The Chemistry of Wine (Chemistry 0821)
The Spring of 2020
A General Education Class for the College of Science and Technology

Instructor: Jaskiran Kaur, Ph. D. Jaskiran.kaur@temple.edu
Lecture: Tuesdays & Thursdays; 3:30-4:50 PM in Beury 166
Lab / Recitation instructor: Christopher Absil (tukg9237@temple.edu)
  Mondays (3:00-3:50 PM; 119Beury)
  Tuesdays (10:00-10:50 AM; 119Beury)
  Wednesday (10:00-10:50 AM; 121Beury)
  Wednesday (1:00-1:50 PM; 119Beury)
  Thursday (2:00-2:50 PM; 119Beury)

Office hours: Jaskiran Kaur (426b Beury): Mondays, Tuesdays and Wednesdays, 10am - noon and by appointment. Christopher Absil: Wednesdays 2pm – 3pm and by appointment

Description: Wine has occupied a central role in human culture. In our exploration of the science of wine we will learn why wine was the beverage of choice through the ages, why a bottle of wine can range from $2 to $2,000, how wine is made, what makes a good/bad wine, how is white different from red, and how we know what is in a bottle of wine. The course involves with a large scale fermentation of red and/or white wine and will continue with team-based hands-on exercises that provide students with the tools and opportunities to analyze the process of turning grape juice into wine. Many aspects of the production and consumption of wine will be addressed in this course. Students will also gain exposure to peer-reviewed literature review in the context of researching wine topics that extend beyond chemistry and into the everyday lives of students and wine enthusiasts. NOTE: This course fulfills a Science & Technology (GS) requirement for students under GenEd and the Science & Technology Second Level (SB) requirement for students under Core. Most lectures are accompanied with demonstrations to illustrate practical applications of the topics being discussed. A lot of concepts will be reinforced in laboratory activities during the recitation sessions.

Learning Goals: Students will learn...
- The basics of the wine-making process while learning about what an experimental variable is and how one would optimize the process to achieve different kinds of wines. This will include how nature's molecules relate to the color, taste, smell, feel, and preservation of wine.
- How to assemble a research presentation on a topic based on peer-reviewed academic literature searches instead of generic internet searches.
- The application of the scientific method and how it relates to the peer-review process in the context of the publishing on academic articles.
- The basics of chemical structure and classification, including the recognition and differentiation of salts, sugars, acids, carbohydrates, fats, and alcohols.
- Why some chemicals mix (e.g. water and salt) and why some will not (e.g. oil and water) and then how this applies to the buoyancy of a liquid (wine), purification of water, and cell & protein structure & function.
### Spring 2020 Semester Overview

<table>
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<tr>
<th>Dates</th>
<th>Topics</th>
<th>Important events</th>
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<tbody>
<tr>
<td>Jan 14th &amp; 16th</td>
<td>Syllabus; The Practical Process of Wine Making; How Chemists Emulate Nature</td>
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<td>Jan 21st &amp; 23rd</td>
<td>Introduction to the periodic table; Chemical Bonding; Chemical Structure</td>
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<td>Jan 28th &amp; 30th</td>
<td>Density, Buoyancy, Specific Gravity, and the Sweetness/Dryness of Wine</td>
<td>January 27th is the last day to add/drop a course</td>
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<td>Feb 4th &amp; 6th</td>
<td>Understanding Chemical Symbols; Which Molecular Pieces Affect Wine and in what Specific Ways</td>
<td>LAB: Density</td>
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<td>Feb 11th &amp; 13th</td>
<td>The (History of) Chemistry of Fermentation; The Law of Conservation of Mass; What is a Carbohydrate?; Glycolysis: Demonstrating that Science is Much More Complicated Than This Course.</td>
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<td>Feb 25th &amp; 27th</td>
<td>The Many Impacts of Acidity (pH) on Wine; Malolactic Fermentation; Equilibrium</td>
<td>LAB: Fermentation I</td>
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<td>Mar 3rd &amp; 5th</td>
<td>No Class</td>
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<td>Mar 10th &amp; 12th</td>
<td>The Oxidation of Chemicals in Wine</td>
<td>LAB: Fermentation II</td>
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<td>Mar 17th &amp; 19th</td>
<td>Energy is Everything: Thermodynamics &amp; Kinetics of Wine; The Many forms of Energy; Qualitative vs. Quantitative; The Relationship Between Stability, Energy, and Reactivity</td>
<td>Mar 17th is the last day to withdraw from a course!</td>
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<td>Mar 31st &amp; 2nd</td>
<td>How Chemists Know Which Molecules are in Wine: Spectroscopy</td>
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<td>Apr 7th &amp; 9th</td>
<td>CSI: Napa Valley: How Enologists Know How Molecules in Wine Taste and/or Smell</td>
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<td>Apr 14th &amp; 16th</td>
<td>Student Presentations</td>
<td>LAB: Chromatography</td>
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<td>Apr 21st &amp; 23rd</td>
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<td>Final Exam Q &amp; A Apr 25</td>
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<td>Date TBA</td>
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**Final Exam**
Course materials: please buy a stapler if you don’t own one.
1) Assorted readings that will be made available for you on Canvas
2) TOP HAT membership—you will receive an email with instructions to follow.
3) “Wine Science” by Ronald S. Jackson, Ph. D. ISBN: 978-0-12-373646-8
4) “Chemical Principles” (3rd Edition) By Richard E. Dickerson, Harry B. Gray, and Gilbert P. Haight
   Available for free from Caltech: http://authors.library.caltech.edu/25050/
   (Extra Credit Reading Assignment)

