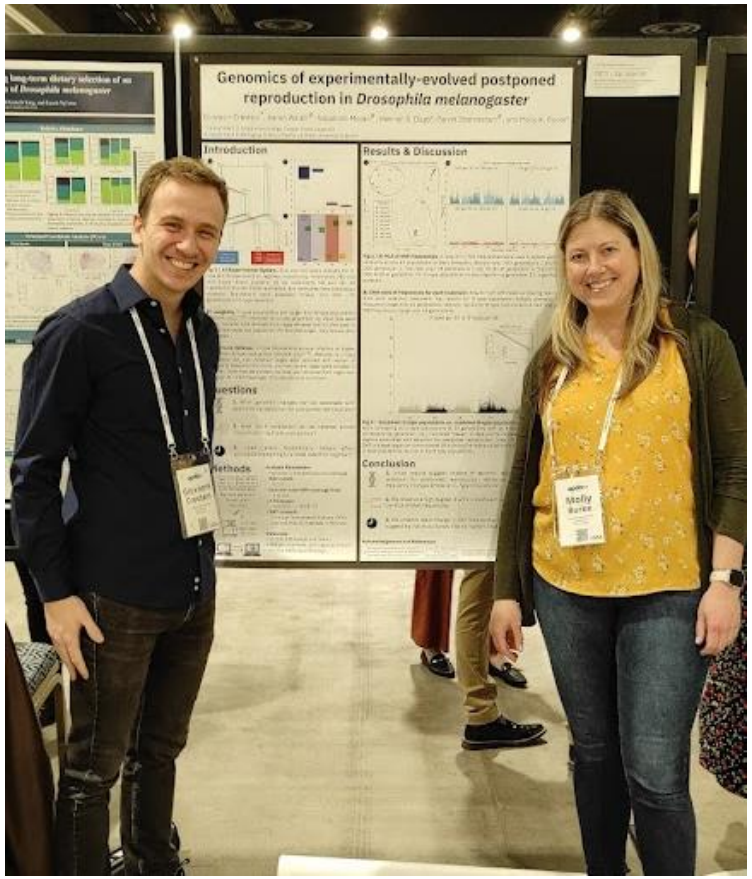
Activity	Time
Introductions/Lab Expectations	35 mins
Part 1: The Stereoscopic Microscope	50 mins
Part 2: The Compound Microscope	50 mins
Part 3: The Scientific Method	30 mins
Clean-up	5 mins

Giovanni Crestani (or Gio)

Gio

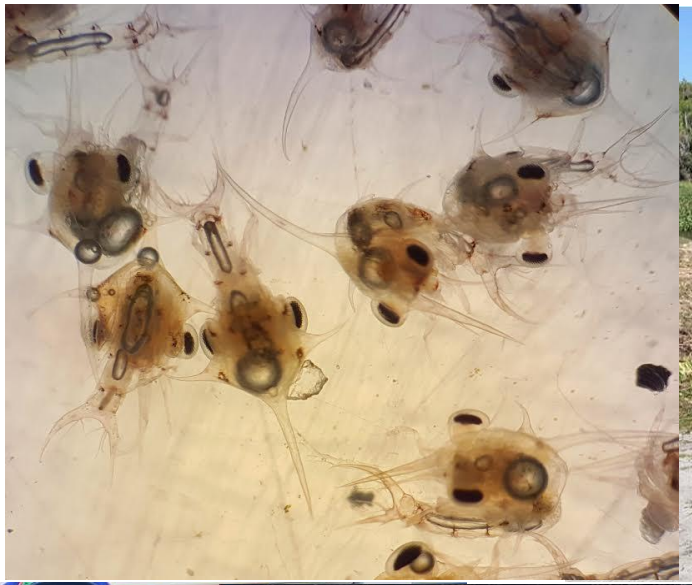
crestang@oregonstate.edu

Office Hours: Cordley 1205, Friday 1~2



Meredith Anderson

- University of Florida, B.S. Marine sciences and Spanish minor
- MS Integrative Biology, Plankton Ecology Lab
- **Vole Hole:** Thursdays 3-4 pm

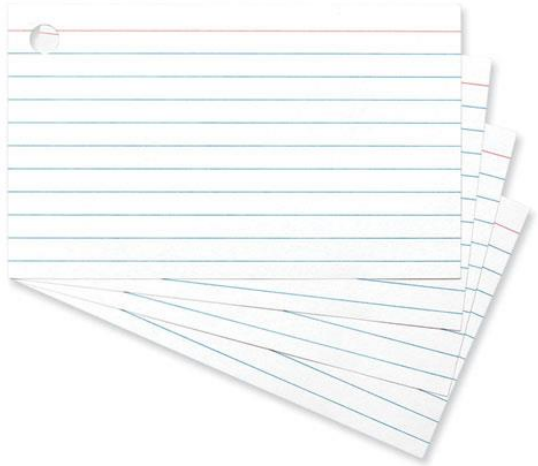


Introduce yourselves

Take 3 minutes to introduce yourself to your lab group.

Also, please write on an index card. These are private (just Gio and Meredith will read it).

- Name and/or preferred name
- Pronouns
- Major/Year
- Anything you want me to know about you!



- Generate questions and construct testable hypotheses about biological mechanisms based on observations of the natural world. (Bclo 1, 2, & 3)
- Design an experiment using appropriate methodology (experimental techniques, controls, data collection and analysis), reach conclusions and identify future lines of inquiry. (Bclo 1, 2, & 3)
- Integrate sub-disciplinary concepts from within and outside biology to address complex problems. (Blco 3)
- Identify ways that interdisciplinary concepts are used to explain biological phenomena. (Blco 1 &3)
- Evaluate multiple representations (e.G., Diagrams, physical models, mathematical relationships) by comparing the applications, strengths, and limitations of different models and their relationship to real biological systems. (Bclo 1, 2, & 3)
- Apply quantitative skills to biological problems. (Bclo 1, 2, & 3)
- Work productively in teams with diverse perspectives.
- Share ideas with peers clearly and accurately using scientific conventions.
- Effectively communicate experimental outcomes using professional scientific formats (e.G. Report, poster, presentation). (Bclo 1, 2, & 3)
- Read and interpret primary scientific literature. (Bclo 1, 2, & 3)

Lab Safety

Do:

- Dispose of chemicals as instructed
- Keep your work area neat and organized
- Follow all instructions and procedures
- Know the location of emergency equipment (including First-aid Kit)
- Wear appropriate clothing and shoes
- Read safety pages ix - x in your lab manual carefully
- ASK if you have questions or are unsure of safety procedures

Do not:

- Eat or drink in the lab
- Taste or smell reagents
- Pour chemicals back into containers
- Move a lit flame
- Operate equipment you have not been instructed to use
- Perform unauthorized experiments
- Horseplay
- Come to lab sick

Expectations

I expect you will…

- Be on time and prepared
- Follow all lab safety rules and etiquette
- Complete all assignments using your own words and with integrity
- Be prepared to stay the full length of lab
- Respect all students, TAs, and TIs
- Respect the lab and lab materials
- Apply yourself and participate

You can expect me to…

- Facilitate a welcome and inclusive learning environment
- Consider respectful and constructive criticism
- Create fair assessments of the material
- Start and end class on time
- Be on time and prepared
- Be available to answer questions during lab and office hours
- Answer emails
- Return assigned work in a timely manner

This lab is a safe space

- Ask questions, make mistakes, be kind. Don't stress out too much!

Academic Integrity

Please review the academic integrity section on the **Syllabus**.

Predominantly, don’t cheat or plagiarize. I am required by contract to report cheating.

About AI tools (such as chatGPT), use it punctually, tell me when you use it, and double check the information it gives you.

22x Series Guide

- GTAs
- One term-long CURE (Course-Based Undergraduate Research Experience) per term
- One individual product & One group product at the final of the term
- **Lecture:** knowledge, from Cells to Ecosystems
- **Lab:** skills, such as microscopy, pipette, computational tools, data analysis, etc.
- **Lab grade:** based on assignments & attendance. *I don't really care about your manual – use it for your own learning process*.

Lab Schedule

Week	Lab Activities	Assignments Due
1	**Introduction to Microscopy and the Scientific Method**	Start Here Module
2	**Introduction to Nematodes** *Pipetting Workshop*	Lab 2 Pre-Lab
3	**Introduction to Excel and Nematode Experiment Setup** *Introduction to Science Communication Product*	Lab 3 Pre-Lab: Individual Experimental Design Individual Figure Facts Assignment
4	**Nematode Experiment Data Collection and DNA Extraction** *Article Discussion*	Lab 4 Pre-Lab Collect Gastropod before Lab Individual Annotated Bibliography Assignment
5	**Polymerase Chain Reaction (PCR) & the Cell Cycle**	Lab 5 Pre-Lab
6	**Gel Electrophoresis and Sanger Sequencing** *Peer Review*	Lab 6 Pre-Lab
7	**Project Check-In, Presentation Work Week & Skills Demonstrations**	First Attempt Skills Demonstration
8	**Nematode Data/DNA Analysis**	Lab 7 Pre-Lab Rough Draft Science Com. Product
9	**No Lab – Thanksgiving Break**	Peer Review of Sci. Com. Product
10	**Group Presentations and Career Connections**	Lab 8 Pre-Lab Final Science Com. Product Biological Fronteirs Group Presentation Peer Evaluation Feedback Form Final Attempt Skills Demonstration

Lab Grading

Assignments	Points per Assignment	Number Graded	Total Points
Start Here Module – Group Norms Pre-Work	**2**	**1**	**2**
Start Here Module – Syllabus Quiz	**2**	**1**	**2**
Pre-lab Assignments	**2**	**7**	**14**
Lab Investigations	**4**	**8**	**32**
Skills Demonstrations	**10**	**2**	**20**
Course-Based Undergraduate Research Project			
Individual Figure Facts Assignment	**12**	**1**	**12**
Individual Annotated Bibliography Assignment	**10**	**1**	**10**
Individual Science Communication Product Rough Draft	**5**	**1**	**5**
Peer Review of Science Communication Product	**5**	**1**	**5**
Individual Science Communication Product Final Draft	**40**	**1**	**40**
Biological Fronteirs Group Presentation	**10**	**1**	**10**
Peer Evaluation Feedback Form	**2**	**1**	**2**
Total			**154/150**

Skills Demonstration

All students must pass 2 skills demonstrations

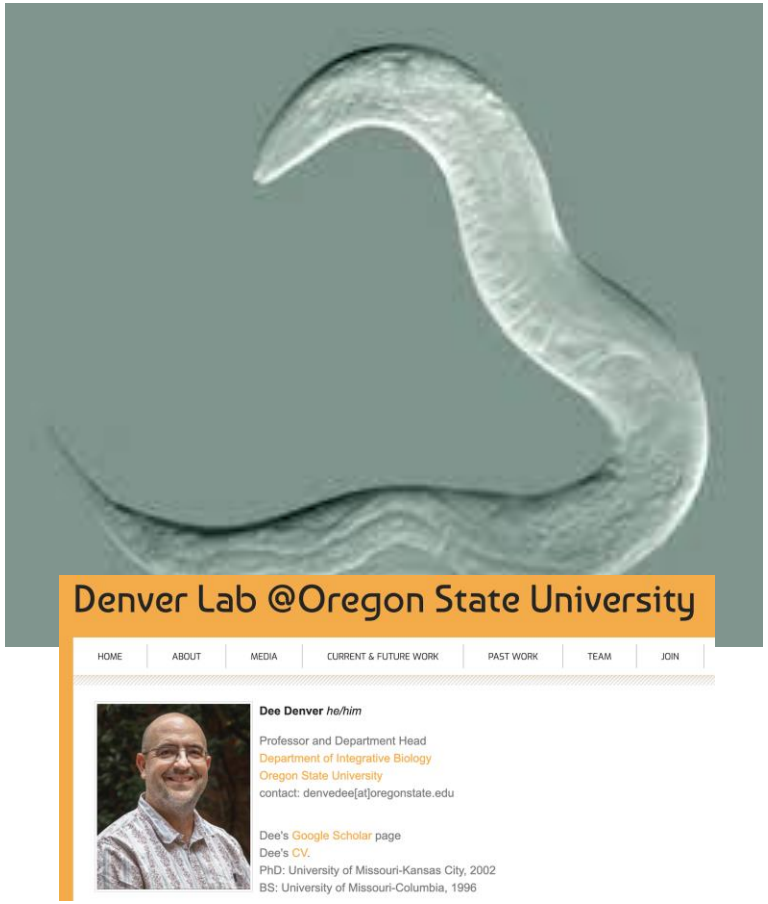
Microscope use & Precision pipetting

P / NP grading. P = 10 pts. There is no partial credit. If you do not pass on first try, you can have one more attempt (two attempts max). First Attempt must be before or during week 8. Read te Rubric in the manual. Practice during lab and Office Hours

When?

