Chemistry 293: Chemistry of Cannabis

Instructor: Dr. Kelly Drew
Office/office hrs: Murie 223F, MWF 10-12:00
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Lecture: TR, 11:30-1:00, REIC 204

Homework: Assignments posted on course schedule as **HW** *are due at the beginning of the next class* unless otherwise indicated. **Late HW is not accepted.**
Homework and reading assignments (other than from the text book) will be posted on blackboard

Home-work make-up: Attend biochemistry or neuroscience seminars. A write-up about a seminar will substitute for one HW assignment (peer-reviews of selected articles). Up to 3 HW assignments can be substituted by a seminar write-up. https://neuroscience.nih.gov/neuroseries/Home.aspx

Course Description: Cannabis is a complex plant, with psychoactive components such as delta-9-tetrahydrocannabinol and nonpsychoactive components such as cannabidiol with promising biomedical efficacy. Cannabis presents unique physiochemical properties that influences the pharmacology of this natural product with implications for legal, social and commercial challenges.

This class will provide basic understanding of the chemistry and pharmacology of cannabis and prepare the student to understand peer-reviewed literature and consider social, legal and commercial questions within the context of chemical principles. Basic concepts introduced in lectures will be applied through guided discussion of original research papers. Students will learn to summarize and present scientific content for a non-science audience.
1. review of basic chem and ochem
2. application of principles to cannabis
3. peer-reviewed literature - searching, reading, discussing, presenting
4. discussion with experts working in cannabis legislation, regulation, compliance (legal) and testing.

Prerequisite: Chem 105/106

Course Goal This class will provide basic understanding of the chemistry and pharmacology of cannabis and prepare the student to understand peer-reviewed literature and consider social, legal and commercial questions within the context of chemical principles. Basic concepts introduced in lectures will be applied through guided discussion of original research papers. Students will learn to summarize and present scientific content for a non-science audience.

Course objectives Lectures, exams and quizzes will focus on the following objectives

- Be able to discuss the difference between natural products (phytocannabinoids) and synthetically produced cannabinoids with the same or modified structure (e.g., (-)
- Know the basic chemistry and pharmacology of cannabis including psychoactive and non-psychoactive constituents.
- Know the neurochemical pathways and functions associated with the endogenous cannabinoid system (endocannabinoids)
- Recognize structure activity relationships and structural similarities between endogenous cannabinoids and active ingredients in cannabis (eg., THC and CBD)
- Understand peer-reviewed literature regarding medical applications and side-effects of cannabis.
- Understand analytical chemistry techniques used for cannabis testing and research
- Understand the pharmacokinetics of THC and the effect of pharmacokinetics on assessment of impairment and DUI.
- Understand the laws regulating the cannabis industry in Alaska and critically evaluate these laws and regulatory processes in the context of chemical principles.

(Homework) Students will be guided by the instructor through critical evaluation of peer-reviewed papers to achieve the following objectives:

- Know how to decipher a scientific paper
- Know how to interpret data presented in formats typical of scientific papers
- Know how to critically evaluate experimental design, graphical representation of data and conclusions drawn from data shown and defend one's own interpretation of the data.

- Know how to write or present an oral summary for the general public of technical information related to the chemistry of cannabis.

(Presentations) Students will be guided through oral presentations of original research towards the following objectives:

- Become familiar with data bases and original literature related to cannabis
- Practice effective techniques for oral presentation of original research
- Know how to critically assess claims of efficacy and to discuss aspects of rigor and reproducibility of research (peer and non-peer reviewed) to identify areas in need of further research.

Text: Cannabinoids and the Brain, Linda Parker, MIT Press, ISBN-13: 9780262035798

Other Required Reading: ACS webinars Cannabis Chemistry 101, Cannabis Chemistry 201
Original research and review articles to be assigned

Homework, Exams and Grading: Exams and quizzes will typically consist of a subset of review questions provided in class. See schedule for when homework is due. Permission to hand-in HW via e-mail may be arranged in advance and will not be accepted without prior arrangements. **Late homework will not be accepted** unless arrangements are made before the homework is late. There will be no make-up exams or quizzes except under **extreme** circumstances. If such circumstances arise notify Dr. Drew (474-7190) **before** the scheduled time of the exam. If a make-up exam is approved it must be completed within 1 week of the original exam. Any student suspected by the instructor of cheating on a quiz or exam may be assigned a course grade of F; course drop forms will not be signed in these cases. **The letter grades assigned will be based on the overall performance of the class** but will usually be in the range 90-100=A, 80-90=B, 70-79=C, 60-69=D, and below 60 is failing.

