##### Biology 271: Introduction to Plant Biology

##### 3 credit hours, lecture and discussion

**General Information:**

Lecture will be held T-TH at 11 AM in 1374 Genome Sciences

Lab (BIOL 271L; required) will be held in 140 Wilson Hall at the following times:

Sec 401: T, 12:30-3:20 PM

Sec 402: W, 12:30-3:20 PM

Instructor: Dr. Patricia Gensel Office: 414 Coker Hall

Email: pgensel@bio.unc.edu Tel.: 962-6937

Office hours: BY APPOINTMENT

Lab Instructor: Andrew Willoughby Office: 4144 GSB

**Target audience:**

Biology majors or non-majors who have taken introductory biology and require a course with a lab, and ideally who are interested in the diversity of life (which includes plants)**.** Second-semester freshmen through seniors are eligible.

**Nature and Objectives of the course:**

The purpose of this course is to acquaint you through a variety of activities with the group of organisms termed plants. These organisms are distinctive relative to other types in the following ways:

1. They have indeterminate growth, localized in specific regions termed meristems;
2. Plants don’t move (although their reproductive cells might);
3. Plants are the major organisms that convert carbon dioxide into sugar, using the energy of the sun. Plants, chemoautotrophic bacteria and photosynthetic protists are the primary producers and only organisms that pull new energy into the biosphere;
4. Plants exhibit many adaptations to cope with survival on land in their structural organization, their methods of reproduction, and their biochemistry/metabolism that add to our understanding of biological processes; and
5. Plants are of major importance to humans as a source of food, clothing, shelter, fuel, medicines, etc.

For these reasons, especially item 3, a study and understanding of plants is an essential part of biological training and can be applied in many every-day situations by both biology and non-biology majors.

**Goals:**

We will examine these many facets of plants and by the end of the course, *you should be able to*:

1. Recognize the distinctive features of plants and be able to determine how a plant is constructed;
2. Analyze how plants photosynthesize and generate energy and discuss ideas about how to improve or enhance this capacity;
3. Develop potential research questions concerning aspects of plant structure and function that make up the diversity of plants present in the world;
4. Describe and understand the various ways plants live and reproduce, how they maintain or promote variation, and ways they are adapted to particular environments;
5. Understand how to grow plants and what their nutritional requirements are;
6. Recognize the major groups of plants and assess their relationships; and
7. Identify several ways plants are used by people

**Consider the following questions in the context of studying plants:**

1. What rules govern the natural world and how are they discovered, tested, and validated?
2. What is distinctive about the approach to understanding employed in the natural sciences? Are all approaches the same?
3. What challenges are encountered in making measurements of the natural world?
4. What are the limits of investigation in the natural sciences?

**This class will:**

1. Pose problems and questions that require systematic thinking about evidence, argument and uncertainty:
	1. Investigation into questions such as: How could one improve photosynthesis? How could one increase plant growth or crop production? How could one determine the relationships between plants on different taxonomic levels (species, genus, family, etc.)?
2. Consider its content in the context of human difference between and within societies; the full range of legitimate debate in its field; and/or change over time:
	1. Understanding how plants have been used as medicine and food in different cultures
	2. Understanding how the study of plants has changed over time, from the initial study of simply describing plants (Linnaeus and his contemporaries) to modern studies of plant genetics, development, and ecology
	3. How to evaluate preserving or leveraging growth and existence of different types of plants or vegetation because of the services they provide to Earth
3. Require:
	1. Writing totaling at least 10 pages in length, or the intellectual equivalent:
		1. You will have guided reading questions, a research paper, and reflections on field trips
	2. Presenting material to the class, small groups, or the public through oral presentations, webpages, or other means that enable corroboration of fact and argument.
		1. You will give two oral presentations, one involving the creation of a research poster
	3. Collaborating in pairs or groups to learn, design, solve, create, build, research or similar.
		1. You will collaborate in pairs or small groups to perform research tasks