- During lab or lead TA office hours
- I will bring a sign-up sheet during lab next week

Course-Based Undergraduate Research Project



- Goals:
  - Provide all students with authentic research experiences
  - Test hypotheses using the scientific process
  - Master skills used in the field (microscopy, DNA extraction, PCR, DNA sequencing, data analysis etc.)
- Context:
  - Nematodes – model organisms and ubiquitous
  - Also, based on research conducted in the Denver Lab, Integrative Biology

  - https://media.oregonstate.edu/media/t/1_pp6f4z1t

Late Work Policy

- 10% reduction each day late (including weekends)
- Maximum of 50% reduction
- After Friday of week 10, all late assignments must go through the course coordinators.
- I will receive late assignments up to 2 weeks after due date
- **Please communicate if you need more time!**

Daily Lab Outline

- Pre-Lab (2 pts each)
  - On Canvas (due 30 min before lab)
- In-lab (4 pts each)
  - SIGNATURE QUESTIONS

Complete Pre-Lab Assignment (1/2 hour before lab)

Intro to the Lab (15 min)

Announcements

Background info on the lab to help you be successful

Lab Exercises (2+ hours)

Group work and “In-Lab” signatures

Lab Clean up

Questions?

Lab 1:

Introduction to Microscopy and Scientific Method

Housekeeping:

	Assignment	Due
1	Start Here Module	
2	Lab 2 Pre-lab	30 min before lab

Lab 1 Outline

Part 1: The Stereoscopic (Dissecting) Microscope

Part 2: The Compound Microscope

Part 3: The Scientific Method

Part 3: The Scientific Method

The Scientific Method

What is science?

The Scientific Method

What is science?

Study of the natural and physical world through observation and experimentation

The Scientific Method

What is science?

Study of the natural and physical world through observation and experimentation

How do we do science?

The Scientific Method

What is science?

Study of the natural and physical world through observation and experimentation

How do we do science?

Ask questions, propose informed explanations, and test the validity of those explanations.

The Scientific Method

What are the components?

The Scientific Method

What are the components?

Question, Hypothesis, Prediction, Experiment, conclusion/analysis

The Scientific Method

What are the components?

Conclusion/analysis

Hypothesis

Prediction

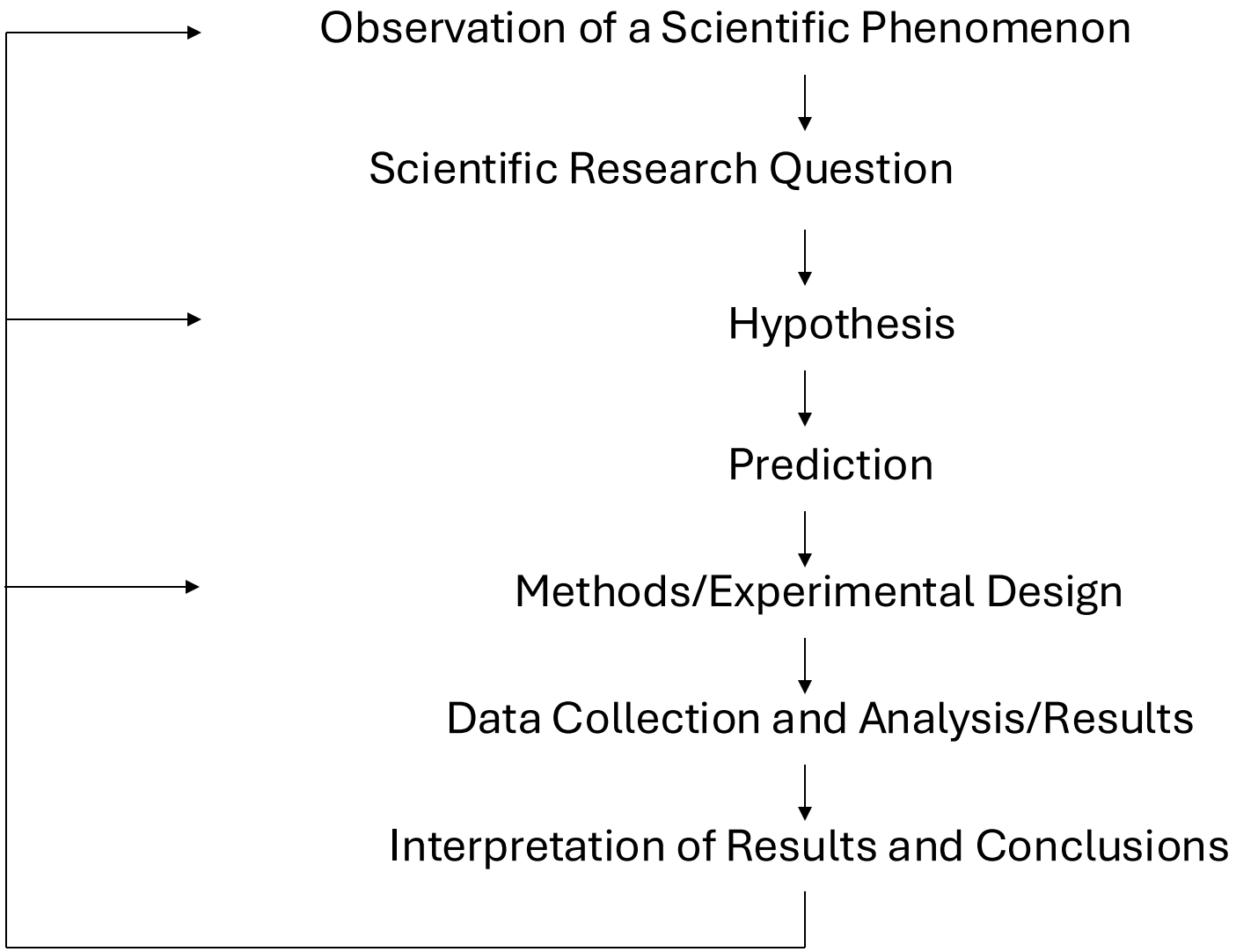
Question

Experiment

Observation

Is there a specific order to them?

Steps in Scientific Method



What makes a good scientific question?

- Measurable
- Controllable
- Testable and falsifiable
- Based on observation
- Well defined
- Feasible

A biological example…

Floridian mice!

