# Breeding and Production of Medicinal Plants and Herbs

HOS 4932 - 2 CREDITS

**MEETING TIMES AND LOCATION**

| | |
|---|---|
| Class Number: 22459 | Mondays and Wednesdays, 8th period (3:00pm – 3:50pm) |
| | Fifield Hall room 2316 |

**INSTRUCTORS**


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|---|---|
| Jeongim Kim, Ph.D. | jkim6@ufl.edu |
| | Fifield Hall 1111 |
| Marcio Resende, Ph.D. | mresende@ufl.edu |
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| Gerardo Nunez, Ph.D. | g.nunez@ufl.edu |
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| Tie Liu, Ph.D. | tieliu@ufl.edu |
| | Fifield Hall 1213 |


**COURSE DESCRIPTION**

Medicinal plants are a rapidly-growing niche in horticulture. This course focuses on current and emerging breeding and cultivation practices used to produce high–value medicinal plants and herbs. Additionally, this course provides a critical analysis of health effects and therapeutic claims of plant-derived physiologically-active products.

**LEARNING OBJECTIVES**

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

- Discuss botany, economics, and regulation of medicinal plants and herbs
- Explain breeding strategies for manipulation of secondary metabolites
- Compare anecdotal and traditional medicine claims of efficacy against scientific literature
- Explain in general terms how hydroponic systems, soilless media, supplemental lighting, and $CO_2$ enrichment operate

- Discuss how physiological stress factors can be used to optimize secondary metabolite production
- Appraise the importance of the medicinal plant niche in horticulture
- Discuss medicinal plants should be harvested during appropriate time period to ensure the best quality and quantity.
- Identify strategies to reduce postharvest loss for both fresh market and processed production.

## COURSE MATERIALS

### Textbook

The following textbooks are recommended for the course. Links to peer-reviewed reading materials will be made available via canvas.

- *Wicked plants: The Weed that Killed Lincoln's Mother and Other Botanical Atrocities*, Amy Stewart, 2009, 1st edition. ISBN 978-1565126831
- *Ball Redbook Volume 2*, Jim Nau (Ed) 2011, 18th Edition. ISBN 978-1-883052-68-3

### Course website

This course has a comprehensive mini-site in the Canvas platform. Take time to familiarize yourself with the "Start Here", "Syllabus", "Course Materials", and "Grades" tabs in the navigation menu. Digital copies of this syllabus, and other learning materials can be found there.

- *E-Learning in Canvas*, www.elearning.ufl.edu

### Technology

Students will need to have access to a laptop computer or tablet to complete the weekly quizzes. Additionally, students will need to have access to a video camera to record their presentation videos. Most cellular phone cameras are adequate for this task.

## LECTURES, ATTENDANCE, AND MAKE-UP POLICY

You are expected to attend every lecture and complete all assignments before the deadlines. Late assignments will be graded only for documented emergencies as per UF's attendance policy. Additional information about UF's attendance policy can be found here:

- *Attendance policy*, www.catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

## COURSE GRADE

**1. Weekly quizzes** **30 points**

Every week on Wednesday during class, a 10-question quiz will be available in Canvas. Quizzes will consist mostly of multiple choice questions. Each quiz will be worth 2 points, and there will be 15 quizzes during the

semester. Each quiz will be timed to 10 minutes, and it can only be taken once. Students must bring a web-enabled device (laptop computer, tablet computer, phone) to take the quiz in. Make up quizzes will be provided in accordance with the policy described above.

**2. Medicinal plant case study** **40 points**

Students will select from a list of available medicinal crops. First, students will write a general description for their medicinal plants including the scientific name, its history, any known bioactive compounds, and impact on human health. Following they will compose a breeding strategy to improve the medicinal attributes of this crop. Then, students will write a brief production manual for their medicinal plant. Finally, student will write an observation reports on the time and method of collection for two different medicinal plants. There will be four partial submissions for this case study (see table below). Each partial submission will be worth 10 points. Additional guidelines and grading rubrics for each submission will be provided via Canvas.

| Deliverable | Assignment opens | Submission due |
|---|---|---|
| General Description | Week 1 | |
| Breeding Strategy | Week 5 | End of week 9 |
| Production manual | Week 9 | End of week 13 |
| Harvest Manual | Week 14 | Week 15 |

**3. Video presentation** **30 points**

The objective of this assignment is to synthesize the information gathered in the medicinal plant case study to create an informative video about a medicinal crop. Students will receive feedback on their partial submissions for the case study. Then, based on their case study information and this feedback, students will prepare and record a 5-minute video where they introduce historical, biochemistry, breeding, production, and postharvest aspects of their medicinal crop. Additional guidelines and grading rubrics for each submission will be provided via Canvas.