**Course Structure:**

* **Lectures** will be designed to facilitate these objectives; you are strongly encouraged to take an active part in discussions during lecture. To prepare, you should read the assigned reading BEFORE the given lecture, look up unfamiliar terms, and consider any questions that have been posed. You will be asked to prepare some assigned readings as summaries or questions, which will allow you to solve problems during the class hour that illustrate important points. I will ask questions during class and arrange other means of active involvement. I encourage you to study in small groups and to share information with each other prior to an exam or during projects.
* **Labs** are designed to illustrate topics covered in lecture and usually occur *after* the topic is presented in lecture. A separate syllabus will be provided for the lab. Read lab handouts BEFORE the laboratory itself and prepare by referring to text or notes about that particular topic. Some labs involve exploring plant structure through dissection, hand-sectioning, observing prepared slides; others explore functions or processes via experiments or field trips (see below). Several lab quizzes, which count towards the final grade, will be given and discussed further in the lab syllabus. Lab grade is separate from lecture grade.
* **Field Trips** are to the Botanical Garden, accessible by certain buses from campus. You will be asked questions about your field experience.

**Textbook:**

*Raven’s* *Biology of Plants*, R. Evert, and S. Eichorn. 2013. 8th edition. Freeman and Worth, publishers. A few, extra reading assignments may be given to supplement the text, especially in areas of ongoing research, and as a source of critical evaluation and discussion. These will be posted as pdfs. The lab guide is available through student stores. To obtain the correct course materials for class, use this to order the text from UNC textbook dept if that is where you plan to purchase it. It definitely is the only source for the lab guide, provided as a coursepack.

**Expectations:**

I expect that you will attend class; although formal attendance will not be recorded, the class is small enough that your absence will be noted. You should be prepared for lectures by having done the assigned reading or exercise. You should participate in class, ask questions when you don’t understand a concept, and work towards applying concepts or tying together different topics in the ways described above for General Education requirements.

**Projects:**

There will be two formal projects during the semester, each worth 25 points: 1) human uses of plants (during February) and 2) a case study of plant pollinator interactions (March-April). Both will require research, either independently or in teams, presentation of results- for the first project, as a poster, and for the second project, a short oral presentation, and a comprehensive and thoughtful report. More information will be provided in class about these. Resources for these projects include library, internet, and materials posted by the professor. Students can work together in groups of two. Students will both present and evaluate during the Poster Sessions.

**Exams and Grading:**

There will be two full period closed-book lecture exams, each worth 60 points and one final exam worth 80 points. The final exam will be cumulative. I plan to give 3-4 short quizzes in class. Each one will cover the material stated when I announce the quiz. I also will assign 2 writing assignments. The quizzes and writing will collectively total 50 points (the lowest grade of six grades will be dropped). The projects total 70 points.

Lecture tests (including the final): 200

Lecture quizzes and writing assignments: 50

Projects: 70

Total points possible: 320

The Honor Code pledge will be a part of each exam.

Your final grade will be determined as the points earned out of 320. A letter grade will be based on the following APPROXIMATE scale: A= 90-100%, B= 80-90%, C= 70-80%, D= 60-70%, F= less than 60 %. I usually end up scaling the grades at least a little.

**Resources:**

If you wish to meet with Dr. Gensel or the TA, **please make an appointment**; we are happy to arrange a time! Course materials will be either posted on Sakai or provided in class.

The Department of Biology values the perspectives of individuals from all backgrounds reflecting the diversity of our students. We broadly define diversity to include race, gender identity, national origin, ethnicity, religion, social class, age, sexual orientation, political background, and physical and learning ability. We strive to make this classroom and this department an inclusive space for all students.