What is a question you might ask? **Q1!**

Fig. 1.24

What would you predict the mice in each habitat will look like?`

Evaluating information (Q4)

Evidence: What you know. Direct observations, data

- **Quantitative** (numbers, height, mass, age, etc.)
- **Qualitative** (not numbers, color, texture, taste, etc.)

- **Inference:** “Guess” based on evidence and outside information

Please do # 2-4!

The Scientific Method – Hypothesis

What is a hypothesis?

A HYPOTHESIS is a proposed scientific explanation for how or why a phenomenon occurs

"Because" statement

X happens ***because*** *of Y and Z.*

A good hypothesis is Testable and falsifiable

Can a hypothesis be proven true? NOOOOOOO!

We Provide evidence for or against the hypothesis

What is a prediction?

- a PREDICTION is how the **data** should look if the hypothesis is true

Proper form of a prediction

- “if….then statement”
- **if** (the hypothesis is true), **then** (expectation of what the data will look like)

Your hypothesis is about your question. Your prediction is about your experiment.

Example Question: Is nematode diversity related to the size of the slug?

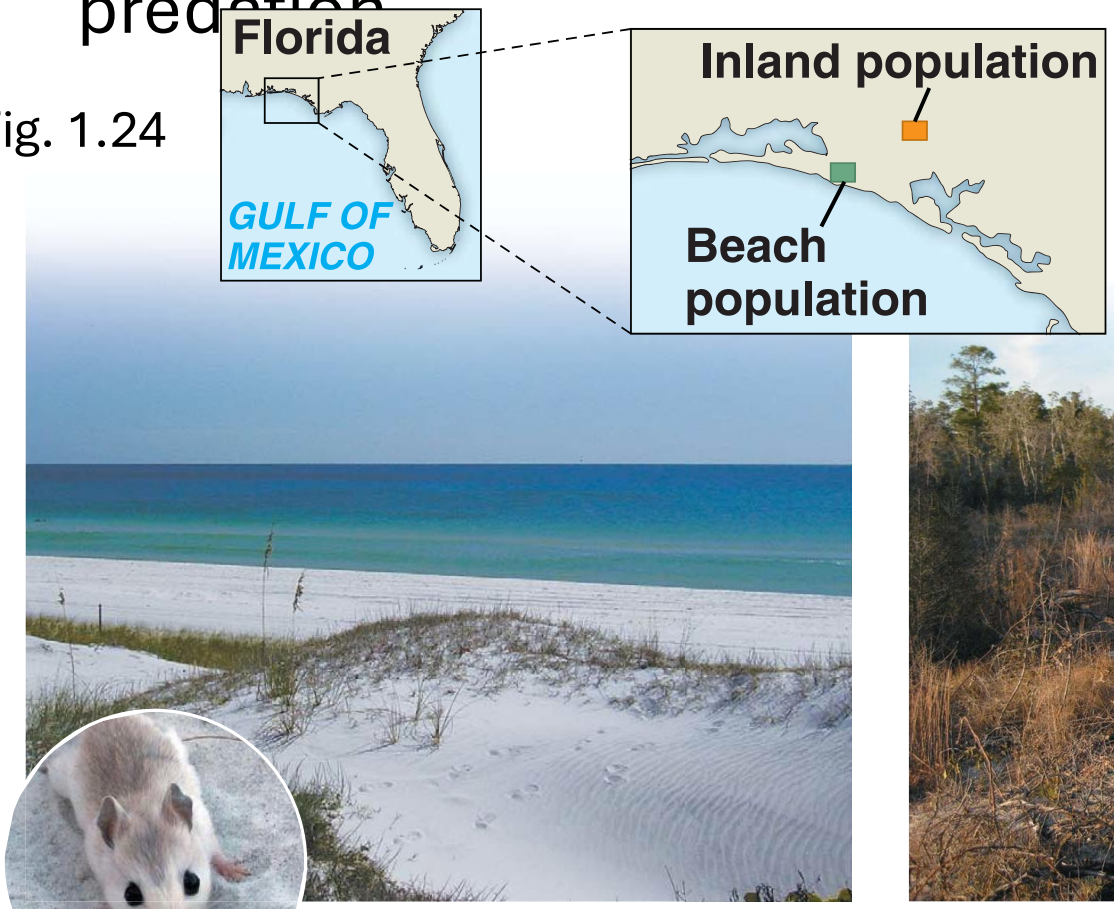
Example Hypothesis: Larger slugs will have a higher diversity of nematodes, because they require larger amounts of food than smaller slugs do, thus increasing their chances of exposure to different nematode species.

Example Prediction: If larger slugs have a higher diversity of nematodes as compared to smaller lugs, then there will be a strong positive correlation between slug size in grams and nematode diversity counts.

Explanatory Hypothesis?

There are different coat colors in different habitats, because it provides camouflage limiting predation

Fig. 1.24



What are two predictions you can make from this???

Please do Q5 and 6!

The Scientific Method – Methods/Experimental Design
A controlled field experiment

Mouse models: white & tan

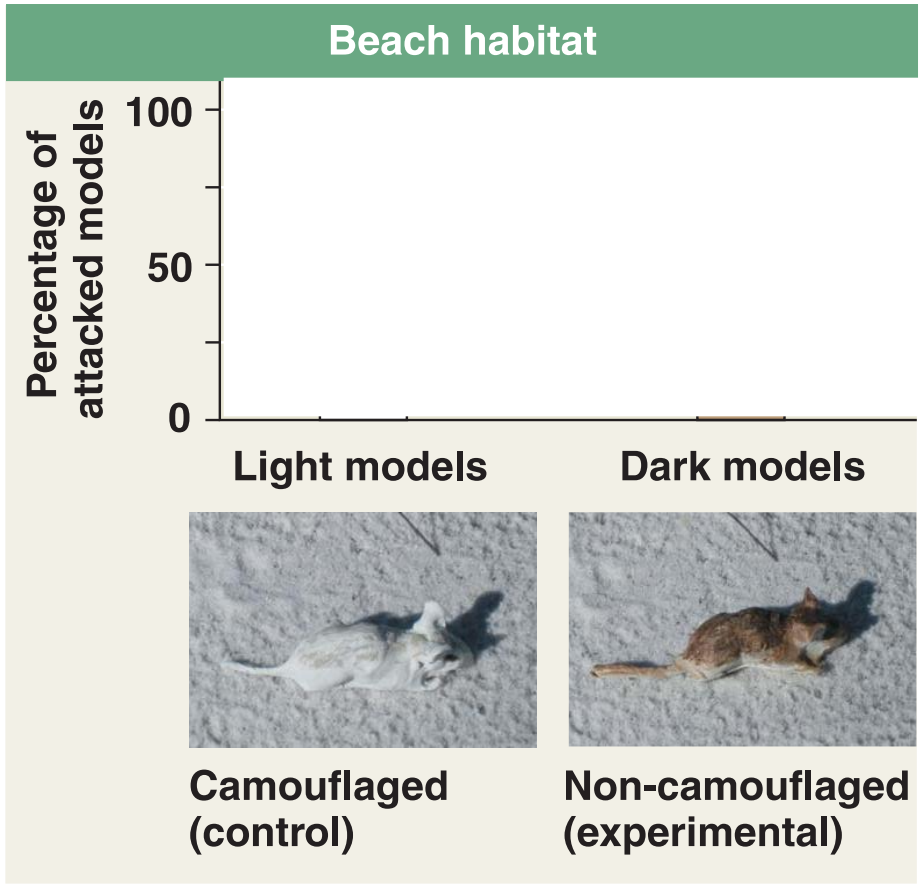
Differ in only one factor at a time!

