

HOS6932: ROOT AND RHIZOSPHERE ECOLOGY

Fall 2018

Credits: 3

Course Description: The aim of this course is to provide a complete view of the rhizosphere and its unique functioning that implies numerous, strong and complex interactions between plant roots, soil constituents and microorganisms. Furthermore, the course not only aims at addressing current knowledge and achievements but also at outlining the future challenges that stand in front of rhizosphere sciences. Topics incorporate how roots and the rhizosphere respond to different environments including multiple interactions between soils, plant roots, microbes, mycorrhizas, and fauna, soil heterogeneity, biogeochemical cycles, abiotic stresses, and emerging contaminants.

Course prerequisites: BOT 2010 or BSC 2010

Knowledge prerequisites: This is an advanced course which examines the interactions between plant root apparatus and the environment. To be successful, students should have a general knowledge of biology, botany, microbiology, and soil chemistry.

Course objectives:

- 1) To provide a review of recent research literature on root and rhizosphere biology and ecology.
- 2) To develop an understanding of unique biochemical processes in roots and in the rhizosphere.
- 3) To promote integration of different disciplines such as plant physiology, biochemistry, natural product chemistry, molecular biology, genomics and chemical ecology to study roots and rhizosphere processes.
- 4) To raise awareness about environmental concerns (*e.g.*, interaction between plant roots and heavy metals, engineered nanoparticles, BTEX, etc.).

Student Learning Outcomes – After successful completion of this course, students will be able to:

- 1) Understand the role of plant roots in the global context of soil development and atmosphere composition.
- 2) Classified and recognized root derived products.
- 3) Compare different Root System Architectures.
- 4) Describe root response to biotic and abiotic stresses.
- 5) Explain key root-rhizosphere interactions, from beneficial microorganisms to detrimental nematodes.
- 6) Recommend modern research techniques for field and lab studies on plant roots.

Lectures

Online course: Each week there is a block of content available with specific due dates.

Instructor: Dr. Lorenzo Rossi

Webpage: Canvas course link

Contact Information:

- Instructor: Dr. Lorenzo Rossi
- Email: use the Canvas e-mail (the most efficient) or l.rossi@ufl.edu.
- Phone: 772-577-7341.
- Office hours: online conferencing via skype every Friday 11am-12pm (or by request).

Recommended textbooks

- Eshel A, and Beeckman T. (2013): **Plant Roots: The Hidden Half**, Fourth Edition. CRC Press. ISBN 978-14-398-4648-3.
- Dessaux Y, Hinsinger P, and Lemanceau P. (2010): **Rhizosphere: Achievements and Challenges**. Springer. ISBN 978-94-007-3092-2
- Cardon Z, and Whitbeck J. (2007): **The Rhizosphere: An Ecological Perspective**. Academic Press (Elsevier). eBook ISBN: 978-00-804-9304-6, Hardcover ISBN: 978-01-208-8775-0
- Pinton R, Varanini Z, and Nannipieri P. (2007): **The Rhizosphere: Biochemistry and Organic Substances at the Soil-Plant Interface**, Second Edition. CRC Press. ISBN 978-08-493-3855-7

Evaluation of learning

<i>Assignment</i>	<i>% of grade</i>	<i>Points</i>
Quiz/Discussion	70	1500
First Exam	10	250
Mid-Term Exam	10	250
Final Exam	10	250
Total	100	2250

<i>Assignment breakdown</i>	<i>Points x Number of assignment = Total Points</i>
Quiz	50 X 15 = 750
Discussion	50 X 15 = 750
Total	1500

<i>Exams</i>	<i>Content covered</i>
First Exam	Modules 1-5
Mid-Term Exam	Modules 6-10
Final Exam	Modules 11-15

UF Grading Policy: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Course organization

The module material of a given week will be made available the Friday of the week before. A first batch the assignments will be due on the Tuesday and the rest on the Friday of a given module week.

