Welcome to PBIO6, The Green World!

Appalachian Jacob’s ladder, *Polemonium vanbruntiae*
Photo: L. Hill

**Lecture Outline:**
- Syllabus and course logistics
- Interactive teaching: Concept Tests, Peer Instruction, and Just-in-Time Teaching

**Chapter 1:**
- Plants supply humans with all life’s essentials
- Characteristics shared by all living organisms
- The molecules of life
- What is science? How do we do science?
Just in Time Teaching and pre-lecture assignments

Pre-lecture assignments:

What are they? Online assignment completed through Blackboard consisting of 2-3 conceptual questions based on assigned reading.

When are they due? Due BEFORE class Tuesdays and Thursdays
• Next pre-lecture is due before class on Thurs, Jan 16

Why do we use them? Studies show that Just in time teaching increases student success and recollection of conceptual knowledge in life science courses
• Gives professors an opportunity to “check in” with students BEFORE lecture to make better use of lecture time
Creating an interactive classroom with concept tests and peer instruction

Concept Tests ("clicker questions") and Peer Instruction:

What are they? In-class questions posed multiple times during lecture to test major concepts in lecture. You will have several opportunities to reach the correct answer before final submission.

How do I get points? Attend lecture, bring your clicker remote, answer the question to the best of your ability, and interact with classmates during peer instruction before your final vote.

Why do we use them?
• Gives us an opportunity to “check in” with you DURING lecture
• You can learn from one another during peer instruction
Creating an interactive classroom with peer instruction and clicker remotes

First, students answer on their own...

Then, peer instruction is encouraged if <90% of the class is answering correctly...

Photos courtesy of J. Dickinson
UVM student comments on interactive teaching methods

• “I feel very solid on the concepts we learned in the course due to all of the bits and pieces from homework assignments to readings from the book to i-clicker questions.”

• “I appreciated the pre-lecture assignments in the long-run, as it made studying for exams not as difficult.”
What is a plant?

- **Nonvascular plants**
- **Semideciduous plants**
- **Gymnosperms** (cone-bearing seed plants)
- **Seedless vascular plants**
- **Angiosperms** (flowering seed plants)

Figure 1.3  Plant Biology, 2/e  © 2006 Pearson Education
6 Fundamental properties of living organisms

1. Growth and reproduction (either sexual and asexual)
2. Ability to respond to a changing environment
3. Ability to evolve and adapt to the environment
4. Metabolism – the sum total of all chemical reactions occurring in living organisms
5. Organized structure in unicellular and multicellular organisms
6. Organic composition – chemical elements combine to form the carbon-based molecules of life
Chemical elements combine to form molecules, which constitute all life.
Botany - the scientific study of plants

Table 1.2
Subdisciplines of Botany

<table>
<thead>
<tr>
<th>Subdiscipline</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bryology</td>
<td>Study of mosses and liverworts</td>
</tr>
<tr>
<td>Economic botany</td>
<td>Study of the utilization of plants by humans</td>
</tr>
<tr>
<td>Ethnobotany</td>
<td>Study of the use of plants by indigenous peoples</td>
</tr>
<tr>
<td>Forestry</td>
<td>Study of forest management and utilization of forest products</td>
</tr>
<tr>
<td>Horticulture</td>
<td>Study of ornamental plants, vegetables, and fruit trees</td>
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<tr>
<td>Mycology</td>
<td>Study of fungi</td>
</tr>
<tr>
<td>Paleobotany</td>
<td>Study of fossil plants</td>
</tr>
<tr>
<td>Palynology</td>
<td>Study of pollen and spores</td>
</tr>
<tr>
<td>Phycology</td>
<td>Study of algae</td>
</tr>
<tr>
<td>Plant anatomy</td>
<td>Study of plant cells and tissues</td>
</tr>
<tr>
<td>Plant ecology</td>
<td>Study of the role of plants in the environment</td>
</tr>
<tr>
<td>Plant biotechnology</td>
<td>Study and manipulation of genes between and within species</td>
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<tr>
<td>Plant genetics</td>
<td>Study of inheritance in plants</td>
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<tr>
<td>Plant morphology</td>
<td>Study of plant form and life cycles</td>
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<tr>
<td>Plant pathology</td>
<td>Study of plant disease</td>
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<tr>
<td>Plant physiology</td>
<td>Study of plant function and development</td>
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<tr>
<td>Plant systematics</td>
<td>Study of the classification and naming of plants</td>
</tr>
</tbody>
</table>
What is science?

Science gathers, processes, classifies, analyzes, and stores information on anything and everything observable in the universe.

Science is much more than just a collection of facts!

Arthur Strahler, 1992
All scientific advances begin with an inquisitive mind carefully observing natural phenomena.

The scientific method:

- Curiosity about the world! Make observations and asking questions.
- Develop a **hypothesis**.
- Use the hypothesis to make predictions.
- Use experiments to test the hypothesis.
- Modify the hypothesis based on experimental results.
Question: How do plants grow?
Hypothesis: Plants grow by eating soil.

Jan Baptista van Helmont ca. 1577-1644

Salix nigra, Black willow
http://www.fcps.edu
Figure 1.19  Idealized version of the scientific method

Observations

Trees grow larger over time.

Question

Why do trees grow larger over time?

Hypothesis

Trees grow larger by eating the soil.

Prediction

If a tree is grown in a pot of soil, the weight of the soil should *decrease* as the weight of the tree *increases*.

Test *does not support* hypothesis: revise hypothesis or pose new one

Test: experiment or additional observation

Test *supports* hypothesis: make additional predictions and test them

Result: the soil did *not* decrease in weight.
van Helmont’s 5-year tree experiment

**Conclusion:**
van Helmont’s hypothesis had been **falsified**: it was demonstrated that plants do not increase in size by eating soil.

- The tree received nothing but water.
- The soil weighed practically the same as at the beginning.
- So, van Helmont argued that the increased weight of the tree was due to **water alone**...

Recall the scientific method:
- Make observations and asking questions
- Develop a **hypothesis**
- Use the hypothesis to make predictions
- Use experiments to test the hypothesis
- **Modify the hypothesis** based on experimental results
Assignments

• Review course content on Blackboard course page and register your iclicker remote (bb.uvm.edu)

• Read Chapters 1 and 3 and complete pre-lecture assignment due Thursday before class
Lecture Review, Chapter 1

• Plants provide humans with the essentials of life. What are these essentials and how do plants provide them for humans?

• All living organisms share certain characteristics. Describe the 6 characteristics of life.

• All living organisms are constructed by 4 major groups of molecules. What are these 4 major groups? What chemical elements make up the majority of life on Earth?