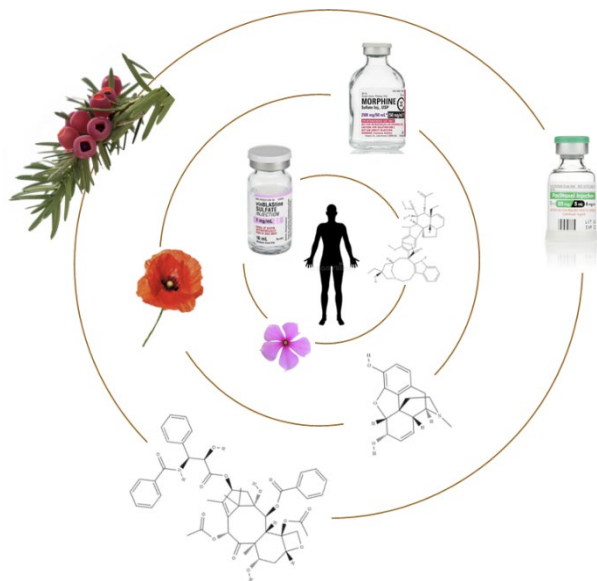


# PLANTS FOR HUMAN MEDICINE

## IDS 2935

### Quest 2

Primary General Education Designation: Biological Sciences



### Class Meetings

- Spring 2024
- Tue 10:40 – 11:30am; Thu 10:40 – 12:35am
- Location TBD

### Instructor

- **Dr. Satya Swathi Nadakuduti**, Ph.D.  
Assistant Professor in Environmental Horticulture
- Email: [s.nadakuduti@ufl.edu](mailto:s.nadakuduti@ufl.edu)
- Phone: 352-273-4575
- Office: 1519 Fifield Hall
- Office hours: Thu 2-4pm. Emailing for an appointment will ensure that there will be no waiting time.
- Teaching Assistant(s) TBA

### Course Description

Human beings and plants have had an intricate relationship since the beginning of joint evolutionary history. Besides being a food source, various cultures around the world used plants as natural health remedies for centuries intertwining plant science and human medicine. We now know that plants have much sophisticated biochemistry. We will learn about plants that provided drugs and essential modern medicines that help. Several modern medicines are either still powered by plants, or their bioactive compounds were first discovered in plants providing the stimulus and inspiration for synthetic drugs. Exploring plants for discovering new molecules, new drug leads and nutraceuticals is a fascinating area of research. In this class we will discover plants as nature's powerhouse of chemical diversity. In fighting some of humankind's deadliest medical conditions including cancers, heart diseases, and pain.

The class is centered around the question of "can we explore plants for human medicine to address current societal health problems?". Childhood leukemia is treated with vincristine and vinblastine drugs derived from Madagascar periwinkle plant, anti-chemotherapeutic drug taxol was first isolated from bark of pacific yew trees, opioids such as morphine and codeine are derived from opium poppy plants, etc., Several such discoveries have led to Nobel Prizes in Physiology or Medicine since they have impacted millions of lives across the globe. As the quest for new medicines for various human diseases continues, it's never been more urgent to understand the origins of chemical diversity of life on planet earth. We will discuss various pressing societal problems such as opioid crisis, pain management, mental health etc.,

major scientific developments involving plant science, pharmacology, chemistry, and medicine in a multidisciplinary way and their impacts on society.

## **Quest and General Education Credit**

- Quest 2
- Biological Sciences
- General Education
- Writing Requirement (WR) 2000 words

*This course accomplishes the Quest and General Education objectives of the subject areas listed above. A minimum grade of C is required for Quest and General Education credit. Courses intended to satisfy Quest and General Education requirements cannot be taken S-U.*

## **Required Readings and Works**

There are no required texts to be purchased, all required study material will be provided. Selected readings will be distributed in class or added on the course site in Canvas. Many of the assigned readings can be obtained on selected e-journal-based locations. Some of the suggested textbooks may be helpful for students, but not mandatory.