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| **Accessibility Resources**  | UNC-Chapel Hill facilitates the implementation of reasonable accommodations for students with learning disabilities, physical disabilities, mental health struggles, chronic medical conditions, temporary disability, or pregnancy complications, all of which can impair student success. See the ARS website for contact and registration information: <https://ars.unc.edu/about-ars/contact-us>  |
| **Attendance Policy**  | No right or privilege exists that permits a student to be absent from any class meetings, except for these University Approved Absences:1. Authorized University activities
2. Disability/religious observance/pregnancy, as required by law and approved by [Accessibility Resources and Service](https://ars.unc.edu/) and/or the [Equal Opportunity and Compliance Office](https://eoc.unc.edu/what-we-do/accommodations/) (EOC)

Significant health condition and/or personal/family emergency as approved by the [Office of the Dean of Students](https://odos.unc.edu/), [Gender Violence Service Coordinators,](https://womenscenter.unc.edu/resources/gender-violence-services/) and/or the [Equal Opportunity and Compliance Office](https://eoc.unc.edu/what-we-do/accommodations/) (EOC).Other necessary absences, such as job or graduate school interviews: contact the instructor to arrange for a make-up - this applies to exams only, not quizzes |
| **University Testing Center** | The College of Arts and Sciences provides a secure, proctored environment in which exams can be taken. The center works with instructors to proctor exams for their undergraduate students who are not registered with ARS and who do not need testing accommodations as provided by ARS. In other words, the Center provides a proctored testing environment for students who are unable to take an exam at the normally scheduled time (with pre-arrangement by your instructor). For more information, visit <http://testingcenter.web.unc.edu/>. |
| **Counseling and Psychological Services**  | CAPS is strongly committed to addressing the mental health needs of a diverse student body through timely access to consultation and connection to clinically appropriate services, whether for short or long-term needs. Go to their website: <https://caps.unc.edu/> or visit their facilities on the third floor of the Campus Health Services building for a walk-in evaluation to learn more. |

**Honor Code Statement:**

Students are bound by the Honor Code in taking exams in in written work. The Honor Code of the University is in effect at all times, and the submission of work signifies understanding and acceptance of those requirements. Plagiarism will not be tolerated. Please consult with me if you have any questions about the honor code.

“The professor reserves to right to make changes to the syllabus, including project due dates and test dates (excluding the officially scheduled final examination), when unforeseen circumstances occur. These changes will be announced as early as possible so that students can adjust their schedules.”

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| Date | Topic | Assigned Reading |
| Th, Jan. 9 | General Introduction: What is a plant? What are the basic groups of plants? How do you recognize and describe plants? | Ch. 1,Ch. 12 |
| T, Jan. 14 | Plant organization: Cells* What features or structures are unique to plant cells?
* What is endosymbiosis?
* How does the cell wall allow materials to move in and out of cells?
 | Ch. 3 |
| Th, Jan. 16 | Cell connections, communication, and chemistry:* Are plants aggregations of cells or simply one much-compartmentalized cell?
* What are the major compounds found in plants?
* What is the difference between primary and secondary metabolites, and what are the functions of these compounds?
* What is co-evolution?

Project 1 introduction: Plant products and their impact on people | Ch. 2, Ch. 4 pp. 82-90, pp. 497-498 |
| T, Jan. 21 | Mitosis and cytokinesis in plants; begin Movement across membranes:* Review mitosis and determine 2-3 ways plant cells differ from animal cells in structure or process during mitosis

**Quiz** | Ch. 3 pp. 62-74, Ch. 4 to p. 80 |
| Th, Jan. 23 | Turgor, cell elongation, and cell differentiation:* Why is turgor so important in plants?
* What are plasmodesmata and what is their importance?
* What happens when a plant wilts?

Begin Stages in plant growth – seed to seedling | Ch. 4,Ch. 22, Ch. 23 |
| T, Jan. 28 | Seed to seedling cont’d, primary tissues | Ch. 4,Ch. 22, Ch. 23 |
| Th, Jan. 30 | **Building a plant/How plants work**: The primary plant body – roots, begin shoots* What are the major cells and tissues in a root, a shoot?
* How do they differ?

