



HOS6355 ROOT AND RHIZOSPHERE ECOLOGY

3 CREDITS



Course Location: 100% online: Login to UF E-learning (Canvas): <https://elearning.ufl.edu/>

Course Communication: Please send email using UF E-learning (Canvas) for course related information

Main Instructor: **Dr. Lorenzo Rossi**, Assistant Professor of Plant Root Biology
UF/IFAS IRREC (Horticultural Sciences Department)

Teaching Assistant: **Mr. L. Jonathan Clavijo-Herrera**, Graduate Research Assistant
Horticultural Sciences Department

Guest Lecturer: **Dr. Diane Rowland**, Dean of College of Natural Sciences, Forestry, and Agriculture
University of Maine

Mr. Clemen De Oliveira, Graduate Research Assistant
UF/IFAS GCREC (Entomology and Nematology Department)

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 focuses on current discoveries and achievements in plant root science and presents and discusses the future challenges that root and rhizosphere research is facing. Topics cover root structure and architecture, function, regulation; and root and rhizosphere response to varying environmental conditions, including interactions among microbes, mycorrhizae, micro fauna, fungi, soil heterogeneity, biogeochemical cycles, biotic and abiotic stresses, and emerging contaminants.

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

Learning Objectives:

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

- Recognize key anatomical and morphological features of plant roots.
- Describe main physiological and biochemical responses in the root system.
- 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 recent scientific studies related to plant root science.

CONTACTING THE INSTRUCTOR AND TEACHING ASSISTANT:

Questions about class materials or content: Please use the discussion boards in Canvas for all questions about class mechanics or content. If you have a question about the class or subject material, others probably share the same question, and posting it to the discussion boards allows everyone to see the question and answer, just as if you had raised your hand in class and asked the question. If you use email to ask a general class related question, you will be asked to post your question on the appropriate board, and it will be answered there. Please do not use the discussion boards for questions about specific quiz questions on a quiz that is still open. Others may not have taken the quiz yet and would have an unfair advantage by seeing the questions ahead.

Individual questions, problems, or appointments: Please use the email function in Canvas to communicate with the instructor and TAs during the semester, rather than regular university email, except in extreme emergencies. Email and phone messages delivered on weekdays (M-F) will generally receive a reply within one business day. Messages may not be checked between 5:00 pm Friday and 8:00 am Monday; messages received over the weekend will generally receive a response on Monday. If I and/or the TAs plan to be out of the office or otherwise unavailable, I will post an announcement on the class website.

Questions about grading: This is a large class, and we work as a team to manage the various components. The course TAs do the grading on the discussion assignments. The TAs are graduate students and apprentice instructors. If you have a question or concern about your discussion post grades, please contact the TA first. If you have an issue that cannot be resolved with your TA, your course instructor will be happy to work with you both to reach a satisfactory understanding. For questions about exam grades, please contact your main instructor. For questions about course concepts, including quiz questions, both the instructors and the TAs are ready to help!

Technical support: If you experience difficulties with accessing components of the site, including lectures, quizzes or tests, contact the UF help desk immediately. If they are not able to resolve your problem, contact the instructor with your help desk ticket number and a description of the problem and steps taken to resolve it. Extensions for due dates will be granted for documented technical problems, as needed.

COURSE MATERIALS

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

Required readings

- Jacob P. Rutten; Kirsten ten Tusscher. 2019. **In Silico Roots: Room for Growth.** *Trends in Plant Science*. Volume 24, issue 3, p250-262.
- 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*. Volume 219, Issue 2, p542-550.
- Xiangpei Kong; Guangchao Liu; Jiajia Liu; Zhaojun Ding. 2018. **The Root Transition Zone: A Hot Spot for Signal Crosstalk.** *Trends in Plant Science*. Volume 23, Issue 5, p403-409.
- Rahul Bhosale, Jitender Giri, et al. 2018. **A mechanistic framework for auxin dependent Arabidopsis root hair elongation to low external phosphate.** *Nature communications*. Volume 9, Article number: 1409