### **Writing manuals:**

1. Abrams, B (2021) Undergraduate's guide to writing in sciences. Boston University introduction to scientific writing and collecting authoritative sources page #s 1-8, 29-38, guidelines for delivering effective presentation: page# 95-100 (will be provided on canvas).
2. Turbek et al., (2016) The Bulletin of the Ecological Society of America: Scientific Writing Made Easy: A Step-by-Step Guide to Undergraduate Writing in the Biological Sciences.

### **Recommended Readings:**

Students will review lecture notes and relevant journal publications provided in the syllabus including papers for background reading and in-class activities. This list may be further updated depending on current literature relevant to the lecture topic. Further, the students will have to review additional literature to complete their chosen topic for self-reflection papers. Guidance will be provided in the classroom on how to perform literature search.

### **Textbooks:**

- 1) *Plants that cure: Plants as a source for Medicines, from Pharmaceuticals to herbal remedies* by Elizabeth A. Dauncey and Melanie-Jayne R. Howes, Princeton university press 2020.
- 2) Medicinal Natural Products, A biosynthetic approach by Paul M. Dewick, Online ISBN: 9780470742761; Print ISBN: 9780470741689. A pdf version of this textbook will be provided on canvas.

### **Journal publications:**

- 1) Natural products in drug discovery: advances and opportunities (2021) Nature Reviews 20:200-216.
- 2) Plant metabolism, the diverse chemistry set of the future (2016) Science vol 353 (6305): 1232-1236
- 3) Responding to the opioid crisis in North America and beyond: recommendations of the Stanford–Lancet Commission. Lancet 2022; 399: 555–604
- 4) The discovery of artemisinin and Nobel Prize in Physiology or Medicine Sci China Life Sci. 2015 Nov; 58(11): 1175–1179.
- 5) Natural Products for Drug Discovery in the 21st Century: Innovations for Novel Drug Discovery (2018) Int. J. Mol. Sci. 2018, 19, 1578; doi:10.3390/ijms19061578.

Materials and Supplies Fees: n/a

## II. Graded Work

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### Description of Graded Work

Assignment	Description of the Assignment	Additional Guidelines	Points
Weekly quizzes	A 10-question quiz will be given as an online poll in the first 10min of the class. Quizzes will consist mostly of multiple-choice questions or true or false questions. Each quiz will be worth 2.5 points, and there will be 10 quizzes during the semester. The objective of this assignment is to understand the concepts of plants and their chemical diversity, success stories of plant based therapeutic drug development for various human diseases.	Each quiz question will be given 1min to answer via online poll	25 points
Introductory Biography	Students submit a 300-word personal introductory biography to introduce themselves.	Required content includes self-introduction, background, interests, major, goals upon graduation, and what may help them succeed in this class	5 points
Think pair share	Give students time to think about One important reason why plants make diverse chemicals, turn to their neighbor for a short discussion and then share the results with the rest of the class.	Participation as a group	5 points
Class discussions	Comments always insightful & constructive; uses appropriate terminology. Comments balanced between general impressions, opinions & specific, thoughtful criticisms, or contributions.	Additional guidelines and grading rubrics will be provided via Canvas. Students should ask two or more questions per week to receive the credits.	5 points
Self-reflection paper I	Students will utilize what they learnt in class along with literature review on opioid crisis in various regions of the world to promote critical thinking on this topic of societal interest. *Commonly prescribed opioid medication and dosage *How does it work *What are the characteristics of these compounds that have addiction potential? *How topics are relevant to their intellectual, personal, and professional development.	Each student will prepare a 1000-word self-reflection report with a title reflecting global opioid crisis (12 font times new roman, 1-inch margins, double spaced). The report will consist of 1) Abstract - 1.0 point, 100 words 2) Introduction and hypothesis 2.5 points, 200 words 3) Literature review of 3 scientific articles to earn 5.0 points for a 600-word review 4) Conclusion 1.5 points, 100 words. Written assignments will count towards	10 points