Course Policies I expect students to attend class and participate in discussions and to abide by good academic integrity https://academicintegrity.org/fundamental-values/; https://en.wikipedia.org/wiki/Academic_integrity

Disabilities: Students with a physical or learning disability are required to identify themselves by calling or visiting the Disability Services office. The student must provide documentation of the disability. I will work with the office of Disabilities Services (208 WHITAKER BLDG, 474-5655) to provide reasonable accommodation to students with disabilities.

Assignments for Chemistry 293

3 Exams (100 pts ea.)	300 pts
3 Quizzes	75 pts
Presentations of original research papers	100 pts
Comprehensive final exam	100 pts
Homework (10 pts ea.)	~200 pts
Attendance for guest speakers (10 pts ea.)	~40 pts

Topic		Reading Assignments	guest speakers
Chemical composition of cannabis Basic chemistry-structures lipids	Jan 15	https://www.nature.com/articles/525S1a, including link to Page S2 Recommended for Chemistry Majors: https://www.ncbi.nlm.nih.gov/pubmed/?term=enantio-selective+separation+of+phytocannabinoids	
Structures in cannabis-reading a label Physical properties Principle of CO2 extraction	Jan 17		
Pharmacology of THC Basic Pharmacology (Dose Response, GPCR-agonist, antagonist, partial agonist, inverse agonist)	Jan 22	https://www.nature.com/articles/525S1a, read Page S6-Drug development: The treasure chest and S4-Botany: The cultivation of weed	
Literature on the pharmacology of THC Peer-review Rigor and reproducibility GLP	Jan 24		
Pharmacology of CBD and terpenes found in cannabis – Basic pharmacology of proposed mechanisms of action Quiz 1	Jan 29	Taming THC: potential cannabis synergy and phytocannabinoid-terpenoid entourage effects https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3165946/pdf/bph0163-1344.pdf	
Analytical Techniques in the cannabis industry-Definitions; Read Trends in Cannabis Analysis	Jan 31	Google-Chromatography Techniques, Dispersive Solid-Phase Extraction (DSPE), Edibles, Gas Chromatography (GC), GC–MS, ICP-MS, ICP-OES, LC–MS, QuEChERS, Sample Preparation, Solid-Phase Microextraction (SPME), http://www.cannabissciencetech.com/tetrahydrocannabinol-thc	
Exam 1	Feb 5	1	
Analytical techniques and standards in the cannabis industry	Feb 7		Tom Green
Presentations	Feb 12		
NCIA-Testing Policy	Feb 14		Jedediah Smith (15-30min)
Handlers permit Alaska's medical marijuana laws, Ballot Measure 2, all of the state wide regulations (Ch 306) https://www.handlealaska.com/events	Feb 19		

Handlers permit-continued Quiz 2	Feb 21		
Legislation of cannabis in Alaska, Role of the MCB and industry perspectives	Feb 26	Alaska's medical marijuana laws, Ballot Measure 2, all of the state wide regulations (Ch 306), the effects of marijuana consumption, how to identify an impaired individual, how to distinguish valid forms of government issued IDs, how to intervene and prevent unlawful consumption, and the penalties for any unlawful acts.	Brandon Emmett
Pharmacokinetics of THC and DUI	Feb 28		
Neurochemistry of endocannabinoids	Mar 5		
Federal Legislation in US and Canada	Mar 7		
Spring break	Mar 11-15		
Legislation affecting medical research and growth of cannabis industry	Mar 19	The legal status of cannabis (marijuana) and cannabidiol (CBD) under U.S. law. https://www.ncbi.nlm.nih.gov/pubmed/28169144	Jana Weltzin
Exam 2- ask about medical topics of interest	Mar 21	2	
Medicinal properties of cannabis –Select topics of interest integrated with peer-reviewed and other evidence Peer-review Steps in Drug Development GLP GMP	Mar 26		
Medicinal properties of cannabis-literature review Quiz 3	Mar 28		
Presentations	Apr 2		
Exam 3	Apr 4	3	
Business perspectives on cannabis in AK	Apr 8		Paul Gitschel
Presentations	Apr 11		
Natural Products – business perspective	Apr 16		Tom Kuhn
Economics of the cannabis industry-aspects of taxation	Apr 18		Joe Little
Presentations	Apr 23		
Final Exam	Apr 25		