Lecture Contact Hours: 48-54; Homework Hours: 96-108; Total Student Learning Hours: 144-162
Laboratory Contact Hours: 48-54; Homework Hours: 0; Total Student Learning Hours: 48-54

CUYAMACA COLLEGE
COURSE OUTLINE OF RECORD

BIOLOGY 122 – THE SECRET LIFE OF PLANTS

3 hours lecture, 3 hours laboratory, 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 and10x)

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) Botany research project(s) in which students are required to analyze, interpret, and draw conclusions from scientific sources and class data
2) Homework assignments that measure students' ability to synthesize concepts including plant function, biochemistry, genetics and evolution

Texts and References

1) Required Lecture Text (representative examples):
   a. Levetin and McMahon *Plants and Society 7th Edition.* McGraw Hill, 2015.
   b. McKenney, et al. *Introductory Plant Science: Investigating the Green World*. 1st edition. Kendall Hunt, 2014.
   c. Bidlack, James and Shelley Jansky. *Stern's Introductory Plant Biology*. 13th edition. McGraw Hill, 2013.
2) Required Laboratory Manual (representative example): Bidlack, *Introductory Plant Biology Laboratory Manual*. 13th edition. McGraw Hill, 2013.
3) Supplemental: As assigned by instructor

Student Learning Outcomes

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

1) Demonstrate the ability to utilize the tools of scientific inquiry to solve botanical problems.
2) Identify, compare and contrast adaptations of nonvascular, vascular, gymnosperm and angiosperm plants, while examining the s evolutionary advantages and/or disadvantages of each.
3) Diagram the process of photosynthesis at the cellular level and describe how this relates to energy flow and carbon cycling in ecosystems.
4) Evaluate the methods of plant biotechnology and assess how this new technology affects agriculture, the environment, and society.