

Hemp and Medical Cannabis

11:776:390 (3 credits)

Fall Semester (yearly)

CONTACT INFORMATION

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COURSE DESCRIPTION

The cannabis industry will be generating several billions of dollars in sales for the next years, with opportunities to employ half a million people. This course will introduce students to the world of this unique species, *Cannabis sativa*. The course will address the diversity of *C. sativa* varieties, including wild varieties and three important groups with remarkable economic products, including fiber, oilseeds, and psychoactive compounds. The course discusses the history and classification of *Cannabis* and its horticulture, focusing on primary production and post-harvest handling and processing technologies, chemistry (e.g., THC, CBD, fatty acids, fiber content, adulteration), quality (safety and efficacy), legal and regulatory issues, and agricultural commercialization of new *Cannabis* crops.

COURSE WEBSITE, RESOURCES AND MATERIALS

- Course website: Canvas
- Additional resources: all readings, including scientific papers, books and book chapters, news and media stories, online video, podcasts, etc., complement lectures and are required. These will be posted to Canvas or placed on reserve at Chang Library.
- Supplemental resources include:
Cherney, J.H. and E. Small. 2016. Industrial hemp in North America: Production, politics and potential. *Agronomy* 6(4), 58. <https://doi.org/10.3390/agronomy6040058>
Clarke, R. C., Merlin, M. D. 2014. *Cannabis Evolution and Ethnobotany*. Berkeley, California: University of California Press. ISBN-13: 978-0520292482

Kaiser, C., C. Cassady and M. Ernst. 2015. Industrial Hemp Production. University of Kentucky, College of Agriculture, Food and Environment, and Cooperative Extension Service.

<http://www.uky.edu/ccd/sites/www.uky.edu.ccd/files/hempproduction.pdf>

Kentucky Department of Agriculture. 2018. Industrial Hemp Research Pilot Program, Summary of Varieties: Including Varieties of Concern and Prohibited Varieties. Kentucky Department of Agriculture, Frankfort, KY. http://www.kyagr.com/marketing/documents/HEMP_LH_Summary_of_Varieties_List_2019.pdf

Roth, G., J. Harper, H. Manzo, A. Collins, and L. Kime. 2018. Industrial Hemp Production. Agricultural Alternatives. The Pennsylvania State University and Penn State Extension.

Small, E. 2016. Cannabis: A Complete Guide, 1st ed. CRC Press. ISBN-13: 978-1498761635

PREREQUISITES

01:119:115 General Biology or equivalent AND 11:776:242 Plant Science OR 11:776:221 Introduction to Horticulture

COURSE LEARNING GOALS (link to Plant Biology Undergraduate Program Goals:

<http://plantbiology.rutgers.edu/undergrad/plantbiology/>)

By the end of this course, the student will be able to:

1. Develop a thorough understanding of the history, uses, botany, chemistry, and horticultural aspects of *Cannabis* species (addresses program goal 1, technical proficiency)
2. Study the economic value of growing, producing, and processing *Cannabis* species and commercializing their products (addresses program goal 2, context)
3. Examine and describe regulatory and legal issues associated with growing and producing medical *Cannabis* (addresses program goals 2, context; 3, communication)
4. Critically examine the scientific literature and regulations associated with *Cannabis* and communicate scientific knowledge to others (addresses program goal 4)

ASSIGNMENTS/RESPONSIBILITIES & ASSESSMENT

Grading (100 points):

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|--|-----------|
| • In-class exams (3 at 25 points each) | 75 points |
| • Project 1: Scientific review | 10 points |
| • Project 2: Policy review | 15 points |

Exams will include lecture material and assigned readings.

Independent projects (two): These represent independent work and Turnitin will be used to assess text for plagiarism. Points will be taken off for misspellings, wrongly formatted text, sloppiness, and similar mistakes, and all plagiarism will be reported to the Dean.

- Project 1 (10 points): Students will present a critical analysis (not a summary) of a scientific review paper shared with the class.
- Project 2 (15 points): Students will present a critical analysis (not a summary) of a public policy paper shared with the class. The analysis will include comparative scientific studies (with citations) that form the basis of the narrative.

Significant and constructive participation in class discussions may enhance grades. Grades are A ($\geq 91\%$); B+ (85-90%); B (80-84%); C (70-79%); D (60-69%). Grades will be posted online so that students can monitor their progress in the class.

Learning goals assessment: Specific questions on exams and review of independent projects will be used to assess student knowledge of all course learning goals, from technical proficiency (course learning goal 1), context (course learning goal 2), and communication of current issues and demonstration of critical thinking (course learning goals 3 and 4). The percentage score on these assessments will determine the level of mastery: $>90\%$ outstanding; 80-89% good; 70-79% satisfactory; $<69\%$ unsatisfactory.

PARTICIPATION GRADE AND ABSENCE POLICY

Attendance is mandatory. Laptops are welcome for note-taking, but internet surfing is not permitted. Students unable to attend may contact the instructor via e-mail prior to the missed class or may use the University absence reporting website (<https://sims.rutgers.edu/ssra/>) to indicate the date and reason for the absence. An e-mail is automatically sent to the instructor.