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	% of grade	Points
• Intro Quiz	1.2	35
• Intro Discussion	1.2	35
• 15 Quizzes due every week	35	1050
• 7 Discussions with activity due every week	32.6	980
• First Exam (Modules 1-5)	10	300
• Mid-Term Exam (Modules 6-10)	10	300
• Final Exam (Modules 11-15)	10	300
Total	100	3000

Exams

There will be 3 exams in this course. All three exams will have 5 questions. 60 points will be available for each question in Exam 1 and 2, and 74 points will be available for each question of the Final Exam, for a total of 370 points. Students will have 4 days to start the exam, and once started, they will have 12 hours to complete it.

Critical exam dates

First Exam	9/30/2021	(Modules 1-5)
Mid Term Exam	11/2/2021	(Modules 6-10)
Final Exam	12/12/2021	(Modules 11-15)

Quizzes

At the end of each module, a specific quiz will assess the student's learning. Ten questions related to each module will be available. Students will have 2 possible attempts. 7 points will be available for each question, for a total of 70 points per quiz.

Discussions

At the end of every second week, a discussion board with a specific prompt will be ready for the students. 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 the next week to at least two other students' posts to receive credit. Students will not be able to read posts made by other students until after they have already completed and submitted their own initial post. Poor quality submissions will receive partial credit. The grading procedures of the discussion will follow this rubric:

Discussion Criteria	Ratings			Points
Original Response to Prompt	90.0 to >45.0 points Responses addresses all parts of the prompt in a convincing and clear manner, and consist of 500 words or less	45.0 to >0.0 points Response only addresses some parts of the prompt and/or is significantly more than 500 words	0.0 points Response not submitted; or all expectations of discussion thread not met	90 points
Reply to Peers	50.0 to >25.0 points Student responds to at least 2 peers with substantive comments that further the conversation	25.0 to >0.0 points Student responds to only 1 peer with substantive comments or responds with 2 comments that lack significance	0.0 points Response not submitted; or all expectations of discussion thread not met	50 points
Total Points: 140.0				

GRADING SCALE

A	=	94 - 100 %	C	=	< 77 - 74 %
A-	=	< 94 - 90 %	C-	=	< 74 - 70 %
B+	=	< 90 - 87 %	D+	=	< 70 - 67 %
B	=	< 87 - 84 %	D	=	< 67 - 64 %
B-	=	< 84 - 80 %	D-	=	< 64 - 61 %
C+	=	< 80 - 77 %	E	=	< 61 %

Passing Grade Points

A	4.0
A-	3.67
B+	3.33
B	3.0
B-	2.67
C+	2.33
C	2.0
C-	1.67
D+	1.33
D	1.0
D-	0.67
S	0

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

- Grading policy, www.catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Course organization

Module material is made available each Saturday. Module quiz and discussion posts are due on Friday of the same 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

8/23/2021	Introduction to the course. Module 1 opens
8/28/2021	Module #2 opens
9/3/2021	Module #1 and #2 quizzes due – Discussion #1 response to question due
9/4/2021	Module 3 opens
9/6/2021	Labor Day
9/10/2021	Module 3 quiz due – Discussion #1 replies to classmates due
9/11/2021	Module 4 opens
9/17/2021	Module 4 quiz due – Discussion #2 response to question due
9/18/2021	Module 5 opens
9/24/2021	Module 5 quiz due – Discussion #2 replies to classmates due
9/25/2021	Module 6 opens
9/30/2021	First Exam due (Modules 1-5)
10/1/2021	Module 6 quiz due – Discussion #3 response to question due
10/2/2021	Module 7 opens
10/8/2021	Homecoming 🦮 Go Gators! 🦮
10/9/2021	Module 8 opens
10/11/2021	Module 7 quiz due – Discussion #3 replies to classmates due
10/15/2021	Module 8 quiz due – Discussion #4 response to question due
10/16/2021	Module 9 opens
10/22/2021	Module 9 quiz due – Discussion #4 replies to classmates due
10/23/2021	Module 10 opens
10/29/2021	Module 10 quiz due – Discussion #5 response to question due
10/30/2021	Module 11 opens
11/4/2021	Mid-Term Exam due (Modules 6-10)
11/5/2021	Module 11 quiz due – Discussion #5 replies to classmates due
11/6/2021	Module 12 opens
11/11/2021	Veterans Day
11/12/2021	Module 12 quiz due – Discussion #6 response to question due
11/13/2021	Module 13 opens
11/19/2021	Module 13 quiz due – Discussion #6 replies to classmates due