		Writing Requirement using the rubric provided above.	
Video recording- Therapeutic horticulture	Plants help variety of vulnerable population with special needs to promote intellectual and sensory stimulation, stress reduction etc., Students visit the Wilmont gardens at UF and tour the gardens to identify at least three elements of the gardens that help with mind relaxation and therapy and record a short video describing these elements while in the garden.	The video must be 3min long and recorded by the student in the location mentioned. Rubric for this assignment includes: 1) Three elements identified and self-reflection as to how they promote stress reduction and sensory stimulation-5.0 points 2) Relevance of the video content to horticultural therapy and video quality-3.0 points 3) 3min video time-2.0 points	10 points
Self-reflection paper II	Global societal health issues - Role of plants. In modern societies across the globe, some of the most common human health issues revolve around plants. Plants could have been the reason for them to exist in some cases and plants are also the solution in some others. For a second self-reflection paper, students will choose to use one of the following societal health related topics to form an empirical argument or hypothesis in a written report and reflect their learning and thoughts through student-led flash talks in the classroom.	Each student will prepare a 1000-word term paper (12 font times new roman, 1-inch margins, double spaced with a title. The report will consist of 1) Abstract - 1.0 points, 100 words 2) Introduction and hypothesis 2.5 points, 200 words 3) Literature review of 3 scientific articles to earn 5.0 points for a 600-word review 4) Conclusion 1.5 points, 100 words. Written assignments will count towards Writing Requirement using the rubric provided above.	10 points
	<ul style="list-style-type: none"> <li>1) Tobacco dependence disease</li> <li>2) Obesity, a global epidemic - Can plants help?</li> <li>3) Nutraceuticals and herbal medicines - social and economic impacts</li> <li>4) Environmental quality impact on human health - role of plants</li> <li>5) Access to health care - plant-based medicine</li> </ul>	5-min flash talk. Rubric for flask talks include: 1) Comprehension and content, whether presentation provided an understanding of the background and significance to the topic – 5.0 points 2) engagement and communication, stage presence, eye contact and maintain audience’s attention – 3.0 points 3) PowerPoint slide clarity, legibility and conciseness-2.0 points.	10 points

MID-TERM EXAM	The mid-term exam will be given on the canvas website. Students must bring a laptop for the exam which will contain 20 multiple choice questions.	Students must bring a web- enabled device (laptop computer, tablet computer, phone) to take the exam. If there is an issue with attending the exam at this time, it should be discussed with the Dr. Nadakuduti at least one week before the exam.	10 points
FINAL EXAM	The FINAL exam will be given on the canvas website. Students must bring a laptop for the exam which will contain 20 multiple choice questions.	Students must bring a web- enabled device (laptop computer, tablet computer, phone) to take the exam. If there is an issue with attending the exam at this time, it should be discussed with the Dr. Nadakuduti at least one week before the exam.	10 points

## Grading Scale

For information on how UF assigns grade points, visit: <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

A	93 – 100%		C	74 – 76.99%
A-	90 – 92.99%		C-	70 – 73.99%
B+	87 – 89.99%		D+	67 – 69.99%
B	84 – 86.99%		D	64 – 66.99%
B-	80 – 83.99%		D-	60 – 63.99%
C+	77 – 79.99%		E	<60

## Grading Rubric(s)

### Writing Assessment Rubric and Statements

	SATISFACTORY (Y)	UNSATISFACTORY (N)
CONTENT	Papers exhibit at least some evidence of ideas that respond to the topic with complexity, critically evaluating and synthesizing sources, and provide at least an adequate discussion with basic understanding of sources.	Papers either include a central idea(s) that is unclear or off-topic or provide only minimal or inadequate discussion of ideas. Papers may also lack sufficient or appropriate sources.
ORGANIZATION AND COHERENCE	Documents and paragraphs exhibit at least some identifiable structure for topics, including a clear thesis statement but may require readers to work to follow progression of ideas.	Documents and paragraphs lack clearly identifiable organization, may lack any coherent sense of logic in associating and organizing ideas, and may also lack transitions and coherence to guide the reader.

