

## **IB 420 (CPSC 484) – PLANT PHYSIOLOGY - SPRING 2020 – 3 CREDIT HOURS**

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Meetings: Tuesday and Thursday from 9:30-10:50 in 2020A Natural History Building.

### **COURSE DESCRIPTION AND OBJECTIVES**

This course is designed to guide you toward an understanding and appreciation of plant physiology. Physiology refers to the physical, mechanical, and biochemical functions of living organisms. It is a sub-discipline of biology that investigates the way organisms work from the molecular and cellular to the organ to the whole-organism levels. The focus of this course is on higher plants, although references to other autotrophic organisms may be made as appropriate to understand underlying principles. As much as possible the concepts of plant physiology will be presented in the context of how plants interact with their environment.

### **COURSE POLICIES, EXPECTATIONS, AND REQUIREMENTS**

#### **Prerequisites:**

Prerequisite: IB 103 or IB 150 and MCB 150; CHEM 232; IB 202 recommended; or consent of instructor.

#### **Required Texts:**

There are no required texts for this course. All resources needed to further your understanding of the course material is accessible through the library (both physical and online) and the internet. The majority of the class lecture material will be based on two texts that are available to the University of Illinois Urbana-Champaign community through the library system. The access the text from the below links requires your computer to be on campus or VPNed into campus.

Bhatla, S.C. and Lal, M.A., 2018. *Plant Physiology, Development and Metabolism*. Springer.

(<https://link.springer.com/book/10.1007%2F978-981-13-2023-1>)\*

Lambers, H. and Oliveira, R.S., 2019. *Plant Physiological Ecology*. Springer

(<https://link.springer.com/book/10.1007/978-3-030-29639-1>)\*

Additional readings outside of the course text will be distributed in class or electronically via the class website and may include peer reviewed publications or sections from the following texts:

Buchanan et al. (2000). *Biochemistry and Molecular Biology of Plants*. American Soc. Plant Physiol. Rockville, MD. ([https://vufind.carli.illinois.edu/vf-uiu/Record/uiu\\_8422020](https://vufind.carli.illinois.edu/vf-uiu/Record/uiu_8422020))

Hirt, H, and Shinozaki, K (Eds.) 2004. *Plant Responses to Abiotic Stress*, Springer-Verlag, Berlin, Heidelberg. ([https://vufind.carli.illinois.edu/vf-uiu/Record/uiu\\_6265772](https://vufind.carli.illinois.edu/vf-uiu/Record/uiu_6265772))

Jenks, M, and Hasegawa, P (Eds.) 2014. *Plant Abiotic Stress*, Blackwell Publishing Ltd., Oxford. ([https://vufind.carli.illinois.edu/vf-uiu/Record/uiu\\_7461117](https://vufind.carli.illinois.edu/vf-uiu/Record/uiu_7461117))

Pessarakli M, Tan KH (2011) *Handbook of Plant and Crop Stress*. CRC Press, Boca Raton. ([https://vufind.carli.illinois.edu/vf-uiu/Record/uiu\\_7437236](https://vufind.carli.illinois.edu/vf-uiu/Record/uiu_7437236))

Rao, KVM et al.(Eds.) 2006. *Physiology and Molecular Biology of Stress Tolerance in Plants*, Springer, Dordrecht ([https://vufind.carli.illinois.edu/vf-uiu/Record/uiu\\_5569750](https://vufind.carli.illinois.edu/vf-uiu/Record/uiu_5569750))

## Evaluation and Feedback

I believe that constructive feedback during the course is essential for effective learning. I will be providing you with periodic evaluations of both in-class and out-of-class work. If at any time you are concerned about your performance in the class, please come see me. I want you to succeed and am available to help. Evaluation will be based on the criteria shown on the next page (with minor changes at my discretion):

<b>Grading:</b>	Midterm Exam	25% of final grade
	Homework assignments and micro-essays	25% of final grade
	Participation/citizenship	10% of final grade
	Attendance	10% of final grade
	Final exam	<u>30% of final grade</u>
		100% of final grade

Your final grade will be assigned based on the following **Grading Scale**:

94-100%	A	83-86%	B	70-76%	C
90-93%	A-	80-82%	B-	60-69%	D
87-89%	B+	77-79%	C+	Below 60%	F

I do not grade on a curve. I recognize that there are times when your overall score may not accurately reflect the quality, effort, or improvement in your work. At my discretion, I may raise your final grade to account for these circumstances.

### A few notes about...

#### ...attendance

Attendance is expected. If you must miss class for a scheduled event, please notify me as early as possible before class. Failure to notify me will result in a failing grade (0%) for any in-class activity which cannot be made up.

#### ...participation

Participation in class discussions and activities is essential. This does *not* mean that I will be grading you based on the number of times you speak. Rather, I believe successful discussions result when participants are prepared and engaged. Remember to listen to your classmates, ask questions, think about what you want to say before you speak, and yield the spotlight to others.