(Vignieri et al., 2010) *Evolution* 64, 2153-2158.

The Scientific Method – data collection/analysis

Data: recorded observations

Dependent (response) Variable



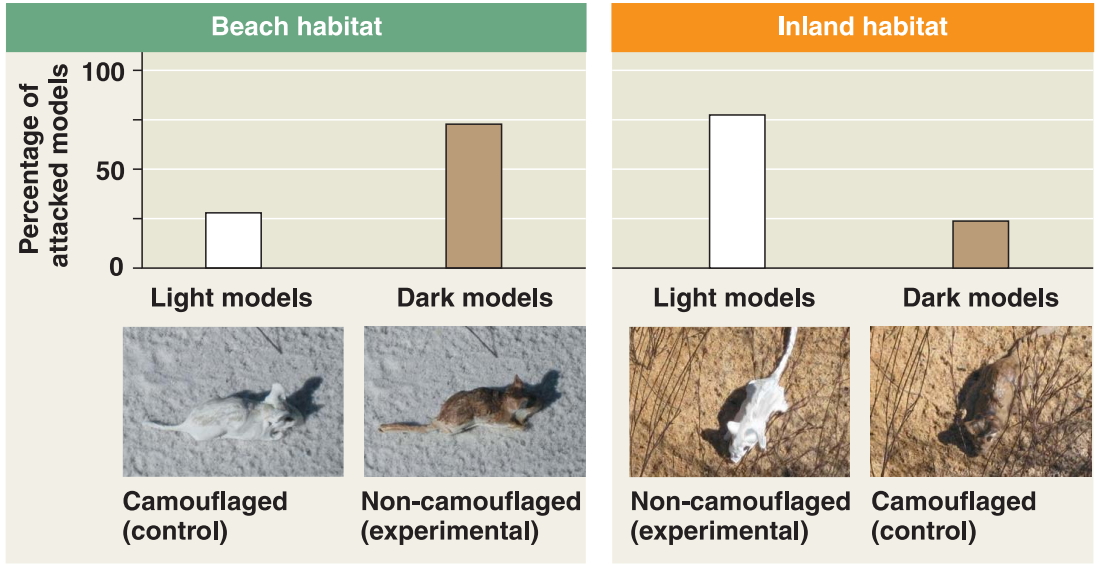
Independent (explanatory) Variable

Fig. 1.25

1. How does the DATA match the PREDICTION?

2. How do the RESULTS tie into our previous understanding?

Hypothesis: supported or not?



Question

Here is a new prediction of the hypothesis:

If the hypothesis is correct, then on the beach there will be **more tan** mice in the stomach contents of snakes than white mice

Which is the dependent (response) variable?

a) Mouse color

b) Location of snake

c) Number of mice eaten

Question

Here is a new prediction of the hypothesis:

If the hypothesis is correct, then on the beach there will be **more tan** mice in the stomach contents of snakes than white mice

Which is the dependent (response) variable?

