight.

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Levels of Organization of Life

| Molecule | The chemical components of cells |
| Tissue | A group of similar cells that perform the same function |
| Organ | A structure with two or more tissues working together to perform a function |
| Organ systems | At least two organs working together to perform a function |

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Levels of Organization of Life

<p>| Individual | A single organism |
| Population | All individuals of the same species in an area |
| Community | All the species in an environment that can interact |
| Biosphere | The part of the earth that supports life |</p>
<table>
<thead>
<tr>
<th>Organ System</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integumentary</td>
<td>Covers and protects our body</td>
</tr>
<tr>
<td>Digestive</td>
<td>Converts food to nutrients</td>
</tr>
<tr>
<td>Circulatory (cardiovascular)</td>
<td>Transports nutrients and wastes to and from the cells</td>
</tr>
<tr>
<td>Immune</td>
<td>Defends against disease</td>
</tr>
<tr>
<td>Respiratory</td>
<td>Exchange gases with the environment</td>
</tr>
<tr>
<td>Urinary</td>
<td>Eliminates wastes</td>
</tr>
<tr>
<td>Nervous</td>
<td>Communication within the body, regulates functions</td>
</tr>
<tr>
<td>Muscular</td>
<td>Moves the body</td>
</tr>
<tr>
<td>Skeletal</td>
<td>Supports the body</td>
</tr>
<tr>
<td>Endocrine</td>
<td>Regulates systems and internal environment</td>
</tr>
<tr>
<td>Reproductive</td>
<td>Produces offspring</td>
</tr>
</tbody>
</table>

**Anatomy and Physiology**

- **Anatomy** – The study of the body's structure and the relationship between the parts of the body
- **Physiology** – The study of how the body works

**Where do humans fit into the world?**

- Biologists like to classify things and put them in categories.
- One way to divide them is into domains

**Domains**

- There are three **domains**:
  - **Domain Eukarya** = have a nucleus
  - **Domain Archaea** = one celled organisms that lack a nucleus (prokaryotic), live in extreme environments
  - **Domain Bacteria** = one celled organisms that lack a nucleus (prokaryotic)

**Domain Eukarya**

- All Domain Eukarya organisms have a nucleus
- Domain Eukarya is divided into kingdoms.

**Four Kingdoms in the Domain Eukarya**

1. Protista = protists (one celled organisms with a nucleus)
2. Fungi (mushrooms and molds)
3. Plantae – plants
4. Animalia – animals, invertebrates and vertebrates
How do we study biology?

- First a scientist identifies a problem or question
  - Why do certain cells turn into cancer cells?
  - Is this substance hazardous to your health?
- Then the scientist formulates a plan to study the problem

Scientific Method

1. Observation – Observe some aspect of biology
2. Investigate what others have found
3. Develop a testable hypothesis – educated guess to explain observation, used to make a prediction
4. Design and perform experiments to test your predictions
5. Repeat experiments
6. Analyze the data
7. Draw conclusions
8. Report the method, data, results and conclusions
Theory

- A theory is well-substantiated explanation of some aspect of the natural world

Experimental Design

- Search the available databases to find out what other scientists have done, how they did their research and their results.
- Design the experiment to test one variable at a time.

Variables

- A variable is something that is changed to see how that change effects the study
- Ex: add artificial sweetener to diet
- Ex: use fertilizer on plants
- Constants – all the factors that are kept the same in the experiment

Experimental Design

- Set up a control group which is identical to the experimental group except without the one variable being tested.
- Repeat the experiment to get statistically significant data.

Example

- Hypothesis: Artificial sweeteners are safe to eat
- The researchers choose the mouse as a model to test the safety of the additive (Why not humans? Are mice good models?)

Example

- They divide a group of similar mice (all the same age, sex, raised the same way) into two groups.
- Half the animals are the control group, they are fed the normal diet, the other half are the experimental group = they are fed a diet of 50% normal food and 50% artificial sweetener (Is this a lot?)
Results

- One third of the test group developed bladder cancer.
- None of the control group developed bladder cancer.
- Cannot accept the hypothesis that the additive is safe at this level of consumption.
- What would have happened if we had looked at a different dependent variable, hyperactivity, would we have missed the bladder cancer?

What are the controls?

1. Same cages
2. The mice not fed the artificial sweetener
3. The scientist

Clinical trials

- Experiments that deal with medicines or other materials used by humans are first tested on laboratory animals.
- If these tests go well, then the first clinical trials begin using humans, all of whom must provide informed consent to participate in the studies.

The Scientific Method

<table>
<thead>
<tr>
<th>TABLE 1.1 Tests Performed on a New Drug before It Is Approved by the Food and Drug Administration (FDA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests on laboratory animals</td>
</tr>
<tr>
<td>Is the drug safe for use on animals?</td>
</tr>
<tr>
<td>Clinical trials</td>
</tr>
<tr>
<td>Phase I</td>
</tr>
<tr>
<td>Phase II</td>
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<tr>
<td>Phase III</td>
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</tbody>
</table>

- Clinical trials
  - Consist of several experimental groups that receive different dosages of the drug, and a control group that receives a placebo.
  - It is absolutely important that both groups be treated identically except for one variable.
The Scientific Method

- **A double blind study**
  - Occurs when neither researchers nor participants know which group is receiving the treatment

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**Smoking cause cancer**

1. True
2. False

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**Does Smoking Cause Cancer**

- One way to study a problem is to look at epidemiology evidence.

- Look at cancer rates over time, correlate cancer rates with events and changes that also occur during that period.
Terminology - general

- **Function** – the normal physiologic activity of an organ or part. This is the job of the part of the body.
- **Produce** – “To produce” = to make
- **Synthesis** – building up of something (synthesize = to build something)
- **Lack** – does not have or does not contain

Terminology - general

- **Inhibit** – To decrease, limit, or block the action or function of
- **Stimulate** – To temporarily increase temporarily the activity of a body organ or part.
- **Dilate** – To make wider or larger
- **Constrict** – To make smaller or narrower by binding or squeezing

Important concepts

- Reading for next lecture: Chapter 2 (Pages 14-25)
- What are the seven characteristics of living organisms?
- What are the domains and kingdoms? What are the characteristics of organisms in the domains and kingdoms?
- Which domain and kingdoms do humans belong in?
- What are the steps of the scientific method? Be able to describe the steps in order.

Important concepts

- What is a hypothesis and how does it differ from a theory?
- Understand how to set up an experiment using the scientific method and be able to identify the hypothesis, variable, test group, control group, and constants.
- Know the phases of clinical trials.

Definitions

- Unicellular, multi-cellular, metabolism, anatomy, physiology, homeostasis, adaptive traits, variable, constant, control group, experimental group, population, community, ecosystem, placebo, double blind study, epidemiology, theory, hypothesis, informed consent, clinical trials, function, produce, synthesis, synthesize, lack, inhibit, stimulate, dilate, constrict