<b>ARGUMENT AND SUPPORT</b>	Documents use persuasive and confident presentation of ideas, strongly supported with evidence. At the weak end of the Satisfactory range, documents may provide only generalized discussion of ideas or may provide adequate discussion but rely on weak support for arguments.	Documents make only weak generalizations, providing little or no support, as in summaries or narratives that fail to provide critical analysis.
<b>STYLE</b>	Documents use a writing style with word choice appropriate to the context, genre, and discipline. Sentences should display complexity and logical sentence structure. At a minimum, documents will display a less precise use of vocabulary and an uneven use of sentence structure or a writing style that occasionally veers away from word choice or tone appropriate to the context, genre, and discipline.	Documents rely on word usage that is inappropriate for the context, genre, or discipline. Sentences may be overly long or short with awkward construction. Documents may also use words incorrectly.
<b>MECHANICS</b>	Papers will feature correct or error-free presentation of ideas. At the weak end of the Satisfactory range, papers may contain some spelling, punctuation, or grammatical errors that remain unobtrusive, so they do not muddy the paper's argument or points.	Papers contain so many mechanical or grammatical errors that they impede the reader's understanding or severely undermine the writer's credibility.

- The Writing Requirement (WR) ensures students both maintain their fluency in writing and use writing as a tool to facilitate learning.
- The instructor will evaluate and provide feedback before the end of the course on all of the student's written assignments with respect to grammar, punctuation, clarity, coherence, and organization.
- WR course grades have two components. To receive writing requirement credit, a student must receive a grade of C or higher and a satisfactory completion of the writing component of the course.

### Participation Rubric

	<b>Excellent (5 points)</b>	<b>Good (4 points)</b>	<b>Average (3 points)</b>	<b>Insufficient (2 points)</b>	<b>Unsatisfactory (1-0 points)</b>
Knowledgeable: Shows evidence of having done the assigned work.					
Thoughtful: Evaluates carefully issues raised in assigned work.					
Considerate: Takes the perspective of others into account and listens attentively.					

### III. Annotated Weekly Schedule

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Week	Activity	Topic/ Assignment
<b>Week 1</b>	Topic	<b>Introductions and course overview; Why Study plants? Plants that transformed the world</b>
	Summary	First week we will introduce ourselves and familiarize with course structure, organization, and student learning objectives. Introduction to plants and human relationship; Recognize the importance of plants for food, fiber, fuel, and medicine
	Reading/works	Plants make our existence possible (Plants People Planet. 2021; New Phytologist 3:2–6)
	Assignment	Entry survey will be given to students on canvas. Submit <b>Introductory Biography</b>
<b>Week 2</b>	Topic	<b>Plant chemical diversity: new ways to use Nature sustainably in healthcare</b>
	Summary	We will learn about plant chemical diversity, why plants make diverse chemicals? How do they make them? What is plant primary and secondary/specialized metabolism
	Reading/works	State of the World's Plants and Fungi 2020 - KEW Royal Botanical Gardens report page# 40 - 49
		State of the World's Plants 2017 - KEW Royal Botanical Gardens report page# 24 - 31
	Assignment	<b>Think-pair-share. Weekly quiz#1</b>
<b>Week 3</b>	Topic	<b>Medicinal plants: Connecting plant biochemistry to human health</b>
	Summary	We will learn about various classes of plant secondary metabolites useful for human health and medicine. Examples of plants and drugs approved from them for pharmaceutical use.
	Reading/works	Critical Reviews in Food Science and Nutrition (2018) 60:5, 873-886,
	Assignment	<b>Weekly quiz#2</b>