Module 0: Introduction to the course

Module 1: Definition of the rhizosphere and origin of roots

Module 2: Root structure, functions and modifications

Module 3: Regulation of root growth

Module 4: Classification and function of root derived products

Module 5: Root exudates and mineral nutrition

Module 6: Root system architecture and nutrient acquisition

Module 7: Legume-Rhizobia symbiosis

Module 8: Mycorrhizal fungi and nutrient acquisition

Module 9: Plant growth promoting rhizobacteria

Module 10: Drought and salt stress

Module 11: Heat and flooding stress

Module 12: Trace metals and emerging contaminants stress

Module 13: Stresses caused by pathogens

Module 14: Modern research techniques for field experiments

Module 15: Modern research techniques for laboratory experiments

Course schedule

8/22/2018	Week 1 – Module 0 – Introduction to canvas and distance education
8/24/2018	Week 1 – Module 0 – Introduction to the course, quiz #0 and discussion #0
8/27/2018	Week 2 – Module 1 – Definition of the Rhizosphere/1
8/29/2018	Week 2 – Module 1 – Definition of the Rhizosphere/1
8/31/2018	Week 2 – Module 1 – Quiz #1, Discussion #1
9/3/2018	Labor Day
9/5/2018	Week 3 – Module 2 – Root structure and development
9/7/2018	Week 3 – Module 2 – Quiz #2, Discussion #2
9/10/2018	Week 4 – Module 3 – Regulation of root growth/1
9/12/2018	Week 4 – Module 3 – Regulation of root growth/2
9/14/2018	Week 4 – Module 3 – Quiz #3, Discussion #3
9/17/2018	Week 5 – Module 4 – Classification and function of root derived products/1
9/19/2018	Week 5 – Module 4 – Classification and function of root derived products/2
9/21/2018	Week 5 – Module 4 – Quiz #4, Discussion #4
9/24/2018	Week 6 – Module 5 – Root exudates and mineral nutrition
9/26/2018	Week 6 – Module 5 – Quiz #5, Discussion #5
9/28/2018	First Exam (Modules 1-5)
10/1/2018	Week 7 – Module 6 – Root system architecture and nutrient acquisition/1
10/3/2018	Week 7 – Module 6 – Root system architecture and nutrient acquisition/2
10/5/2018	Week 7 – Module 6 – Quiz #6, Discussion #6
10/8/2018	Week 8 – Module 7 – Legume-Rhizobia symbiosis/1
10/10/2018	Week 8 – Module 7 – Legume-Rhizobia symbiosis/2
10/12/2018	Week 8 – Module 7 – Quiz #7, Discussion #7
10/15/2018	Week 9 – Module 8 – Mycorrhizal fungi and nutrient acquisition/1
10/17/2018	Week 9 – Module 8 – Mycorrhizal fungi and nutrient acquisition/2
10/19/2018	Week 9 – Module 8 – Quiz #8, Discussion #8
10/22/2018	Week 10 – Module 9 – Plant growth promoting rhizobacteria/1
10/24/2018	Week 10 – Module 9 – Plant growth promoting rhizobacteria/2
10/26/2018	Week 10 – Module 9 – Quiz #9, Discussion #9
10/29/2018	Week 11 – Module 10 – Drought and salt stress
10/31/2018	Week 11 – Module 10 – Quiz #10, Discussion #10
11/2/2018	Homecoming – Go Gators!
11/5/2018	Mid-Term Exam (Modules 6-10)
11/7/2018	Week 12 – Module 11 – Heath and flooding stress
11/9/2018	Week 12 – Module 11 – Quiz #11, Discussion #11
11/12/2018	Veterans Day
11/14/2018	Week 13 – Module 12 – Metals and emerging contaminants stresses
11/16/2018	Week 13 – Module 12 – Quiz #12, Discussion #12
11/19/2018	Week 14 – Module 13 – Stresses caused by pathogens
11/21/2018	Holiday break
11/23/2018	Happy Thanksgiving!
11/26/2018	Week 15 – Module 13 – Quiz #13, Online discussion #13
11/28/2018	Week 15 – Module 14 – Modern research techniques for field experiments
11/30/2018	Week 15 – Module 14 – Quiz #14, Discussion #14
12/3/2018	Week 16 – Module 15 – Modern research techniques for laboratory experiments
12/5/2018	Week 16 – Module 15 – Quiz #15, Discussion #15
12/10/2018	Final Exam (Modules 11-15)

University of Florida Policies

Accommodations for students with disabilities: Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Class attendance and make-up work: Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Online course evaluation process: Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.