

**HOS6932**  
**CULTIVATION, EXTRACTION, AND APPLICATION OF MEDICINAL PLANTS AND THEIR BIOACTIVE COMPOUNDS**  
**Spring 2022 - 3 credits**

**MEETING DAYS, TIMES, AND LOCATION**

- **Lectures:** Each week, one to two lectures will be made available online within the course Canvas page (<http://lss.at.ufl.edu>). The lecture schedule is listed within the Tentative Course Schedule section of this syllabus.
- **Literature discussion:** Every Friday a 50-minute synchronous Zoom session will be held from 10:40am to 11:30am.
- **Labs:** Six laboratory lessons will be held throughout the semester on the dates listed within the Tentative Course Schedule. Laboratory lesson times will take place from 10:40am until 12:35pm.
- **Field trip:** One optional field trip is scheduled to occur on Wednesday, April 13<sup>th</sup> from 8:30am until 4:55pm.

**PREREQUISITE**

BCH3023 (Elementary Organic and Biological Chemistry) or HOS4932 (Breeding and Production of Medicinal Plants and Herbs) or equivalent.

**INSTRUCTORS**

Brian Pearson, Ph.D.

Assistant Professor

Environmental Horticulture Department, UF/IFAS

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**Phone:** (407) 410-6930

**Office Hours:** In-person office hours by appointment. Virtual office hours every Wednesday from 3:00-4:00pm via Zoom or by appointment.

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Assistant Professor

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Mengzi Zhang

Biological Scientist

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Office Hours: By appointment

### **COURSE DESCRIPTION**

Strong interest in cultivation, extraction, and use of medicinal crops has recently emerged in the fields of plant science, biochemistry and pharmacology. This three-credit graduate level course will focus on development of a more thorough understanding of plant production and management as well as secondary plant compound synthesis, extraction, analysis, and use. This course is co-taught by faculty in the UF/IFAS College of Agriculture and Life Sciences and the UF College of Pharmacy to prepare students for careers in natural plant product development and commercial cultivation of medicinal crops. Significant emphasis will be placed on the cultivation and use of *Cannabis sativa*, *Mitragyna speciosa*, and *Piper methysticum*.

### **COURSE LEARNING OBJECTIVES**

Upon successful completion of the course students will be able to:

- Examine and critique the influence of production factors on synthesis of secondary plant compounds cultivated and extracted for use as human medicines
- Successfully propagate, selectively prune, harvest, and dry select, high-value medicinal plant species
- Prepare and perform plant sample extractions to isolate bioactive compounds
- Organize, manage, and perform analytical procedures to accurately quantify plant secondary metabolites
- Predict and explain the pharmacodynamics associated with select plant compounds
- Propose appropriate procedures for successful research on medicinal chemistry and drug interactions
- Evaluate principles of drug actions and their use as therapeutics

### **TEXT AND MATERIALS**

Textbook: Heinrich, M., J. Barnes, J. Garcia, S. Gibbons, and E. Williamson, 2018. *Fundamentals of Pharmacognosy and Phytotherapy*. Edinburgh: Elsevier (ISBN: 978-0702070082).

Additional course reading materials will be provided and posted within the Canvas course site.

## **COURSE ACTIVITIES**

Each week, one to two lectures will be made available online within the course Canvas page (<http://lss.at.ufl.edu>). The lecture schedule is listed within the Tentative Course Schedule section of this syllabus. Additionally, each week a synchronous (face-to-face) session will be held via Zoom to review, critique, and reflect upon recent research publications as they relate to both previously presented materials and the future of medicinal plant science. Students will be assigned and tasked with identifying scientific manuscripts pertinent to course materials and leading the weekly literature review discussions. Lastly, six laboratory lessons will be held throughout the semester. The laboratory lesson schedule is listed within the Tentative Course Schedule section of this syllabus. The labs will provide students with the opportunity to obtain hands-on experience working with medical plants. The lessons have been designed to provide students with experience on how to propagate medicinal plants, cultivate them within various production environments, harvest and dry plant material, and extract and analyze plant samples for analysis.

To assess successful attainment of learning objectives, the following assignment types will be utilized:

**Quizzes:** Four quizzes will be assigned throughout the course. Quizzes will focus on content presented in lecture and assigned readings to assess comprehension, interpretation, and application of topics. All quizzes will be administered via Canvas using the “Quizzes” tool. Quizzes will be available beginning on the date listed on the schedule and must be completed within one week. Once you begin, you will have 30 min to complete the quiz.