<b>Week 4</b>	Topic	<b>Is it worth investigating medicinal plants used by world cultures and focus on Ethnobotany?</b>
		Students learn about the importance of Ethnobotany and history of medicinal plants in various cultures across the world. Case study of Artemisinin discovery from traditional Chinese Medicine pharmacopoeia and Youyou Tu's landmark work leading to artemisinin-based therapies against acute and severe malaria saving millions of lives.
	Reading/works	Plants that cure: Plants as a source for Medicines, from Pharmaceuticals to herbal remedies page#11-19
	Assignment	<b>Weekly quiz#3</b>
<b>Week 5</b>	Topic	<b>Opium: A dark classic in chemical neuroscience</b>
	Summary	Learn about opium poppy plant that produces dozens of opioids including morphine, codeine etc., which are responsible for medicinal properties including analgesic, antitussive effects. Learn about the science underlying the chemical compounds that belong to alkaloid class of plant specialized metabolites, their diversity and mechanism of action for pain management.
	Reading/works	DARK Classics in Chemical Neuroscience: Opium, a Historical Perspective (ACS Chem. Neurosci. (2018) 9: 2503–2518)
	Assignment	<b>Weekly quiz#4.</b> TED talk: Seeing Pain: New approach to diagnosing and treating nerve damage by Dr. Christopher McCurdy (13min) <a href="https://youtu.be/Aetg4kJie0o">https://youtu.be/Aetg4kJie0o</a> . Class discussion led by Dr. Swathi Nadakuduti/ <b>Dr. Christopher McCurdy from College of Pharmacy, UF</b>
<b>Week 6</b>	Topic	<b>Opioid crisis in the United States - what led to this crisis? Are there alternatives?</b>
	Summary	The current opioid crisis in the United States is one of the most devastating public health catastrophes of our time. We discuss the history of opioid crisis starting from Oxycontin related deaths, heroin market leading to addiction and illegal synthetic opioids. We also learn about the opioid origins from plants and their role. Research on alternatives to pain medication
	Reading/works	<a href="https://www.hsph.harvard.edu/news/features/what-led-to-the-opioid-crisis-and-how-to-fix-it/">https://www.hsph.harvard.edu/news/features/what-led-to-the-opioid-crisis-and-how-to-fix-it/</a>
		Responding to the opioid crisis in North America and beyond: recommendations of the Stanford–Lancet Commission. Lancet 2022; 399: 555–604
	Assignment	<b>Weekly quiz#5.</b> Self-reflection paper I



<b>Week 7</b>	Topic	<b>Brain and Mental Health - Can plants help in calming the nerves and alleviate depression?</b>
	Summary	Brain is central to chronic conditions such as mental illness, addiction, and movement disorders. According to National Institute of Health (NIH) depression is one of the most common mental disorders in the US, affecting nearly 7 percent of adults and 5 percent of children. It is two to four times more common in girls and women. We will learn what plant compounds that have been developed and being investigated for their therapeutic value in nervous system related disorders including Dementia and depression. <b>Special guest invitation from UF McKnight Brain Institute TBD</b>
	Reading/works	<a href="https://www.nih.gov/about-nih/what-we-do/nihe280a6turning-discovery-into-healthc2ae/healthy-mind">https://www.nih.gov/about-nih/what-we-do/nihe280a6turning-discovery-into-healthc2ae/healthy-mind</a>
	Assignment	<b>Weekly quiz#6.</b> Therapeutic Horticulture video recording
<b>Week 8</b>	Topic	<b>Chemotherapeutic drugs with plant origins - paths to new discoveries</b>
		Cancer has a major impact on society in the United States and across the world. Plants played a key role in drug discovery for cancers. Students learn about chemotherapeutic drugs discovered from plants focusing on the story of vincristine and vinblastine discovery from periwinkle and paclitaxel from pacific yew tree along with other plants under investigation. Students will appreciate that plants are the best chemists producing complex natural products that are difficult to synthesize in the lab and the significance of exploring chemical diversity in plants can lead to life saving drugs. <b>Special guest invitation from UF Health Cancer center TBD</b>
	Reading/works	<a href="https://www.cancer.gov/about-cancer/causes-prevention/patient-prevention-overview-pdq">https://www.cancer.gov/about-cancer/causes-prevention/patient-prevention-overview-pdq</a>
		Frontiers in Pharmacology (2020) 10:1614,
	Assignment	<b>Weekly quiz#7.</b> Self-reflection paper II
<b>Week 9</b>	Topic	<b>Heart health - discovery of cardiac glycosides from plants</b>
		Cardiovascular disease remains the leading cause of death in the United States, accounted for 928,741 deaths in the year 2020 according to American Heart Association. Students will learn about plants which are researched for chemicals to treat heart disease and focus on success story of foxglove plant that makes compounds present in prescription cardiac drug Digoxin. <b>Special guest invitation from UF Health Heart and Vascular care TBD</b>
	Reading/works	<a href="https://www.aaas.org/digitalis-flower-drug-poison">https://www.aaas.org/digitalis-flower-drug-poison</a>
		<a href="#">American Journal of Cardiovascular Drugs (2018) 18: 427–440</a>

