

Lecture Contact Hours: 48-54; Outside-of-Class Hours: 96-108;
Laboratory Contact Hours: 48-54; Outside-of-Class Hours: 0;
Total Student Learning Hours: 192-216

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

Biology 122 – The Secret Life of Plants

3 hours lecture, 3 units
3 hours laboratory, 1 unit
Total units: 4 units

Catalog Description

Examines the fundamentals of plant biology: how plants grow, develop and respond to environmental stimuli, photosynthesis, water relations and phloem transport, reproduction, and evolution. Emphasis is on structural and functional aspects of plants while focusing on seed producers. Covers contemporary topics in plant biology including the basics of genetic engineering and biotechnology, and revealing the impacts on agriculture, the environment and society.

Prerequisite

None

Course Content

- 1) Lecture:
 - a. Classification and evolution of Kingdom Plantae
 - b. Algal ancestry and life cycle
 - c. Terrestrial adaptations of non-vascular and vascular plants
 - d. Characteristics and life cycle of gymnosperms and angiosperms
 - e. Sporophyte dominant life cycle and seed evolution
 - f. Reproductive adaptations of gymnosperms
 - g. Morphology of seeds, flowers and fruits
 - h. Rise of the angiosperms (monocots and eudicots)
 - i. Plant cell structure and tissues
 - j. Sensory systems in plants including gravitropisms, phototropisms and signaling
 - k. Five classes of plant hormones and their influence on plant movement, growth and development
 - l. Anatomy of plant growth (primary versus secondary)
 - m. Water potential and water transport via xylem
 - n. Phloem transport of sugars from sources to sinks
 - o. Adaptive variations, and light and dark reactions of photosynthesis
 - p. Adaptations and identification of chaparral, woodland and riparian plants from San Diego County
 - q. Macronutrients and micronutrients
 - r. *Arabidopsis thaliana* as a plant model
 - s. Genetic transformation techniques and their impact on agriculture and the environment
- 2) Laboratory: In addition to examining and illustrating many of the topics discussed in lecture, students will:
 - a. Use and care for a compound, binocular microscope and stereoscope
 - b. Identify native plant species and adaptations
 - c. Use scientific inquiry to measure the effects of macronutrient deficiencies
 - d. Perform and interpret bioassays to identify the effects of plant hormones on callus tissue

Course Objectives

Students will be able to:

- 1) Describe the various methods and components of scientific inquiry, describe their applications, and use these methods to solve botanical problems.
- 2) Identify, compare and contrast the structural and functional morphologies of nonvascular, vascular, gymnosperm and angiosperm plants. Students will also differentiate between vascular plant tissues and organs, describing anatomy and physiological role in transport, conduction, and translocation in the larger plant system.
- 3) Identify and describe the function of structural components in a plant cell.
- 4) Describe and identify plant life cycles including mitosis, meiosis and alternation of generations.
- 5) Identify and describe the anatomy of different types of reproductive structures including cones, seeds, and flowers, and examine the evolutionary advantages of each.
- 6) Compare and contrast primary versus secondary growth including growth patterns in wood and bark.
- 7) Describe a bioassay and determine the effects of different hormones and environmental stimuli on plant growth, movement, and development.
- 8) Investigate plant communities of San Diego County and identify different adaptations of native flora.
- 9) Define systematics and taxonomy and develop cladograms of different plant lineages. Compare and contrast primitive and advanced plant phylogeny in order to assess evidence to generate and support theories of plant evolution.
- 10) Describe the steps in photosynthesis and biochemically differentiate between the three different types including C3, C4, and CAM.
- 11) Describe Mendel's Laws of Inheritance and assess the results of a monohybrid cross.
- 12) Evaluate the methods of plant biotechnology and assess how this new technology affects agriculture, the environment, and society.
- 13) Identify and describe macronutrient requirements of plants and assess nutritional deficiencies.

Method of Evaluation

A grading system will be established by the instructor and implemented uniformly. Grades will be based on demonstrated proficiency in subject matter determined by multiple measurements for evaluation, one of which must be essay, exams, skills demonstration or, where appropriate, the symbol system.

- 1) Quizzes and exams that measure students' ability to recognize, explain, and provide examples of botanical concepts including plant structure, genetics, ecology, and evolution.
- 2) Laboratory activities and assignments in which students interact and collaborate while demonstrating their ability to identify and assess function of plant structures, and plant communities.
- 3) Practical exams that measure students' ability to identify and describe plants and their structures from the organismal to the cellular level.

Special Materials Required of Student

Hand lens (5x and 10x)

Minimum Instructional Facilities

- 1) Smart classroom with overhead projector/screen
- 2) Standard general biology laboratory equipped with compound and dissecting microscopes
- 3) Standard plant growth chamber in nearby support facilities
- 4) Greenhouse to grow and maintain specimens

Method of Instruction

- 1) Traditional and computer-assisted lecture
- 2) Reading assignments
- 3) Laboratory (individual and small groups)

- 4) Discussion and demonstration
- 5) Group discussion, interactive problem solving

Out-of-Class Assignments

- 1) **Reading:** Assigned textbook chapters, instructor-provided study guides, and multimedia resources that explain key concepts in plant biology such as structure and function, photosynthesis, transport, and evolution. Students may also read current articles highlighting plant/environment relationships, sustainable agriculture, and biotechnological innovations.
- 2) **Writing / Analysis:** Short written reflections, data analyses, or problem-solving exercises that ask students to interpret experimental results, connect plant processes to ecological systems, and apply concepts from lecture and lab to real-world examples.
- 3) **Other:** A botany research or observation project in which students gather and interpret information from scientific sources, class data, or local environments. Students may collaborate in online discussions or group workspaces to share findings, compare plant adaptations, and develop evidence-based conclusions. Lab investigations using common materials or virtual simulations to explore plant growth, anatomy, and physiological processes. Activities may include designing simple experiments, recording observations, and analyzing data to reinforce hands-on understanding of plant function and scientific inquiry.

Texts and References

- 1) Required Lecture Text (representative examples):
 - a. Levetin and McMahon *Plants and Society 9th Edition*. McGraw Hill, 2024.
 - b. Bidlack, James and Shelley Jansky. *Stern's Introductory Plant Biology*. 15th edition. McGraw Hill, 2022.
- 2) Required Laboratory Manual (representative example): Bidlack, *Introductory Plant Biology Laboratory Manual*. 15th edition. McGraw Hill, 2021.
- 3) Lab manual developed by instructor

Student Learning Outcomes

Upon successful completion of this course, students will be able to:

- 1) Explain how plants interact with their environment through processes such as photosynthesis, transport, and/or response to stimuli, and analyze how these processes contribute to ecosystem energy flow and carbon cycling.
- 2) Explain the evolutionary innovations in plants that have enabled success in diverse environments, using examples from major plant groups to interpret patterns of structure and function.
- 3) Evaluate the relationship between humans and plants through lenses of biotechnology, agriculture, and/or sustainability, considering both benefits and ethical or ecological implications.