MEPS 316
Theory and Practice of Plant Physiology

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Prerequisites: Junior or senior classification


Plant physiology is the science that studies plant function. Thousands of chemical reactions are underway in every living cell, transforming water, mineral salts, and gases from the environment into organized plant tissue and organs. From the moment of a plant’s conception to its death, organized processes of development are enlarging the plant, increasing its complexity, and initiating changes in its growth such as flowering and loss of leaves in the fall. Key to applying plant physiology to the real world is to develop a basic understanding of how the myriad of biochemical and physical processes in the plant work together to assure its growth, development, and survival. Plant physiology involves application of physics and chemistry to develop that understanding. This course is designed to provide students with a basic understanding of plant function at organelle, cellular and whole plant scales, and the practical tools necessary to apply basic principles to address real-world problems.

Learning Outcomes
At the end of this course, you should be able to:

• Describe how cellular functions are integrated with plant processes and functions at the whole plant level
• Describe energy transfer and transformations at organelle, cellular, and whole plant levels
• Describe water relations, water uptake and transport, and their impact on plant metabolic processes
• Compare and contrast the major metabolic pathways of photosynthesis, respiration, and nitrogen assimilation and explain their contribution to plant growth and development.
• Describe the involvement of hormones in plant responses and their interaction to environmental stimuli
• Assimilate the above information and apply it to real-world problems associated with crop production and plant growth and development

Grading
A: 90%, B: 80%, C: 70%, D: 60%, F: <60%

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Points</th>
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<tbody>
<tr>
<td>Lecture Quizzes (Tuesdays)</td>
<td>100</td>
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<tr>
<td>Examinations (2)</td>
<td>200</td>
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<tr>
<td>Final Exam (Comprehensive)</td>
<td>100</td>
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Laboratory Quizzes (weekly) 50
Laboratory Assignments (weekly) 50
Laboratory Practical Examinations (2) 100
Total Points 600

Electronic Resources
All lectures will be PowerPoint presentations. They will be posted in PDF format on the course website (http://meps316.tamu.edu). All students will be responsible for printing PDF files of lectures and bringing them to class for taking notes during lectures. Quiz and examination answers will also be posted on the website.

Lecture Topics

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Topics</th>
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| 1       | Introduction [Cothren and Heilman]  
*Plant Structure* [Cothren] |
| 2 - 4   | Plant and Cell Architecture  
*Plants and Energy* [Heilman] |
| 5       | Energy and Cells; Membrane Potentials |
| 6       | Leaf Energy Balance  
*Water Relations* [Heilman] |
| 7       | Properties of Water, and Function of Water in Plants |
| 8       | Cell Water Relations |
| 10      | Transpiration and Water Uptake |
| 11      | Ascent of Sap; Stomatal Regulation of Water Use |

Exam 1
*Photosynthesis and Respiration* [Cothren]

12 - 18 | Light Reactions; CO₂ Exchange; Metabolism in Leaves (C₃ vs. C₄) |
19 – 20  | Leaf Photosynthetic Responses to Light, Water, Temperature and CO₂ |
21      | Translocation |
22 - 24 | Role of Respiration in Plant Carbon Balance |
25      | Response of Respiration to Environmental Stimuli |

Exam 2
*Plant Hormones* [Heilman]

26 - 27 | Hormone Regulation of Growth and Plant Function |

Laboratory Topics

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to statistics and scientific methodology</td>
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<tr>
<td>2</td>
<td>Description of biological variation</td>
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<td>3</td>
<td>Measurement of solar radiation</td>
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<tr>
<td>4</td>
<td>Measurement of water potential in plants</td>
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<td>5</td>
<td>Transpiration and water flow in plants, and stomatal resistance</td>
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<tr>
<td>6</td>
<td>Measurement of the carbon dioxide and light dependence of photosynthesis</td>
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Mid-term Laboratory Practical Exam
Measurement of photorespiration in C₃ and C₄ plants
Partitioning and assay of photoassimilates
Mineral nutrition of plants
Nitrogen fixation of soybean
Thanksgiving Day
Review

Final Laboratory Practical Exam

Requirements
Weekly lab quizzes will be given. They will include questions on methodology from the previous week’s lab, and question about theory for the current week’s lab. Laboratory practical exams will test student mastery of laboratory techniques.

Lab Assistant  Srinidhi Holalu, sholalu@ag.tamu.edu

Electronic Resources
Class results and observations for laboratory exercises will be posted on the class website.

Americans with Disabilities Act (ADA) Policy Statement
The Americans with Disabilities Act (ADA) is a federal antidiscrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services in Cain Hall, Room B118, call 845-1637 or visit: http://disability.tamu.edu/.

Academic Integrity
“An Aggie does not lie, cheat, or steal or tolerate those who do.”
Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning and to follow the philosophy and rules of the Honor System. Ignorance of the rules does not exclude any member of the Texas A&M University community from the requirements or the processes of the Honor System. For additional information please visit: www.tamu.edu/aggiehonor/. Any student engaging in academic misconduct will receive a grade of F* for the course and the notation “FAILURE DUE TO ACADEMIC DISHONESTY” will appear on the student’s transcripts.