HOS 6932: ROOT AND RHIZOSPHERE ECOLOGY

3 CREDITS

Instructor: Dr. Lorenzo Rossi

Webpage: https://ufl.instructure.com/courses/357898

Contact Information:
- Email: use the Canvas e-mail (the most efficient) or l.rossi@ufl.edu
- Phone: 772-577-7341
- Usually replies to voicemails and emails in 24 hours
- Office hours: online conferencing via Canvas/Zoom every Friday 11am-12pm (or by request)

Lectures: 100% Online course. Each week, there is a block of content available with specific due dates.

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 among plant roots, soil constituents, and microorganisms. Furthermore, the course not only aims to address current knowledge and achievements but also outlines the future challenges that confront rhizosphere studies. Topics incorporate how roots and the rhizosphere respond to different environments, including multiple interactions among soils, plant roots, microbes, mycorrhizae, 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 that examines the interactions between the plant root apparatus and the environment. To be successful in this course, students should have a general knowledge of biology, botany, microbiology, and soil chemistry.

Course objectives:
- To critically appraise the current literature on root and rhizosphere biology and ecology and to present and discuss recent plant root science articles in a form of a journal club.
- To develop an understanding of unique biochemical processes in roots and the rhizosphere.
- To discuss modern research techniques for field and lab studies on plant roots.
- To promote integration of different disciplines, such as plant physiology, biochemistry, natural product chemistry, molecular biology, genomics and, chemical ecology, to study root and rhizosphere processes.
- To raise awareness about environmental concerns which affect roots (e.g., interaction between plant roots and heavy metals, engineered nanoparticles, emerging pathogens, etc.).
LEARNING OBJECTIVES

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

- Identify the role of plant roots in the global context of soil development and atmosphere composition.
- Classify and recognize root-derived products.
- Compare different root system architectures.
- Describe root responses to biotic and abiotic stresses.
- Explain key root-rhizosphere interactions, from beneficial microorganisms to detrimental nematodes.
- Recommend modern research techniques for field and lab studies on plant roots.
- Locate, appraise, and assimilate evidence from scientific studies related to plant root science.

COURSE MATERIALS

Recommended textbooks


Required readings

- Sheikh M. F. Rabbi; Matthew K. Tighe; Richard J. Flavel; Brent N. Kaiser; Chris N. Guppy; Xiaoxian Zhang; Iain M. Young. 2018. **Plant roots redesign the rhizosphere to alter the three-dimensional physical architecture and water dynamics**. *New Phytologist*. Volume219, Issue2, p542-550.
EVALUATION OF LEARNING

<table>
<thead>
<tr>
<th>Assignment</th>
<th>% of grade</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) 15 Weekly Quizzes/Discussions</td>
<td>70</td>
<td>1500</td>
</tr>
<tr>
<td>2) First Exam</td>
<td>10</td>
<td>250</td>
</tr>
<tr>
<td>3) Mid-Term Exam</td>
<td>10</td>
<td>250</td>
</tr>
<tr>
<td>4) Final Exam</td>
<td>10</td>
<td>250</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>2250</td>
</tr>
</tbody>
</table>

**Quizzes**

At the end of each module, a specific quiz will assess the student’s learning. Ten questions related to the module will be available. Students will have 2 attempts to answer the questions properly. Up to 5 points will be rewarded for a correct response to each question, for a total of 50 points per quiz.

**Discussions**

At the end of each week, a discussion board with a specific prompt will be ready for the students. Students will not be able to read posts made by other students until after they have already completed and submitted their own post. Each submitted post should consist of 500 words or less and must address all parts of the prompt. Each student will also be expected to post a reply to at least two other students’ posts to receive full credit. Please note that points will not be assigned separately for discussion comments and discussion posts. Students will either receive all potential points for making an original post and posting two comments, or they will receive nothing for skipping either part of the assignment. Poor quality submissions will receive partial credit.