		<b>MID TERM EXAM</b>
<b>Week 10</b>	Topic	<b>Biopharming' how can plants aid in manufacturing drugs?</b>
		Several pharmaceuticals are being produced in plants by advanced genetic engineering and synthetic biology techniques. Students will learn what means biopharming, introduction to genetic engineering and synthetic biology approaches, some advantages and concerns with biopharming, the federal regulatory agencies overseeing the approvals for biopharming.
	Reading/works	<a href="https://www.npr.org/sections/health-shots/2020/10/15/923210562/tobacco-plants-contribute-key-ingredient-for-covid-19-vaccine">https://www.npr.org/sections/health-shots/2020/10/15/923210562/tobacco-plants-contribute-key-ingredient-for-covid-19-vaccine</a>
		<a href="https://www.pbs.org/newshour/show/how-to-grow-an-ebola-vaccine-with-a-tobacco-plant">https://www.pbs.org/newshour/show/how-to-grow-an-ebola-vaccine-with-a-tobacco-plant</a>
	Assignment	Weekly quiz#8. Students in groups give oral presentations on case studies on some of the Biopharming companies in the US and across the world and what therapeutics are commercially produced in these firms.
<b>Week 11</b>	Topic	<b>Making medicine in alternative hosts</b>
		The bioactive compounds produced in plants may be in minute amounts and extraction procedures quite tedious and low yielding. Synthetic biology approaches are quite useful specially to speed up investigational new drug applications using alternative hosts such as cell lines or microorganisms. The covid-19 pandemic has highlighted the importance of having multiple parallel pathways for lead candidates to first human studies. We will discuss various examples and importance of synthetic biology approaches in medicinal plant research.
	Reading/works	Alternative hosts as the missing link for equitable therapeutic protein production. Nature Biotechnology (2021), 39: 401–407
	Assignment	Weekly quiz#9. Students continue in groups to give oral presentations on case studies on some of the Biopharming companies in the US and across the world and what therapeutics are commercially produced in these firms.
<b>Week 12</b>	Topic	<b>Gene editing CRISPR technology for medicinal plants - is editing medicinal plant genomes worthwhile?</b>
		Revolutionary genome editing technologies, especially CRISPR systems are being deployed in various crops for crop improvement, controlling pests and diseases and enhance the nutritional quality. We learn basics of CRISPR technologies and its applications in medicinal plants and in correcting human diseases.