**Challenge questions:** Four challenge questions will be given throughout the course. Challenge questions will assess your ability to evaluate, critique, formulate, and propose solutions to challenging questions related to materials presented in the course. Challenge questions will be made available at the beginning of the week with one week provided to complete the assignment.

**Literature review:** Each student, either individually or in assigned paired groups, will be identify two scientific manuscripts throughout the semester to review and present to the class. Students will be responsible for identifying, examining, critiquing, and reflecting on the impacts presented within the assigned manuscripts. Moreover, students will be responsible for leading the online classroom discussion session during their assigned week. Purposes of this assignment are to develop literature review and assessment skills as well as bolster proficiency in professional communication and oral speaking skills. Grades for this assignment will be peer-assessed.

**Lab report:** Six in-person laboratory exercises will be performed throughout the semester. Laboratory exercises will focus on development of skills in plant propagation techniques, plant production and operations management, harvest and post-harvest techniques, and extraction and analysis of medicinal plant compounds. Additionally, one in-person field trip to a medicinal crop cultivation facility will provide students the opportunity to interact with plant production managers and evaluate commercial facilities and operational procedures. A final laboratory report encompassing findings from the six laboratory exercises will be due at the end of the semester. Each of the six exercises should be presented in a manner similar to an abbreviated scientific manuscript inclusive of the introduction, methods and materials, results and discussion, and conclusion section. The purpose of this assignment is to provide time for reflection of laboratory exercises and to further develop written communication skills.

**TENTATIVE SCHEDULE**

Week	Date	Day	Lead Instructor	Topic	Reading
1	1/7/22	F	Dr. Pearson	Introduction to Pharmacognosy	<i>Fundamentals of Pharmacology and Phytotherapy</i> - Chapter 1
2	1/10/22	M	Dr. Pearson	History of Plants, People, and Natural Products	<i>Fundamentals of Pharmacology and Phytotherapy</i> – Chapter 2
2	1/12/22	W	Dr. Ping/Dr. Nadakuduti	Lab 1 – Germination and Propagation	EDIS CIR579 – <i>Plant Propagation Techniques for the Florida Gardener</i>
2	1/14/22	F	Dr. Pearson	Literature Review #1	Student selected
3	1/17/22	M	-	Holiday	-
3	1/19/22	W	Dr. Pearson	Plant Morphology and Important Plant Families for Phytopharmaceuticals	<i>Fundamentals of Pharmacology and Phytotherapy</i> – Chapters 3 & 4
3	1/21/22	F	Dr. Pearson	Literature Review #2	Student selected
4	1/24/22	M	Dr. Nadakuduti	Primary and Secondary Metabolism Quiz #1	TBA
4	1/26/22	W	Dr. Pearson/Dr. Nadakuduti	Lab 2 – Greenhouse and Field Management	EDIS SSENH901 – <i>Botany Handbook for Florida</i>
4	1/28/22	F	Dr. Ping	Literature Review #3	Student selected
5	1/31/22	M	Ms. Zhang	Influence of Production Environment on Growth and Secondary Metabolites Challenge Question #1	TBA
5	2/2/22	W	Dr. Pearson	Ethnobotany	<i>Fundamentals of Pharmacology and Phytotherapy</i> – Chapter 5
5	2/4/22	F	Dr. Pearson	Literature Review #4	Student selected
6	2/7/22	M	Dr. Nadakuduti	Biosynthesis of Natural Products for Human Use	<i>Fundamentals of Pharmacology and Phytotherapy</i> – Chapter 6
6	2/9/22	W	Dr. Pearson/Dr. Nadakuduti	Lab 3 – Harvest and Post-harvest Techniques	EDIS ENH1304 – <i>Process of Drying Post-harvest Hops (Humulus lupulus) for Small-scale Producers Using a Novel Drying Rig</i>
6	2/11/22	F	Dr. Pearson	Literature Review #5	Student selected
7	2/14/22	M	Dr. Nadakuduti	Aromatic Plants for Essential Oils	TBA
7	2/16/22	W	Dr. McCurdy	Natural Product Chemistry	<i>Fundamentals of Pharmacology and Phytotherapy</i> – Chapter 11
7	2/18/22	F	Dr. Pearson	Literature Review #6	Student selected
8	2/21/22	M	Dr. Sharma	Production, Quality Control, and Standardization Quiz #2	<i>Fundamentals of Pharmacology and Phytotherapy</i> – Chapter 10
8	2/23/22	W	Dr. Pearson/Dr. Sharma	Lab 4 – Sample Extraction Techniques I	TBA
8	2/25/22	F	Dr. Sharma	Literature Review #7	Student selected
9	2/28/22	M	Dr. Sharma	Methods in Natural Product Chemistry Challenge Question #2	<i>Fundamentals of Pharmacology and Phytotherapy</i> – Chapter 8