The grading procedures of the discussion will follow this rubric.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Ratings</th>
<th>Pts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25.0 to &gt;10.0 pts Response addresses all parts of the prompt in a convincing and clear manner, and consists of 300 words or less</td>
<td>25.0</td>
</tr>
<tr>
<td>Original Response to Prompt</td>
<td>10.0 to &gt;0.0 pts Response only addresses some parts of the prompt and/or is significantly more than 500 words</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>0.0 pts Response not submitted or all expectations of discussion thread not met</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>0.0 pts Student does not respond to at least 2 peers with substantive comments that further the conversation; or all expectations of discussion thread not met</td>
<td>25.0</td>
</tr>
<tr>
<td>Reply to Peers</td>
<td>25.0 pts Student responds to at least 2 peers with substantive comments that further the conversation</td>
<td>25.0</td>
</tr>
</tbody>
</table>

**Exams**

<table>
<thead>
<tr>
<th>Exams</th>
<th>Content covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) First Exam</td>
<td>Modules 1-5</td>
</tr>
<tr>
<td>2) Mid-Term Exam</td>
<td>Modules 6-10</td>
</tr>
<tr>
<td>3) Final Exam</td>
<td>Modules 11-15</td>
</tr>
</tbody>
</table>

All three exams will have 5 questions. Fifty points will be available for each question, for a total of 250 points. Students will have 7 days to start the exam and, once they started, they will have 24 hrs to complete it.
### Assignment Breakdown

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Points x Number of Assignments = Total Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 Quizzes</td>
<td>50 x 15 = 750</td>
</tr>
<tr>
<td>15 Discussions</td>
<td>50 x 15 = 750</td>
</tr>
<tr>
<td>3 Exams</td>
<td>250 x 3 = 750</td>
</tr>
<tr>
<td>Total</td>
<td>2250</td>
</tr>
</tbody>
</table>

### Critical Dates

- **First Exam**: 9/27/2019 (Modules 1-5)
- **Mid Term Exam**: 11/4/2019 (Modules 6-10)
- **Final Exam**: 12/11/2019 (Modules 11-15)

### Grading Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>94 - 100 %</td>
</tr>
<tr>
<td>A-</td>
<td>&lt; 94 - 90 %</td>
</tr>
<tr>
<td>B+</td>
<td>&lt; 90 - 87 %</td>
</tr>
<tr>
<td>B</td>
<td>&lt; 87 - 84 %</td>
</tr>
<tr>
<td>B-</td>
<td>&lt; 84 - 80 %</td>
</tr>
<tr>
<td>C+</td>
<td>&lt; 80 - 77 %</td>
</tr>
<tr>
<td>C</td>
<td>&lt; 77 - 74 %</td>
</tr>
<tr>
<td>C-</td>
<td>&lt; 74 - 70 %</td>
</tr>
<tr>
<td>D+</td>
<td>&lt; 70 - 67 %</td>
</tr>
<tr>
<td>D</td>
<td>&lt; 67 - 64 %</td>
</tr>
<tr>
<td>D-</td>
<td>&lt; 64 - 61 %</td>
</tr>
<tr>
<td>E</td>
<td>&lt; 61 %</td>
</tr>
</tbody>
</table>

### Passing Grade Points

<table>
<thead>
<tr>
<th>Grade</th>
<th>Grade Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.0</td>
</tr>
<tr>
<td>A-</td>
<td>3.67</td>
</tr>
<tr>
<td>B+</td>
<td>3.33</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
</tr>
<tr>
<td>B-</td>
<td>2.67</td>
</tr>
<tr>
<td>C+</td>
<td>2.33</td>
</tr>
<tr>
<td>C</td>
<td>2.0</td>
</tr>
<tr>
<td>C-</td>
<td>1.67</td>
</tr>
<tr>
<td>D+</td>
<td>1.33</td>
</tr>
<tr>
<td>D</td>
<td>1.0</td>
</tr>
<tr>
<td>D-</td>
<td>0.67</td>
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<tr>
<td>S</td>
<td>0</td>
</tr>
</tbody>
</table>

Additional information on current UF grading policies for assigning grade points can be found here:

Course organization

The module material of a given week will be made available the Friday of the week before. Quizzes and discussion posts must be submitted by midnight of the Friday of a given module’s 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: Rhizobacteria that promote plant growth
Module 10: Drought and salt stress
Module 11: Heat and flooding stress
Module 12: Stress from trace metals and emerging contaminants
Module 13: Stresses caused by pathogens
Module 14: Modern research techniques for field experiments
Module 15: Modern research techniques for laboratory experiments