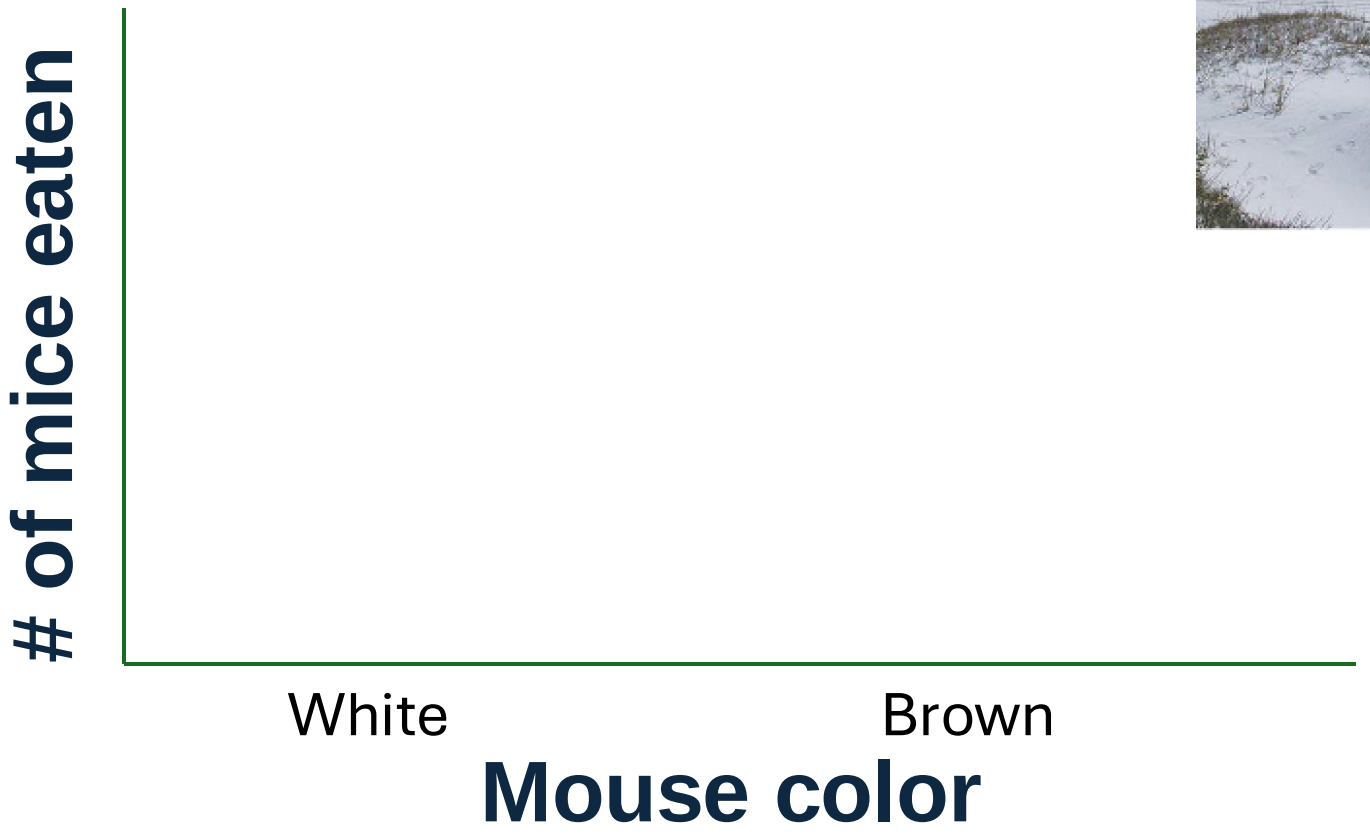
a) Mouse color

b) Location of snake

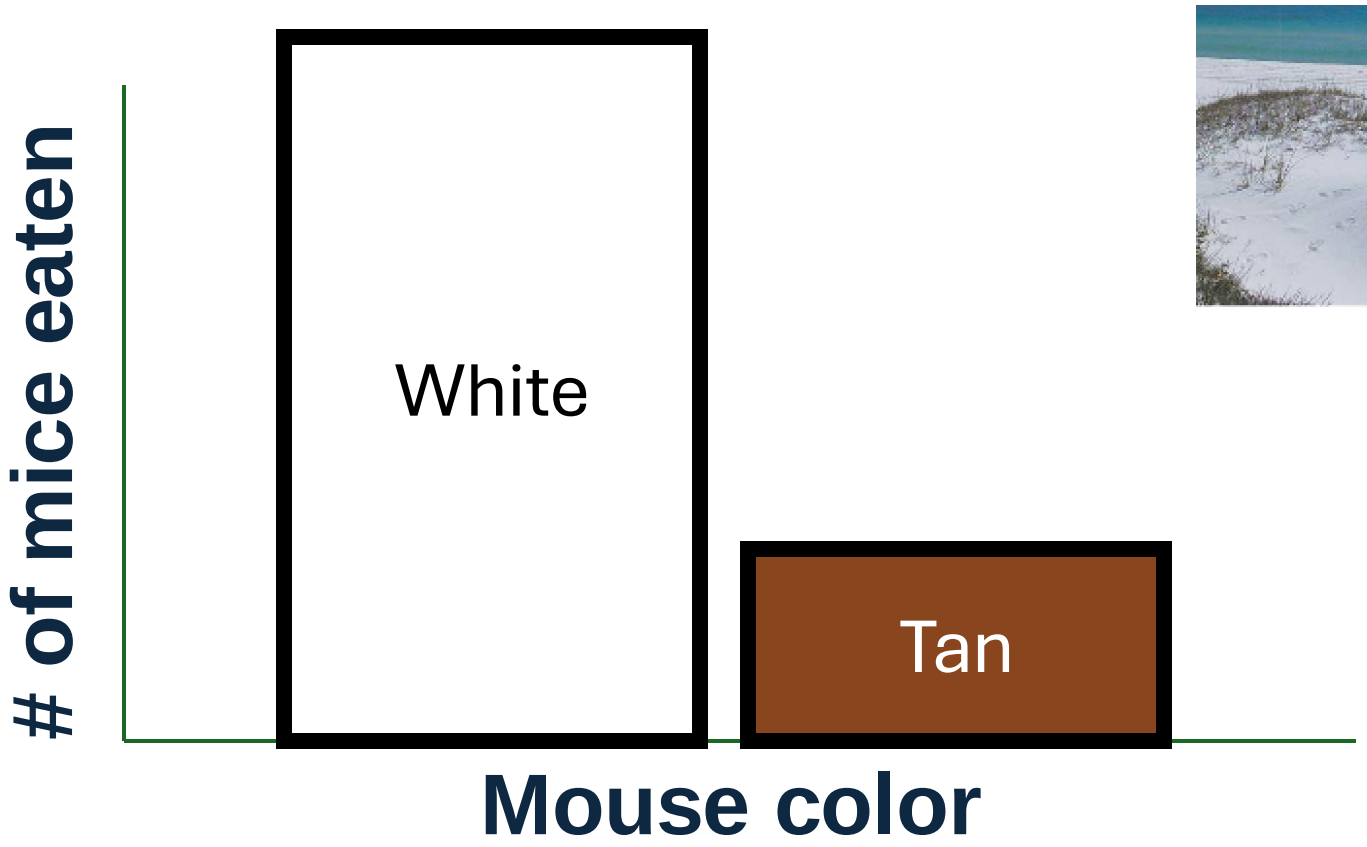
c) Number of mice eaten

Question

- What will this graph look like in beach environment?



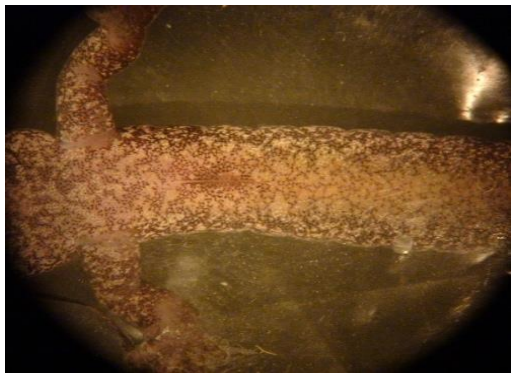
- Do these new data support or refute the hypothesis?