**GRADING SCALE**

| | | | | | |
|---|---|---|---|---|---|
| A | = | 95 - 100 points | C | = | < 77 - 73 points |
| A- | = | < 95 - 90 points | C- | = | < 73 - 70 points |
| B+ | = | < 90 - 87 points | D+ | = | < 70 - 67 points |
| B | = | < 87 - 83 points | D | = | < 67 - 63 points |
| B- | = | < 83 - 80 points | D- | = | < 63 - 60 points |
| C+ | = | < 80 - 77 points | E | = | <60 points |

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 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

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/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.

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. These evaluations are conducted online at:

- *Course evaluations*, www.evaluations.ufl.edu

Evaluations are typically open during the last two or three weeks of the semester. You will be notified of the specific times when evaluations for this course are open. Summary results of these assessments are available to students at:

- *Evaluations summary,* www.evaluations.ufl.edu/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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/

Open field production

## Breeding and Production of Medicinal Plants and Herbs

2 CREDITS

| Week | Date | Lecture Topics | Activity-Project |
|---|---|---|---|
| Week 1<br>Kim | Jan 7 (Mon) | Botany and uses of medicinal plants | Introduce the course<br>Divide groups for the project |
| | Jan 9 (Wed) | Introduction to medicinal plants<br><br>Cannabis, Scutellaria, Atemisia | Quiz 1<br>Provide the list of medicinal plants for the group project |
| Week 2<br>Kim | Jan 14 (Mon) | medicinal plants and human health1 | |
| | Jan 16 (Wed) | medicinal plants and human health2 | Quiz 2 |
| Week 3<br>Kim | Jan 21 (Mon) | No Class - Holiday | |
| | Jan 23 (Wed) | Economically important herbs | Quiz 3 |
| Week 4<br>Kim | Jan 28 (Mon) | Economically important herbs | |
| | Jan 30 (Wed) | Functional foods and nutraceutical regulations under the FDA certified organic production and other labels | Quiz4<br>Due for project outline1-<br>10 points |
| Week 5<br>Resende | Feb 4 (Mon) | Introduction to medicinal plant breeding | |
| | Feb 6 (Wed) | Crop evolution, domestication and genetic diversity | Quiz 5 |
| Week 6<br>Resende | Feb 11<br>(Mon) | Principles of breeding (breeding strategy, modes of reproduction) | |
| | Feb 13<br>(Wed) | Principles of breeding (theory of selection, genetic gain) | Quiz 6 |
| Week 7<br>Resende | Feb 18<br>(Mon) | Traits of interest, breeding objectives and tools for medicinal plant breeding | |
| | Feb 20<br>(Wed) | Breeding for therapeutic compounds | Quiz 7 |
| Week 8<br>Resende | Feb 25<br>(Mon) | Breeding to reduce toxic compounds | |
| | Feb 27<br>(Wed) | Modern breeding and molecular technologies applied to medicinal plants | Quiz 8 |

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|---|---|---|---|
| Week 9<br>Gerardo | Mar 11<br>(Mon) | Cloning and propagation of medicinal plants and herbs | |
| | Mar 13<br>(Wed) | Case study: Seed (Anise), root cutting (Valerian), stem cuttings (Mint) | Quiz 9 |
| Week 10<br>Gerardo | Mar 18<br>(Mon) | Open field production | |
| | Mar 20<br>(Wed) | Case study: perennials (Stevia) | Quiz 10<br>Due for project outline 2 |
| Week 11<br>Gerardo | Mar 25<br>(Mon) | Hydroponic systems, and soilless cultivation | |
| | Mar 27<br>(Wed) | Case study: root-derived extracts (Echinacea) | Quiz 11 |
| Week 12<br>Gerardo | Apr 1 (Mon) | Supplemental lighting and photomorphogenic responses | |
| | Apr 3 (Wed) | Case study: leaf-derived extracts (Basil) | Quiz 12 |
| Week 13<br>Gerardo | Apr 8 (Mon) | Temperature control and $CO_2$ enrichment | |
| | Apr 10 (Wed) | Case study: flower/inflorescence-derived extracts (Chamomile) | Quiz 13 |
| Week 14<br>Liu | Apr 15 (Mon) | Guide to harvesting medicinal plants:<br>Identification and developmental stage of medicinal plants | |
| | Apr 17 (Wed) | Time and method of harvesting different medicinal plants | Quiz 14 |
| Week 15<br>Liu | Apr 22 (Mon) | Postharvest for fresh market production | |
| | Apr 24 (Wed) | Postharvest for processed production | Quiz 15 |