**Quiz** | Ch. 24 |
| T, Feb. 4 | The primary plant body, cont’d – shoots, begin leaves:* What are the major cells and tissues in a shoot, a leaf?
* How do they differ?
* Is a tree trunk a shoot?
 | Ch. 25 to p. 590 |
| Th, Feb. 6 | The primary plant body continued – leaves and reproductive structures* Bring in one or two flowers if possible

**-** How are flowers and leaves similar? | Ch. 25,pp. 460-465 |
| T, Feb. 11 | Secondary growth* When does secondary growth occur?
* Where in the plant does it occur?
* What tissues are produced?
* What is the significance of these tissues to plants? to humans?
 | Ch. 26 |
| Th, Feb. 13 | Transport of water and photosynthate in plants* How do materials move around in plants?

Begin Growth and Development: Hormones part 1* What is a hormone? a plant growth regulator?
* Do plants have glands?
* What are some of the main controls of growth and development in plants?
 | Ch. 30,Ch. 27 |
| T, Feb. 18 | **Exam 1: Introduction through Secondary Growth** |
| Th, Feb. 20 | Hormones part 2; Light induced reactions* Define tropism, circadian rhythm, day-neutral before coming to class
* What is the ABCDE model of flowering?

**Quiz** | Ch. 28,pp. 604- |
| T, Feb. 25 | Poster session 1 |  |
| Th, Feb. 27 | Poster session 2 |  |
| T, Mar. 3 | Hormones part 3 |  |
| Th, Mar. 5 | Growing plants well: plant nutrition and soils* Why is it important to have the correct type of soil when growing plants

**Writing assignment** | Ch. 29 |
| Mar. 7-15 | **Spring Break** |
| T, Mar. 17 | Metabolism: Plants’ major contribution to the biosphere (a.k.a. Photosynthesis)* How do plants counteract the tendency toward entropy?
* What is/are the essence(s) of the photosynthetic processes?
 | Ch. 5,Ch. 7 to end of light-independent reaction |
| Th, Mar. 19 | Photosynthesis cont’d – C4, CAM, adaptations* How and to what are these types of photosynthesis adaptations?
 | Ch. 7 p. 138-end |
| T, Mar. 24 | Sexual reproduction: Meiosis, genetic variation, and life cycles* Review meiosis
* What is meant by alternation of generations?

Begin How to recognize the major plant groups: life cycles, non-vascular plants**Introduce Project 2: Plants and their pollinators** | Ch. 8,pp. 345-47, pp. 353-58,Ch. 16 |
| Th, Mar. 26 | How to recognize the major plant groups, cont’d: spore producing plants (bryophytes cont’d, ferns, lycopsids)* Which of these lacks vascular tissue?
* What is free-sporing reproduction?
 | Ch. 16,Ch. 17 |
| T, Mar 31 | **Exam 2: Transport through sexual reproduction and the basic plant life cycle** |
| Th, Apr. 2 | How to recognize the major plant groups, cont’d: heterospory, the seed habit, gymnosperms* What is a seed?
* What are the distinguishing features of gymnosperms?
 | Ch. 18 |
| T, Apr. 7 | How to recognize the major plant groups, cont’d: Angiosperms (Flowering plants) and their basic features* How are flowering plants different?
 | Ch. 19,Ch. 20 |
| Th, Apr. 9 | Genetic variation and speciation; breeding systems* How can plants best adapt to their environment in regards to reproducing?
 | Ch. 11 |
| T, Apr. 14 | Plant defenses | Assigned reading |
| Th, Apr. 16 | Pollination reports 1 |  |
| T, Apr. 21 | Pollination reports 2 |  |
| Th, Apr. 24 | Course summary and review |  |
| M, April 27 | **Final Exam – 8 AM** |