Types of Microscopes

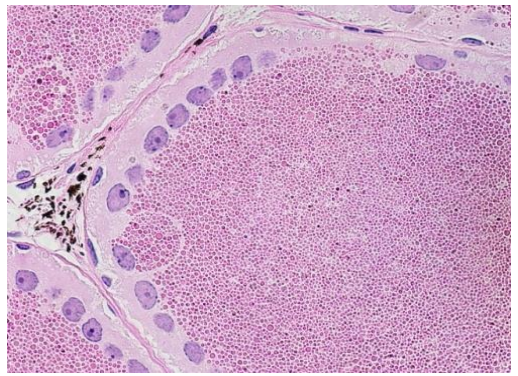
Light Microscopes

Stereoscopic



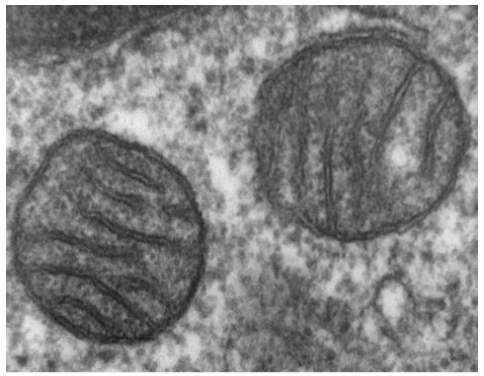
7x – 30x

Compound



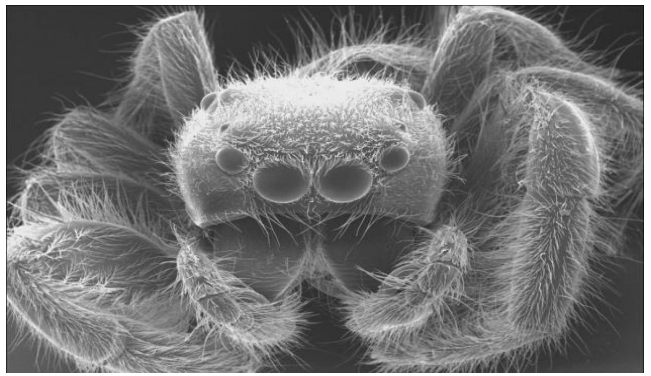
40x - 1,000x

Transmission Electron



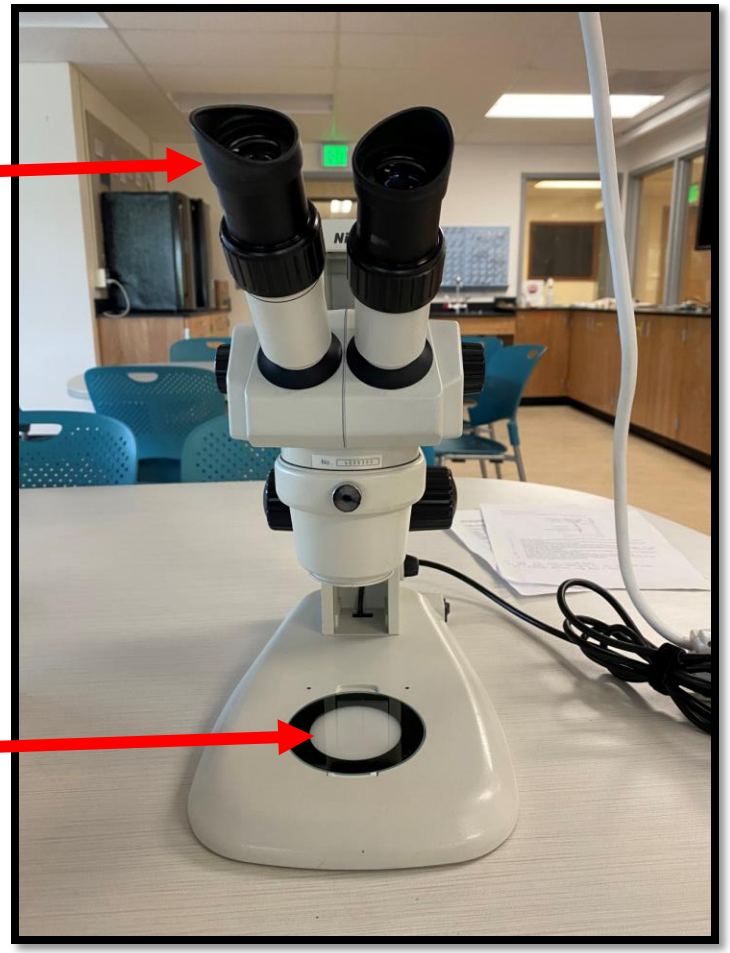
Up to 1,000,000x

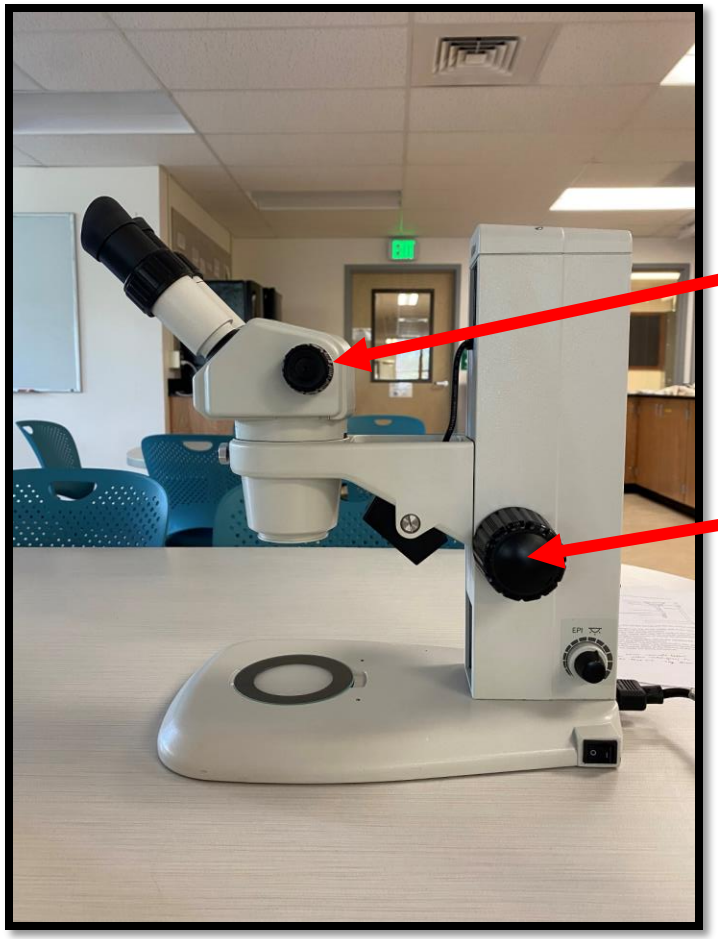
Scanning Electron



Up to 500,000x

Part 1: The Stereoscopic (Dissecting) Microscope



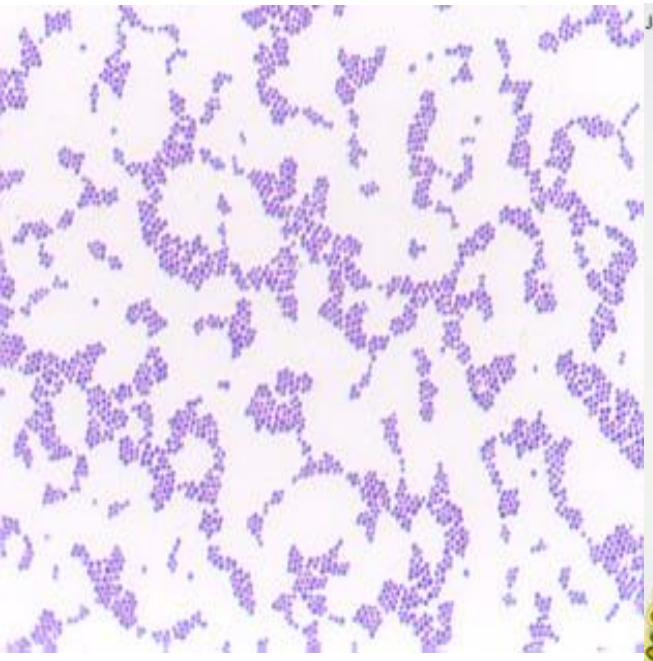


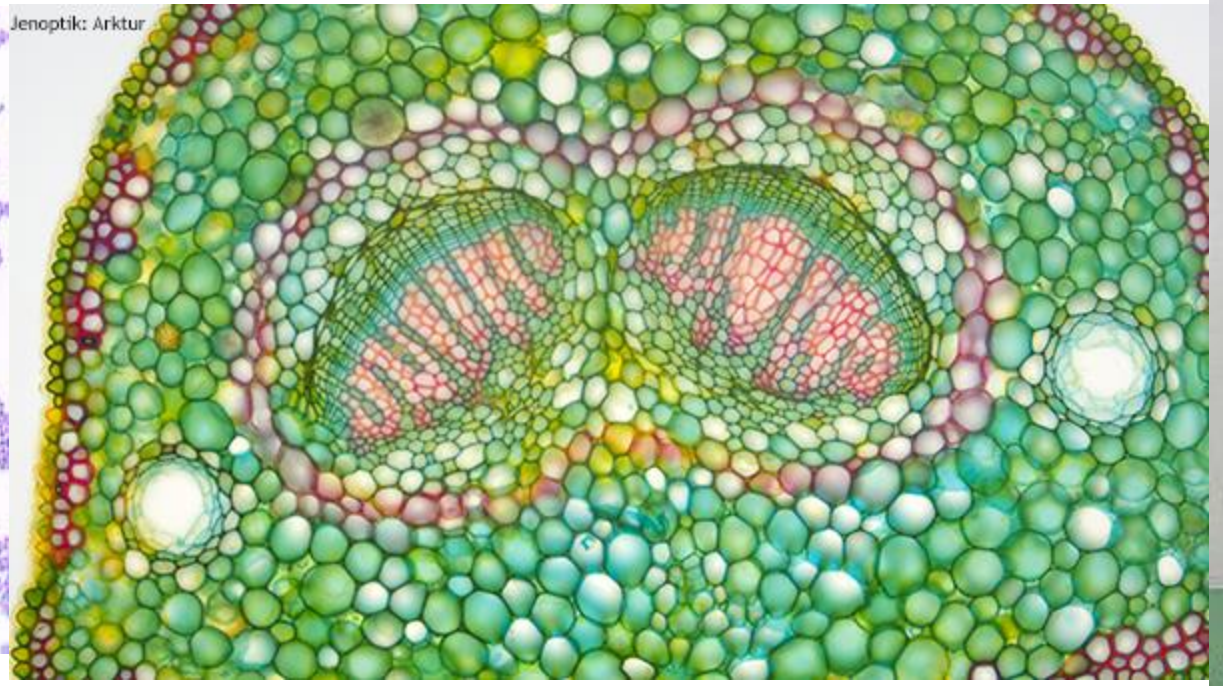
Lower Magnification
Incident Light
Dissecting or studying the surface of a sample

Part 1: The Stereoscopic (Dissecting) Microscope

1. Prepared slide of letter “e”
2. Pond water sample

Part 2: Compound or Light Microscope





Mid-range magnification
Transmitted light
Good for viewing cells

Part 2: The Compound Microscope

<u>Important Components</u>:

- **Ocular Lenses**
- **Objective Lenses**
- **Stage**
- **Stage Adjusters**
- **Revolving Nosepiece**
- **Light Intensity Levers**
- **Lamp**
- **Base and Arm**
- **Iris**
- **Condenser**
- **Coarse Focus**
- **Fine Focus**

A major goal of today's lab will be to identify these components and experiment with their function to learn how to effectively utilize these microscopes!

Part 2: The Compound Microscope

- Microscope etiquette & tips:
  - - Always start on the lowest power
  - - Use the coarse and fine adjustment knobs to focus specimen on low power
  - - Move to the next power and switch to only focusing using the fine adjustment knob
  - - Make sure you watch as you are increasing magnification. You may not be able to go to 40X when using thicker slides
  - - When finished, remove and clean slide, return microscope to low power, turn off and wrap cord, places coverslip in Glass Disposal

Part 2: The Compound Microscope

1. Prepared slide “e” (and go back to part 1 to fill in chart)
2. Measure field of view
3. Prepared slide of colored threads
4. Make a live-mount slide of pond water

- If you’re having trouble, ask a nearby group or the TA for help!

Lab Safety/ clean up

Part I:

Properly store microscopes – remove slide, move to lowest magnification lens, turn off, unplug and wrap cord, cover

Part II:

Dispose of glass COVERS. **DO NOT** dispose of slides (unless they're broken) - cover slips go in glass disposal.
Wash depression slides and put back at table

General:

1. Use the iris diaphragm to adjust light
2. There are 2 of each scope on your tables – use them both!
3. **DO NOT** leave anything by the sink. Everything at your table should be the same as when you got here