

CHEM 496 Rome Italy, Intersession 2023

Biochemistry, Physiology & Neurochemistry of Alcohol, Beer & Wine

University of San Diego Chemistry and Biochemistry

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Required Text: Science of Cooking. Understanding the Biology and Chemistry Behind Food and Cooking. ISBN: 978-1-118-67420-8

Supporting website: Class website is linked from <http://home.sandiego.edu/~josephprovost/> Go to this website for all class information, lecture handouts, important links and updates.

Course Description: We will cover the biochemistry, physiology and neurochemistry of alcohol metabolism, alcohol addiction, the production and analysis, of liquor, beer and wine. The course will examine historical issues in beer wine and alcohol and will include a trip to Florence. Sites in Rome and Florence will provide a wider perspective of development of wine and other alcoholic drinks in Italy and around the world. We will include a focus on the unique differences of pre-roman wine to modern viniculture. The course will also cover the genetic of grapes grown in the region as well as the unique genetics of three human genes involved in alcohol addiction identified and localized to Florence. While not a laboratory course, we will include a trip to a winery to tour the science of growing grapes and the production of wine. The course and tour will also nicely tie into Rome as we will include the historical impact of the Medici's on wine production and their use in delivering poisons to political rivals. Florence still has over 100 "wine windows" historically used to limit the spread of the plague. We will also coordinate a meal where students research the chemistry of the food prior to and relate the pairing of the meal with the wine using a modern cuisine scientific approach.

Student Learning Objectives: The goal of this course is to improve your understanding of the scientific principles of metabolism, biomolecule structure function, the production and analysis of alcohol and the impact on body and mind. Students will use methods of chemistry and biochemistry to better understand the importance of science in the effects of liquor on the human body. To achieve these goals, students will learn the concepts and principles of macromolecular molecules and their reactions as they learn about each topic. Students are expected to lead journal article discussions to examine the roles of alcohol on human physiology and neurochemistry.

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

1. Understand the basic biochemistry of fermentation and role oxygen plays on microorganism output
2. Describe the unique chemistry of different types of alcohol and how they are made
3. Know the biochemistry of flavors of alcohols and how they are perceived in food pairing
4. Appreciate the use of alcohol in different cultures both historical and modern times
5. Assess the impact of alcohol on human physiology, toxicology and repair
6. Identify some of the genetic causes of alcoholism and addiction
7. Discuss the basic neurosignaling of reward and addiction using a biochemical approach
8. Outline the result of alcohol addiction on physiology and neurobiology
9. Discuss and predict novel molecular approaches to alcohol addiction and withdrawal.

Grading:

- Four exams.	4 x 100 pts = 400 pts
- In Class Discussions	4 x 5 pts = 20 pts
- Journal Club	<u>30 pts = 30 pts</u>
	TOTAL = 450 pts

Attendance Policy: Attendance is required; it is critical for. There are a number of in-class activities and quizzes that cannot and will not be made up.

Class	Date	Activity	Assignments/Notes
1	Thurs Jan 5	BLOCK I - Introduction to macromolecules: proteins, carbohydrates, yeast biology, yeast metabolism, and fusel chain alcohols	Handout, Chpt, Fund of Biochem, Wiki Yeast
2	Fri Jan 6	Fermenting and finishing wine, wine types, chemical properties of wine and chemistry of wine aging	Handout, Fund of Biochem
3	Mon Jan 9	Topics discussion - <i>Groups 1&2 present journal article</i> - <i>Group work on learning objectives</i>	Handout, Fund of Biochem
4	Tues Jan 10	Exam 1 BLOCK II - Fermentation of Beer, starting products, chemistry of processing	Text chapter 8 and handout and select journal articles
5	Wed Jan 11	Hopps and oils, and reactions of beer aging, Genetics of microbes used for beer Distillation and introduction to hard liquors Chemistry and flavor profiles of tequila, whiskey and rum.	ACS Handout – the history of and chemistry of alcohols
6	Thurs Jan 12	Topics discussion - <i>Groups 3&4 present journal article</i> - <i>Group work on learning objectives</i>	ACS Handout – the history of and chemistry of alcohols
7	Fri Jan 13	Exam 2 BLOCK III - How are ethanol and other alcohols metabolized in the body, alcohol-drug interactions and alcohol poisoning.	Linked Journal Articles and ACS Handout
8	Mon Jan 16	Physiology and genetics of alcohol metabolism, flushing syndrome and NAD dependent aldehyde dehydrogenase. Effect of chronic alcohol intake on nutrition and damage to various organs.	Linked Journal Articles
9	Tues Jan 17	Topics discussion - <i>Groups 5&6 present journal article</i> - <i>Group work on learning objectives</i>	Linked Journal Articles
10	Fri Jan 18	Exam 3 BLOCK IV - The neurobiology of signaling and addiction Ethanol as a positive reinforcer, dopamine and opiate signaling	Neuroscience and Linked Journal Articles
11	Mon Jan 19	Neurochemical mechanisms of alcohol use disorder, withdrawal Biochemistry of treatments for alcohol addiction	neurobiology of AUD
12	Tues Jan 20	Topics discussion - <i>Groups 7&8 present journal article</i> - <i>Group work on learning objectives</i> Online Exam 4	