9	3/1/22	W	Dr. Nadakuduti	Genomics Enabled Plant Biochemistry	TBA
9	3/4/22	F	Dr. Nadakuduti	Literature Review #8	Student selected
10	3/7/22	M	-	Spring Break	-
10	3/9/22	W	-	Spring Break	-
10	3/11/22	F	-	Spring Break	-
11	3/14/22	M	Dr. Pearson	Medicinal Species Deep Dive I – <i>Cannabis sativa</i>	TBA
11	3/16/22	W	Dr. Pearson/Dr. Sharma	Lab 5 – Sample Extraction Techniques II	TBA
11	3/18/22	F	Dr. Pearson	Literature Review #9	Student selected
12	3/21/22	M	TBA	Medicinal Species Deep Dive II – <i>Cannabis sativa</i> Quiz #3	UF/IFAS Industrial Hemp Pilot Project Report
12	3/23/22	W	Dr. Pearson	Medicinal Species Deep Dive I – <i>Mitragyna speciosa</i>	<i>Kratom and Other Mitragynines: The Chemistry and Pharmacology of Opioids from a Non-Opium Source – Chapter 6</i>
12	3/25/22	F	Dr. Pearson	Literature Review #10	Student selected
13	3/28/22	M	Ms. Zhang	Medicinal Species Deep Dive II – <i>Mitragyna speciosa</i> Challenge Question #3	TBA
13	3/30/22	W	Dr. Pearson/Dr. Sharma	Lab 6 – GC/MS and HPLC Techniques	TBA
13	4/1/22	F	Dr. Pearson	Literature Review #11	Student selected
14	4/4/22	M	Dr. McCurdy	Medicinal Species Deep Dive III – <i>Mitragyna speciosa</i>	TBA
14	4/6/22	W	Dr. Pearson	Medicinal Species Deep Dive I – <i>Piper methysticum</i>	<i>Hawaiian 'Awa: Views of an Ethnobotanical Treasure – Chapter 3</i>
14	4/8/22	F	Dr. Pearson	Literature Review Discussion #12	Student selected
15	4/11/22	M	TBA	Medicinal Species Deep Dive II – <i>Piper methysticum</i>	<i>Hawaiian 'Awa: Views of an Ethnobotanical Treasure – Chapter 4</i>
15	4/13/22	W	-	Field Trip	-
15	4/15/22	F	Dr. Pearson	Literature Review #13	Student selected
16	4/18/22	M	Dr. Sharma	Principles of Drug Action and Therapeutics Quiz #4	<i>Fundamentals of Pharmacology and Phytotherapy – Chapter 11</i>
16	4/20/22	W	Dr. McCurdy	Research Procedures in Medicinal Chemistry and Drug Interactions Challenge Question #4	<i>Fundamentals of Pharmacology and Phytotherapy – Chapter 12</i>
16	4/22/22	F	-	Reading Day	-

## **EVALUATION AND GRADING**

Course grades will be based on 1000 points. All students are expected to view recorded lectures, participate in literature review discussions, and conduct laboratory exercises. Additionally, all students are expected to participate in one field trip event.

<b>Assignment</b>	<b>Number</b>	<b>Points per assignment</b>	<b>Total</b>
Quiz	4	75	300
Challenge question	4	75	300
Literature review	2	100	200
Lab report	1	200	200
<b>Total</b>			<b>1000</b>

The final grade earned in the course will be assigned based on accumulated total score and its associated letter grade as displayed below:

<b>Total points</b>	<b>% points</b>	<b>Letter grade</b>	<b>Grade points</b>
940 - 1000	94 – 100%	A	4.0
900 - 939	90 - 93.9%	A-	3.67
860 - 899	86 - 89.9%	B+	3.33
830 - 859	83 - 85.9%	B	3.0
800 - 829	80 - 82.9%	B-	2.67
760 - 799	76 - 79.9%	C+	2.33
730 - 759	73 - 75.9%	C	2.0
700 - 729	70 - 72.9%	C-	1.67
660 - 699	66 - 69.9%	D+	1.33
630 - 659	63 - 65.9%	D	1.0
500 - 629	50 - 62.9%	D-	0.67
0-499	0-49.9%	E	0.00