11/20/2021	Module 14 opens
11/24/2021	Thanksgiving break
11/26/2021	🍷 Happy Thanksgiving! 🍷
11/28/2021	Module 15 opens
11/29/2021	Module 14 quiz due – Discussion #7 response to question due
12/6/2021	Module 15 quiz due – Discussion #7 replies to classmates due
12/14/2021	Final Exam due (Modules 11-15)

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>

Academic Honesty

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students 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.”** The Conduct Code specifies a number of behaviors that are in violation of this code and the possible sanctions. Click here to read the Conduct Code. If you have any questions or concerns, please consult with the instructor or TAs in this class.

In-Class Recordings:

- Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are: (1) for personal educational use (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third-party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Policy on Course Syllabi Honor Code and Student Conduct Code.

- For more information regarding the Student Honor Code, please see: <http://www.dso.ufl.edu/sccr/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.

Canvas Technology Requirements

Computers, Internet, and Web browsers: Canvas runs on Windows, Mac, Linux, iOS, Android, or any other device with a modern web browser. It is recommended to use a computer less than five years old with at least 1GB of RAM. It is recommended to have a minimum Internet speed of 512kbps. It is strongly recommended to not use a wireless connection, phone, tablet, or notepad for critical course tasks such as exams and discussions.

Canvas currently supports the following browsers: Chrome, Safari, Firefox, Edge. Canvas supports the last two versions of most browsers. It is highly recommend updating to the newest version of whatever browser you are using. Note that your computer's operating system may affect browser function. Failure to use one of these browsers will cause problems.

For more information on approved computers and browsers please visit: <https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-are-the-browser-and-computer-requirements-for-Canvas/ta-p/66>

On this web page there is an area titled "Is My Browser up to Date?" Use it to check each computer and browser you may use in this course. There is another important area on "Browser Privacy Settings." Read the section(s) for any browser intended for use. For example, Note that: In browsers such as Safari, insecure content will never be displayed in the browser. Return to the page to check for updates on technology issues in Canvas.

If you encounter technical difficulties in this course, contact the UF Computing Help Desk right away to troubleshoot. <https://helpdesk.ufl.edu/> or (352) 392-HELP. If the problem cannot be fixed immediately, notify your instructor, and provide them with the Help Desk ticket number.

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 : <https://disability.ufl.edu/get-started/>

Campus Health and Wellness 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.

- *U Matter, We Care*: If you or someone you know is in distress, please contact umatter@ufl.edu, 352-392-1575, or visit [U Matter, We Care website](#) to refer or report a concern and a team member will reach out to the student in distress.

- *Counseling and Wellness Center*: [Visit the Counseling and Wellness Center website](#) or call 352-392-1575 for information on crisis services as well as non-crisis services.
- *Student Health Care Center*: Call 352-392-1161 for 24/7 information to help you find the care you need, or [visit the Student Health Care Center website](#).
- *University Police Department*: [Visit UF Police Department website](#) or call 352-392-1111 (or 9-1-1 for emergencies).
- *UF Health Shands Emergency Room / Trauma Center*: For immediate medical care call 352-733-0111 or go to the emergency room at 1515 SW Archer Road, Gainesville, FL 32608; [Visit the UF Health Emergency Room and Trauma Center website](#)

Course Evaluation Process

Student assessment of instruction is an important part of the effort to improve teaching and learning. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. [Click here for guidance on how to give feedback in a professional and respectful manner](#). 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. [Summaries of course evaluation results are available to students here](#).

Student Complaints

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

- *Student complaints in online courses*, <http://distance.ufl.edu/student-complaint-process/>