University of Duhok

Faculty of Science

Department of Biology

Course Book
Plant Physiology
First semester
Fourth Year Students
Academic Year 2022-2023

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Lecturer

COURSE OVERVIEW

The approaches to an introductory course in plant physiology are highly variable. Some people emphasize the molecular and biochemical aspects of physiology, while others emphasize the plant organism rather than the cell and concentrate more on what is called growth and differentiation. There are textbooks that reflect each of these approaches. However, many people take an intermediate approach, which probably is the more traditional approach, in which all areas of plant physiology are considered.

The reason for these varied and diverse approaches are: first, it is impossible to cover everything that fits in the category of plants physiology (even though some try), and second, a person often dwells longest on the things that interest him the most and with which he is personally most comfortable. Nevertheless, this is an introductory course and it is a survey course, so it should be somewhat comprehensive in scope. In addition, for most people taking the course, it probably is the only plant physiology course they will ever have. Therefore, it does have to accomplish a lot.

Topics like photosynthesis, water relations, respiration, etc. are usually considered as discrete topics with the angiospermous plant in mind. The difficulty with this seemingly sensible way to do it is that unnecessary questions arise, such as—is transpiration a necessary evil? Why do cells have large central vacuoles? Why is there so much variation in leaf size and shape? Why some plant shift to CAM photosynthesis Etc.

I think there is a way to approach the topics of plant physiology so that answers to these questions are intuitively obvious, and, thus one truly ends up with a better feeling of why plants do things the way they do and why it had to be this way . The approach that will be used in this course is such that we will discuss topics in class in a manner that first within the structure of "problems most complex form. " for example , we will not take topic like photosynthesis and discuss it as a unit based on how the process occurs in an angiosperm leaf . Rather, we will consider first the simplest single celled green plant and consider the problems that confronted them in their aqueous environment. How do they obtain energy to do things? Where do come from, how is it captured by the plant cell, and how is it converted to useable forms within the cell? This means we will talk about photosynthesis in single celled plants in relation to energy requirements, chemical mechanisms, and raw material supply as they would pertain to a single cell in an aqueous environment.

We thus, also will at this time consider how raw materials are obtained by the cell. How do they get in? , why do something get in and others not, why don't organic molecules in the cell leak out, and how is water balance maintained? Then we

will consider the advantages of multicellularity and subsequently the movement from aqueous to terrestrial environment. What are the advantages of this progression, and what are the additional physiological problems introduced by this move? How do photosynthesizing cells now located in a leaf far from the aqueous environment obtain the raw materials that move directly into cells found in the aqueous environment? How about water, how do they get water? How do cells that now are found in complete darkness, root cells, e.g., and cannot photosynthesize, obtain their energy? There must be transport problem that had to be solved. In the aqueous environment temperature fluctuation are minimal, but on land they can be quiet drastic and extreme. How do plants handle this problem? How do they survive the extreme periods of stress, i.e., freezing temperature, lack of water, and extreme heat? The message that is conveyed if one considers physiology in this context is that things are the way they are in plants because they had to be that way.

COURSE OBJECTIVES

The course offers the students the basic plant physiology information in the functions and the vital processes occurring in plants. In essence, plant physiology is a study of plant way of life, which include various aspects of the plant lifestyle and survival including: metabolism, water relations, mineral nutrition, irritability (response to the environment), organization, growth and transport processes.

Plant physiology is a 3-credit lecture course and laboratory work in which class participation and interaction with the instructor are strongly encouraged. Basic concepts and problems common to higher plants will be addressed, with an emphasis on molecular and biochemical aspects of physiology. Topics to be covered include plant cell structure and function, water relations, mineral nutrition, solutes, photosynthesis, translocation, respiration, plant growth and development, stress physiology and secondary metabolites. The course will be divided into three sections, each of which will be followed by an examination.

COURSE READING LIST

The textbook we will use this year is “Plant Physiology” by Lincoln Taiz and Eduardo Zeiger, 5th ed., 2010 . Other books are will be available such as;

1. “Introduction to Plant Physiology” by William G. Hopkins and Norman P. A. Hüner, 4th ed., 2008.
2. “Plant Physiology” by George N. Agrios, 5th ed., 2005.

3. “Plant Physiology” by Frank B. Salisbury and Cleon W. Ross 4th ed., 1991.
4. “Plant biochemistry” by Caroline Bowsher, Martine Steer and Tlyson Tobin. 2008.

I will also provide you with the most recent literature along with the course. The primary text and lecture notes derived from PowerPoint presentations of the course material will be available for downloading and lecture notes will also be available as hard copies on closed reserve at the copy room (1st floor).

CORUSE SYLLABUS:

Week	Topic	Details
1	Plant physiology concept. Course book review	Introduction to the science of plant physiology, significance of plant physiology to human and biosphere as a whole, relationship between plant physiology and other biosciences.
2	Plant-water relationship	Energy flow, Significance of water. Characteristics of water.
3	Plant-water relationship	Diffusion, the concept and gas diffusion. Osmosis, optimal conditions, plant membranes, semi permeability and selectivity.
4	Plant-water relationship	Osmotic water and pressure potential, plasmolysis and methods of measuring potentials
5	Plant-water relationship	Water absorption, translocation, mechanisms, factors affecting water absorption and translocation.
7	Plant nutrition	Organic constituents of plants, essential elements (macro and micro and beneficial elements), passive absorption and mechanisms.
8	Plant nutrition	Active transport: concept and indications, mechanisms, physiological significance of essential elements.
9	Photosynthesis	Pigments, the absorption spectrum and action spectrum, light and visible spectrum.
10	Photosynthesis	Light reactions: the origin of O_2., electron transport, Emerson effect, photosystem I and II, Oxidative photophosphorylation
11	Photosynthesis	Dark reactions (chemical reactions) ,C3,C4, and CAM plants ,photorespiration

12	Photosynthesis	Factors affecting photosynthesis
13	Phloem transport	Overview, features of transport, mechanism of transport
14	Respiration	Glycolysis, Kreb's cycle, Oxidative phosphprylation, Phosphote pentose pathway, Glycoylate pathway and respiration quintet.

COURSE DELIVERY:

- Lectures: Two Lectures / Week, monday: 10.30 – 12.30.
  Thursday: 10.30 – 12.30.
- Credit: 3 units. Approximate class size :33 / two classes
- There will be one written examinations in the lecture part of the course during the semester, worth 15 marks.
- There will be comprehensive final examination (40 marks =40% of the total marks) and the laboratory grade equal (35 marks = 15 marks for practical exam during the course +20 marks for the final practical exam) which equal 35% of the total marks.
- Questions: Different types of questions, short and long answer questions, differentiation, comparisons etc., were given.

Policy on examinations:

To insure that all students receive fair and equal treatment, the following policies regarding examinations will be followed:
Every student is required to complete all course examinations, including the final. A student who misses an examination, and who has a written medical excuse as required by the administration is permitted to make up the examination. The make-up does not have to be the same format as the original examination.

A student who misses an examination, and who does not have a written medical excuse, or some other reasonable excuses, is NOT permitted to make up the examination. Reasonable excuses should be limited to problems that are beyond the student`s control. The instructor must be notified within one week of a missed exam that a student has a valid medical excuse or other reasonable excuses in order to schedule a make-up exam. Students are required to arrive on time for completing scheduled make up work. Late arrival will result in no credit for the makeup examination.