	Reading/works	Guo et al. Chinese Medicine (2022) 17:33
	Assignment	<b>Field visit to UF ICBR Proteomics &amp; Mass Spectrometry Facility</b>
<b>Week 13</b>	Topic	<b>On-demand natural product systems? Use of plants in space for mental health and making medicine for space travelers</b>
		Plants are an essential cargo in space missions providing food, psychological benefit for crew members and finally to make medicine in future. We will explore plants as hosts for making therapeutic proteins and molecules that can be used as medicine for astronauts in space.
	Reading/works	<a href="https://themedicinemaker.com/manufacture/medicine-making-on-mars">https://themedicinemaker.com/manufacture/medicine-making-on-mars</a>
		<a href="https://www.discovermagazine.com/the-sciences/astronauts-get-sick-too-heres-the-tech-that-could-grow-medicine-on-mars">https://www.discovermagazine.com/the-sciences/astronauts-get-sick-too-heres-the-tech-that-could-grow-medicine-on-mars</a>
		<a href="https://www.labiotech.eu/in-depth/space-medicine-plants/">https://www.labiotech.eu/in-depth/space-medicine-plants/</a>
	Assignment	Weekly quiz#10
<b>Week 14</b>	Topic	<b>Commercial botanicals and herbal products - challenges in monitoring safety, quality, and regulation</b>
		Global use of herbal products and supplements has increased tremendously especially in the western world. Students will learn about some of the ways to authenticate these herbal products that are commercially available including the analytical chemistry methods and major challenges in monitoring safety and quality of over-the-counter botanicals. We will also discuss about the regulatory aspects in the US for herbal products and how their regulatory pipeline differs from other drugs.
	Reading/works	Leong et al. Chin Med (2020) 15:76
	Assignment	Self-reflection paper III - Reflection paper on how the course changed or did not change their perceptions of plants and relationship to human health and medicine - exit survey
<b>Week 15</b>	Topic	<b>Ethics surrounding medicinal plants from traditional medicinal pharmacopoeias across the world</b>
		The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is a supplementary agreement to the Convention on Biological Diversity (CBD). It provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources.

	Reading/works	<a href="https://www.cbd.int/abs/about/default.shtml/">https://www.cbd.int/abs/about/default.shtml/</a>
		<b>FINAL EXAM</b>

## IV. Student Learning Outcomes (SLOs)

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### **Quest 2:**

Quest 2 courses are grounded in the modes of inquiry and analysis characteristic of the social and/or biophysical sciences, Quest 2 courses invite students to address pressing questions facing human society and the planet—questions that outstrip the boundaries of any one discipline and that represent the kind of open-ended, complex issues they will face as critical, creative, and thoughtful adults navigating a complex and interconnected world.

### **General Education, Biological Sciences (B):**

Biological science courses provide instruction in the basic concepts, theories, and terms of the scientific method in the context of the life sciences. Courses focus on major scientific developments and their impacts on society, science and the environment, and the relevant processes that govern biological systems. Students will formulate empirically testable hypotheses derived from the study of living things, apply logical reasoning skills through scientific criticism and argument, and apply techniques of discovery and critical thinking to evaluate outcomes of experiments.

At the end of this course, students will be expected to have achieved the [Quest](#) and [General Education](#) learning outcomes as follows:

**Content:** Students demonstrate competence in the terminology, concepts, theories, and methodologies used within medicinal plants research, plant metabolites, especially medicinal compounds, and their classification. Discuss about important analytical chemistry and genetic tools used to analyze the botanical material and evaluate how rapid advancements in the field of medicinal plants research affects global social policies on plant utilization. Further, students will identify the significance of plants and contributions to modern human medicine and discuss critical societal health problems, their origins and current status. Student competencies will be assessed through quizzes, exams, group discussions.

**Critical Thinking:** Students carefully and logically analyze information from multiple perspectives and develop reasoned solutions to problems. Students critically analyze why plants make diverse chemicals that can be used by humans and share with the class. As a part of self-reflection papers, I and II students will analyze certain current societal health problems in collaboration to form an empirical argument or hypothesis for the reports. Assessments including think pair share, self-reflection papers are used to assess critical thinking.

**Communication:** Students communicate knowledge, ideas, and reasoning clearly and effectively in written and oral forms. Students use reflective writing assignments, collaborate in group discussions, and do oral presentations.

**Connection:** Students connect course content with meaningful critical reflection on their intellectual, personal, and professional development at UF and beyond. Students will make useful connections between natural product discovery from plants and human medicine. They will evaluate the importance of global plant exploration to identify novel compounds and drug leads.