Course schedule

8/20/2019 Week 1 – Module 1– Definition of the rhizosphere/1
8/22/2019 Week 1 – Module 1 – Definition of the rhizosphere/2
8/23/2019 Week 1 – Module 1 – Quiz #1, Discussion #1
8/26/2019 Week 2 – Module 2 – Root structure and development/1
8/28/2019 Week 2 – Module 2 – Root structure and development/2
8/30/2019 Week 2 – Module 2 – Quiz #2, Discussion #2
9/2/2019 Labor Day
9/3/2019 Week 3 – Module 3 – Regulation of root growth/1
9/5/2019 Week 3 – Module 3 – Regulation of root growth/2
9/6/2019 Week 3 – Module 3 – Quiz #3, Discussion #3
9/9/2019 Week 4 – Module 4 – Classification and function of root-derived products/1
9/11/2019 Week 4 – Module 4 – Classification and function of root-derived products/2
9/13/2019 Week 4 – Module 4 – Quiz #4, Discussion #4
9/16/2019 Week 5 – Module 5 – Root exudates and mineral nutrition/1
9/18/2019 Week 5 – Module 5 – Root exudates and mineral nutrition/2
9/20/2019 Week 5 – Module 5 – Quiz #5, Discussion #5
9/23/2019 Week 6 – Module 6 – Root system architecture and nutrient acquisition/1
9/25/2019 Week 6 – Module 6 – Root system architecture and nutrient acquisition/2
9/27/2019 Week 6 – Module 6 – Quiz #6, Discussion #6
9/27/2019 First Exam (Modules 1-5)
9/30/2019 Week 7 – Module 7 – Legume-Rhizobia symbiosis/1
10/2/2019 Week 7 – Module 7 – Legume-Rhizobia symbiosis/2
10/3/2019 Week 7 – Module 7 – Quiz #7, Discussion #7
10/4/2019 Homecoming – Go Gators!
10/7/2019 Week 8 – Module 8 – Mycorrhizal fungi and nutrient acquisition/1
10/9/2019 Week 8 – Module 8 – Mycorrhizal fungi and nutrient acquisition/2
10/11/2019 Week 8 – Module 8 – Quiz #8, Discussion #8
10/14/2019 Week 9 – Module 9 – Rhizobacteria that promote plant growth/1
10/16/2019 Week 9 – Module 9 – Rhizobacteria that promote plant growth/2
COURSE POLICIES

Attendance and Make-up Policy

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:

- **UF Attendance policy**, [https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx](https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx)

Academic Honesty

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.” You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment."

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action.
For more information regarding the Student Honor Code, please see:
http://www.dso.ufl.edu/scrr/process/student-conduct-honor-code

Software Use

All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken when appropriate.

Services for Students with Disabilities

Students with disabilities requesting accommodations should first register with the Disability Resource Center 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.

- Disability Resource Center, 0001 Reid Hall, (352) 392-8565, www.dso.ufl.edu/drc/

Campus Helping Resources

Students experiencing crises or personal problems that interfere with their general well-being are encouraged to utilize the university’s counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- Counseling and Wellness Center, 3190 Radio Road, 392-1575, www.counseling.ufl.edu
  Counseling Services
  Groups and Workshops
  Outreach and Consultation
  Self-Help Library
  Wellness Coaching
- U Matter We Care, www.umatter.ufl.edu
- Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161.
- University Police Department, 392-1111 (or 9-1-1 for emergencies), www.police.ufl.edu

Additionally, if you would like orientation on choosing a major, finding an internship, or planning your career, I encourage you to use the university’s on-campus resources.

- Career Connections Center, CR-100 Reitz Union, 392-1601, https://career.ufl.edu/

Course Evaluation Process
Student assessment of instruction is an important part of the effort to improve teaching and learning. At the end of the semester, you are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Evaluations are typically open during the last two or three weeks of the semester. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/.

Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/

Student Complaints
You can file and resolve any complaints about your experience in this course in the following site:

- Student complaints in residential courses, https://scrr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/
- Student complaints in online courses, http://distance.ufl.edu/student-complaint-process/