#### ...late work

Missed Exams may be made up only if you have an excused absence. Late work will not be accepted except under extreme circumstances. If an assignment is due at the beginning of class and you are late for class, your assignment will be considered late.

#### ...group work and academic integrity

Science is a collaborative endeavor. Each of you brings a unique set of interests and experiences to this course. We can all learn from each other and I encourage you to discuss the readings with your classmates and seek their feedback.

According to the Student Code, 'It is the responsibility of each student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions.' Please know that it is my responsibility as an instructor to uphold the academic integrity policy of the University, which can be found here:

[http://studentcode.illinois.edu/article1\\_part4\\_1-401.html](http://studentcode.illinois.edu/article1_part4_1-401.html)

#### ...accommodations

Disability Accommodations -To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TTY), or e-mail a message to [disability@illinois.edu](mailto:disability@illinois.edu).

**Student Learning Outcomes:**

At the end of this semester, students will be able to:

Critically understand the basic metabolic pathways involved in primary plant function, including, but not limited to, photosynthesis, photorespiration, respiration, sugar/starch/lipid synthesis and breakdown.

Understand physiology functioning of plant responses to their environment, including variable environmental conditions, water transport, and solute uptake and partitioning.

Demonstrate competencies in understanding plant physiological response to and interactions with biotic and abiotic stresses.

**Class Format:**

The course will be taught in modules. How long each module take will depend on the level of understanding of material based on many criteria including in-class discussions, homework, and in-class assignments.

The format of each class will include:

Announcements and Questions (~5 minutes)

*This is time allocated to announcements of upcoming class activities, follow-up questions from previous lectures, and clarification of information previously presented.*

Review of previous homework/micro-essay (~10 minutes)

*This time will be used to discuss recently turned-in homework assignments or topics of the micro-essay from the previous class*

Lecture\* (20-40 minutes)

*Topics relative to the class topic will be presented here.*

In-class activities\* (20-40 minutes)

*This time will be dedicated to students working together to answer questions or work on activities related to the lecture material. The activities may include, but are not limited to, hands-on activities, worksheets, data/figure analysis, discussion of literature, etc.*

*\*note that multiple in-class activities may be nested within the lecture.*

Homework assignment or in-class micro-essay (5 minutes)

*I will frequently assign homework or an in-class micro-essay. This time will be for me to explain the work and for the students to either ask questions clarifying the homework or to write their micro-essay*

*The format of the homework will vary based on the module and will be graded for completion and correct answers.*

*The micro-essay will be turned in at the end of class for the purpose of assessing the understanding of topics and for taking attendance. A micro-essay with nothing written other than a name will be awarded credit for attendance but no credit toward the Homework/Micro-Essay component of the class.*

**\*Tentative Course Schedule**

<b>Date</b>	<b>Topics</b>
	Module 1: Course Introduction
1/21/2020	Class introduction
	How do plants interact with their environment?
1/23/2020	Evolution of plants
	What are the plant organs and cell types?
	Module 2: Uptake and transport of Water and Nutrients
1/28/2020	Properties of water from the perspective of plants
	Plant Water Relations
1/30/2020	Water and Solute Transport
2/4/2020	Plant Mineral Nutrition
	Module 3: Metabolism
2/6/2020	General Concepts
2/11/2020	ATP Synthesis
2/13/2020	Photosynthesis
2/18/2020	Ecology of Photosynthesis
2/20/2020	Stomatal Biology
2/25/2020	Phloem Transport
2/27/2020	Respiration
3/3/2020	Carbohydrate Metabolism
3/5/2020	Lipid Metabolism
3/10/2020	Inorganic Nutrient Metabolism
3/12/2020	<b>Midterm Exam</b>
3/17/2020	<b>Spring Break</b>
3/19/2020	<b>Spring Break</b>
	Module 4: Development
3/24/2020	Light Receptors
3/26/2020	Plant Growth Regulators (1)
3/31/2020	Plant Growth Regulators (2)
4/2/2020	Plant Growth Regulators (3)
4/7/2020	Signal Perception and Transduction (1)
4/9/2020	Signal Perception and Transduction (2)
4/14/2020	Seed Dormancy and Germination
4/16/2020	Plant Movement
4/21/2020	Senescence
	Module 5: Stress Physiology and Global Change
4/23/2020	Abiotic Stress (1)
4/28/2020	Abiotic Stress (2)
4/30/2020	Biotic Stress (1)
5/5/2020	Biotic Stress (2)
5/11/2020	<b>Final Exam from 7-10 PM (tentative)</b>

**FINAL EXAM (comprehensive, but weighted since Exam 2)**

*\* Please note: this schedule is not a contract; it is a semester plan and may be changed at the discretion of the Professor*