COURSE SCHEDULE

Week	Topic	Lecture
1	Hemp and Cannabis: An Introduction and Historical Perspective	Lecture 1: Introduction to the course and expectations Lecture 2: Global history of cannabis and hemp
2	Botany of Cannabis	Lecture 3: Botany of <i>Cannabis</i> species – leaves, flowers, seeds, and stalks Lecture 4: The ecological amplitude of <i>Cannabis</i>
3	Biology and Phytochemistry of Cannabis and Hemp	Lectures 5 and 6: Structural diversity of cannabinoids and their associated biochemical pathways, bioactivities, and adverse effects
4	Hemp Products	Lecture 7: Natural products of hemp: polyphenols, fatty acids and hemp oil Lecture 8: Hemp as a source of fiber
5	CBD Oil	Lecture 9: CBD Oil Exam I
6	Genetics and Plant Breeding	Lecture 10: Genetics and breeding of <i>Cannabis</i> and hemp Deadline: Project 1 due
7	Agronomic and Horticultural Aspects of Production	Lecture 11: Growth and development of hemp Lecture 12: Agronomic and horticultural production of hemp – from direct seeding or transplanting to seed production
8	Postharvest and Processing Technologies	Lecture 13: Harvesting and postharvest handling of hemp fiber, seeds, oil, and CBDs Lecture 14: Extraction and processing systems for hemp and CBDs
9	Quality Control	Lecture 15: Botanical authentication including microscopy and imaging and adulteration; proximate analysis: moisture, ashes, total phenolics, proteins, crude fats, nutrient composition, fiber content, and assessing overall raw botanical product Lecture 16: Concerns relative to microbiological and pesticide contamination

Week	Topic	Lecture
10	Quality Control (cont.)	Exam II Lecture 17: Use of chromatography (GC/MS and HPLC/MS) and other approaches for compound identification: from simple to complex
11	Agricultural Commercialization of Hemp as a New Crop	Lecture 18: Case studies and research on hemp production Lecture 19: Applications and commercial products of hemp as a source of raw material to value-added products
12	Agricultural Commercialization of CBDs	Lecture 20: Case studies and research of CBD production Lecture 21: Applications of CBD and commercial products
13	Safety and Efficacy	Lecture 22: Reports and research on the benefits and adverse effects of <i>Cannabis</i> for hemp and CBDs Deadline: Project 2 due Thanksgiving recess
14	Safety and Efficacy (cont.) Laws and Regulations	Lecture 23: CBD vs. THC: Pharmacognosy, medical benefits, adverse reports, drug testing, and issues from science to politics Lecture 24: Legal and regulatory status on hemp, CBD, and marijuana
Final exam (Exam III, not cumulative, date to be determined)		

FINAL EXAM/PAPER DATE AND TIME

The final exam (Exam III) is not cumulative and covers that last third of the course. The Online Final exam Schedule: <http://finalexams.rutgers.edu/>

ACCOMODATIONS FOR STUDENTS WITH DISABILITIES

Please follow the procedures outlined at <https://ods.rutgers.edu/students/registration-form>. Full policies and procedures are at <https://ods.rutgers.edu/>

ACADEMIC INTEGRITY

The university's policy on Academic Integrity is available at <http://academicintegrity.rutgers.edu>

The principles of academic integrity require that a student:

- Properly acknowledge and cite all use of the ideas, results, or words of others.
- Properly acknowledge all contributors to a given piece of work.
- Make sure that all work submitted as his or her own in a course or other academic activity is produced without the aid of impermissible materials or impermissible collaboration.
- Obtain all data or results by ethical means and report them accurately without suppressing any results inconsistent with his or her interpretation or conclusions.
- Treat all other students in an ethical manner, respecting their integrity and right to pursue their educational goals without interference. This requires that a student neither facilitate academic dishonesty by others nor obstruct their academic progress.
- Uphold the canons of the ethical or professional code of the profession for which he or she is preparing.

Adherence to these principles is necessary in order to ensure that:

- Everyone is given proper credit for his or her ideas, words, results, and other scholarly accomplishments.
- All student work is fairly evaluated and no student has an inappropriate advantage over others.

- The academic and ethical development of all students is fostered.
- The reputation of the University for integrity in its teaching, research, and scholarship is maintained and enhanced.

Failure to uphold these principles of academic integrity threatens both the reputation of the University and the value of the degrees awarded to its students. Every member of the University community therefore bears a responsibility for ensuring that the highest standards of academic integrity are upheld.

STUDENT WELLNESS SERVICES

Just In Case Web App <http://codu.co/cee05e>

Access helpful mental health information and resources for yourself or a friend in a mental health crisis on your smartphone or tablet and easily contact CAPS or RUPD.

Counseling, ADAP & Psychiatric Services (CAPS)

(848) 932-7884 / 17 Senior Street, New Brunswick, NJ 08901 / www.rhscaps.rutgers.edu/

CAPS is a University mental health support service that includes counseling, alcohol and other drug assistance, and psychiatric services staffed by a team of professional within Rutgers Health services to support students' efforts to succeed at Rutgers University. CAPS offers a variety of services that include: individual therapy, group therapy and workshops, crisis intervention, referral to specialists in the community and consultation and collaboration with campus partners.

Violence Prevention & Victim Assistance (VPVA)

(848) 932-1181 / 3 Bartlett Street, New Brunswick, NJ 08901 / www.vpva.rutgers.edu/

The Office for Violence Prevention and Victim Assistance provides confidential crisis intervention, counseling and advocacy for victims of sexual and relationship violence and stalking to students, staff and faculty. To reach staff during office hours when the university is open or to reach an advocate after hours, call 848-932-1181.

Disability Services

(848) 445-6800 / Lucy Stone Hall, Suite A145, Livingston Campus, 54 Joyce Kilmer Avenue, Piscataway, NJ 08854 / <https://ods.rutgers.edu/>

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: <https://ods.rutgers.edu/students/documentation-guidelines>. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: <https://ods.rutgers.edu/students/registration-form>.

Scarlet Listeners

(732) 247-5555 / <http://www.scarletlisteners.com/>

Free and confidential peer counseling and referral hotline, providing a comforting and supportive safe space.