**General Education SLOs:**

1. The general education objects will be accomplished through the identification and discussion of global health crisis scenarios including opioid crisis, heart diseases, mental health issues etc., to discuss role of plants and potential solutions from medicinal plants research to substantially improve human health.
2. Students will understand that traditional medicines used by various cultures across the globe involve variety of plants or plant extracts as remedies for various health issues. Traditional medicines and world pharmacopoeias have valuable information to explore plants to search to cure human diseases.
3. Weekly lectures, TED talks and assignments including discussions, self-reflection papers will help with critical thinking and analyses of health and societal problems and how plants may play a role in solving some of these.

**Student Learning Outcomes Assessment:**

Reflecting the curricular structures of Quest 2 and these Gen Ed designations, at the end of this course, students will be able to:

1. Define metabolism in plants, explain the basics of chemical diversity in plants and describe how humans have harnessed it (**Content SLOs for Q2, Gen Ed Bio, and International**).
2. Identify some modern drugs and their plant origins to reflect on the importance of global plant exploration for discovery of novel molecules (**Content SLOs for Q2, Gen Ed Bio, and International**).
3. Evaluate the importance of traditional medicines across the world and ethnobotany (study of how native people used plants) in developing modern medicine (**Connection SLOs for Q2, Gen Ed Bio, and International**).
4. Analyze certain critical global societal problems related to human health and explain the role of plants in solving them (**Critical thinking SLOs for Q2, Gen Ed Bio, and International**).
5. Explore plants as alternative sources for making medicine and therapeutic proteins (**Content SLOs for Q2, Gen Ed Bio, and International**).
6. Evaluate modern analytical chemistry and genetic tools that aid in medicinal plants research using science and experiential learning (**Content SLOs for Q2, Gen Ed Bio, and International**).
7. Explore ethics and policy in studying and utilizing plants affecting global society (**Critical thinking SLOs for Q2, Gen Ed Bio, and International**).
8. Cultivate positive group work environments capable of communication using oral and written skills (**Communication SLOs for Q2, Gen Ed Bio, and International**).
9. Explore application of plants as medicine through class lectures, self-reflection papers and discussions, looking to the future of medicines from plants (**Critical thinking SLOs for Q2, Gen Ed Bio, and International**).
10. Assignments including self-reflection paper I, self-reflection paper II, and Think-pair share (**Critical thinking, communication SLOs for Q2, Gen Ed Bio, and International**).

## V. Quest Learning Experiences

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### 1. Details of Experiential Learning Component

Video recording-Therapeutic horticulture: Students visit and tour the Wilmont gardens at UF to identify at least three elements of the gardens that help with mind relaxation and therapy and record a short video describing these elements while in the garden. Students will experience the garden features and realize that plants and nature in general can help with calming the nerves.

Field visit to UF ICBR Proteomics & Mass Spectrometry Facility: The students will have a guided tour of the analytical equipment that is used to identify plant metabolites and medicinal compounds that they will be exposed to in the class.

The in-class experiential learning will be in-class discussions on societal health problems.

### 2. Details of Self-Reflection Component

Students will complete a questionnaire at the beginning of the course that will gauge their knowledge and opinion on several issues in plants and relationships with human medicine. This will be later assessed towards the end of the course as a self-reflection exercise. Self-reflection writings and oral presentation are included. For example, students write self-reflection paper I on opioid crisis epidemic and self-reflection II semester project where students form groups to choose one of the given global societal health related topics to write a report as well as do an oral presentation in class.

## VI. Required Policies

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### Attendance Policy

Students are expected to attend every lecture and complete all assignments before the deadlines. Late assignments will be accepted after the due date with a 25% deduction per day and graded without penalty for documented emergencies as per UF's attendance 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: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

### Students Requiring Accommodation

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

### UF Evaluations Process

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

## **University Honesty Policy**

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 Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

## **Counseling and Wellness Center**

Contact information for the Counseling and Wellness Center: <http://www.counseling.ufl.edu/>, 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

## **The Writing Studio**

The writing studio is committed to helping University of Florida students meet their academic and professional goals by becoming better writers. Visit the writing studio online at <http://writing.ufl.edu/writing-studio/> or in 2215 Turlington Hall for one-on-one consultations and workshops.

## **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 Honor Code and Student Conduct Code.