For information on current UF policies for assigning grade points, see:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx> (Undergrads)

<http://gradcatalog.ufl.edu/content.php?catoid=2&navoid=762#grades> (Graduate students)

### **Class policies that students MUST follow:**

**Attendance:** Your attendance and participation are a strong expectation, but if you are ill or an emergency occurs, contact your instructor PRIOR TO the scheduled class time. Participation credit can be earned in every class discussion. Requirements for class attendance and make-up exams, assignments and other work are consistent with university policies that can be found at: <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>.

**Preparation for class:** Please come to class prepared by reading all assigned readings and viewing all posted lectures. This can help you not only for this class but for your future semesters and your research as well.

**Late Assignments:** Assignments will NOT be accepted after the due date. If communicated ahead of time, late assignments may be considered with a late penalty of 25%.

**Makeup Quizzes:** Special permission is required ahead of time to accommodate makeup quizzes. This will be made possible only under reasonable circumstances but NOT for all requests.

**Expectations for laboratory and field trip behavior:** Please do not talk privately during the laboratory exercises or the field trip. Please do not multitask (i.e. doing work for other courses or research, using your computer, cell phone or other electronic devices for web surfing or email). Ask questions and be involved in the class.

**COVID Response Statements:**

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who unmute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

**Online Course Evaluation Process:**

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students 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/>. 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/\\_](https://ufl.bluera.com/ufl/_). Summaries of course evaluation results are available to students at: <https://gatorevals.aa.ufl.edu/public-results/>. Students will be given specific time in the class to fulfill this requirement.

**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>.

\*\* Please DO NOT borrow the writing of others – this is called Plagiarism. If you do not understand what this means, ask your instructor to clarify. If you are presenting others’ thoughts or writing including diagrams/pictures you must cite them. Instructors will do the same!

**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 as appropriate.

**Services for Students with Disabilities:**

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

0001 Reid Hall, 352-392-8565, <https://disability.ufl.edu/>

**Campus Helping Resources:**

Students experiencing crises or personal problems that interfere with their general wellbeing 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.

Health and Wellness

**U Matter, We Care:**

If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352-392-1575 so that a team member can reach out to the student. Dean of Students Office (CARE team)  
<https://care.dso.ufl.edu/>

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc> 352-392-1575

**Sexual Assault Recovery Services (SARS)** Student Health Care Center, 352-392-1161

**University Police Department** at 352-392-1111 (or 9-1-1 for emergencies), or  
<http://www.police.ufl.edu/>

## Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to [Learningsupport@ufl.edu](mailto:Learningsupport@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>

**Career Connections Center**, First Floor JWRU, 392-1601, <https://career.ufl.edu/>

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/>

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/>

### **Student Complaints**

Residential Course: <https://sccr.dso.ufl.edu/policies/student-honor-code-studentconduct-code/>

Online Course: <http://www.distance.ufl.edu/student-complaint-process>

### **University of Florida Complaints Policy**

The University of Florida believes strongly in the ability of students to express concerns regarding their experiences at the University. The University encourages its students who wish to file a written complaint to submit that complaint directly to the department that manages that policy.

A student who is unsure as to the official responsible for handling his or her particular complaint may contact the Ombuds office or the Dean of Students Office. For complaints that are not satisfactorily resolved at the department level or which seem to be broader than one department, students are encouraged to submit those complaints to one of the following locations: Ombuds: <http://www.ombuds.ufl.edu/> 31 Tigert Hall, 352-392-1308

The purpose of the Ombuds office is to assist students in resolving problems and conflicts that arise in the course of interacting with the University of Florida. By considering problems in an unbiased way, the Ombuds works to achieve a fair resolution and works to protect the rights of all parties involved. Dean of Students Office: <http://www.dso.ufl.edu/> 202 Peabody Hall, 352-392-1261

The Dean of Students Office works with students, faculty, and families to address a broad range of complaints either through directly assisting the student involved to resolve the issue, working with the student to contact the appropriate personnel, or referring the student to resources or offices that can directly address the issue. Follow up is provided to the student until the situation is resolved. Additionally, the University of Florida regulations provide a procedure for filing a formal grievance in Regulation 4.012: <http://regulations.ufl.edu/regulations/uf-4-student-affairs>