Grading: Your course grade will be based on your performance on:
in-class questions (TOP HAT).................................................................(50 points)
Recitation & Lab participation (including pre-labs)..............................................(300 points)
1 team presentation (see the list of possible topics below).................................(150 points)
2 midterm examinations..................................................................................(250 points)
a final examination...........................................................................................(250 points)
There will also be...
Extra credit opportunities: Designing a Temple wine label (25 points), Book Discussion of “The Emperor of Scent” by Chandler Burr (25 pts)

Grading cutoffs: The worst grade you can earn with the following course percentages are as follows:
100%-90% (A-); 89%-80% (B-); 79%-70% (C-); 69%-60% (D); <60% (F).

Team Presentation Topics:

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<th>1. Effects of alcohol on the brain</th>
<th>13. Corked wine</th>
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<td>2. Effects of alcohol on sleep.</td>
<td>14. Plastic vs. cork vs. screw top</td>
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<td>3. Terroir – Soil</td>
<td>15. Champagne</td>
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<td>4. Determining alcohol content</td>
<td>16. Clear vs. Colored bottles; Why so many green bottles?</td>
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<td>5. When you are under the influence</td>
<td>17. Wine and cardiovascular disease</td>
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<td>6. Fortified wines</td>
<td>18. Does eating before/while drinking affect blood alcohol levels?</td>
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<td>8. Counterfeit wines</td>
<td>20. Yeast strains vs. wine quality</td>
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<td>10. Detecting blood alcohol levels</td>
<td>22. Why the legal drinking age could be 18.</td>
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<td>12. Ice wine</td>
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Accounting for Improvement:
If a) your attendance record is solid, b) you have handed in all course assignments on time, and c) you have taken both midterm exams, then your final exam percentage can replace a lower score on one of your midterm exams.
Course Resources

Lecture: TR 3:30-4:50 AM. Please come! Attendance and participation will be monitored via Tophat interactions throughout each class

Canvas: There will be a course Canvas site. Dr. Kaur will use this site to post a few slides from each lecture, reading assignments, homework assignments, answer keys, and grades.

Recitation/Laboratory Sessions (worth 30% of your grade): You will meet in smaller groups once a week to work on questions that will help you prepare for the exams, to develop your research skills for the end of semester presentations, and to conduct laboratory exercises. You will need to purchase a pair of safety goggles and fill out a laboratory safety form in order to be allowed into lab. These will be TA-run.

Problem sets: These will be covered in recitation, but they will also be made available on Canvas.

Text(s): See aforementioned “Course materials” section.

Library Site: http://guides.temple.edu/wine

TOPHAT

Recitation instructor office hours: (see first page). Remember: office hours are NOT just for emergency situations!

Dr. Kaur: I have weekly office hours (see first page). Additionally, you are welcome to arrange a time to meet with me to discuss course content, your current performance, to solicit suggestions on improving your learning experience, or anything else pertaining to the Chemistry of Wine. Email is the best way to arrange such appointments.

Chemistry Department Calculator Policy (9/1/2008)

The use of programmable and/or graphing calculators on examinations or quizzes is strictly prohibited. The use of simple calculators (i.e. those without keyboards) is allowed only with the permission of the Instructor. The use of PDAs, cell phones, and electronic or paper dictionaries is strictly prohibited.
Laboratory Safety

Students are expected to conduct themselves as adults who are cognizant of their safety and the safety of those around them. Unauthorized experiments utilizing equipment and/or chemicals are not permitted. Participants in this course who are behaving inappropriately or unsafely will not be permitted to continue in the laboratory. Make-up of missed laboratory work will not be permitted. Although most of the chemicals used in this course are no more dangerous than those used in your home, students are required to come to class dressed properly.

- Eating and/or drinking in the laboratory are not permitted.

- Long pants or full-length skirts should be worn. Short pants, short skirts, and kilts are not permitted in the lab at any time. Arms should be covered to the elbow and midriffs should not be exposed. Clothing serves to provide an additional barrier which is important in a laboratory environment.

- Shoes/sneakers that cover the entire foot should be worn. Sandals, clogs, or open-toe shoes are not permitted in the lab at any time.

- Laboratory participants must wear safety glasses or safety goggles as soon as they enter the laboratory. We do not keep spare goggles to lend to students. It is the students’ responsibility to bring their goggles with them to the lab meeting. The wearing of contact lenses is not recommended. Contact lenses should, if possible, be replaced with eye-glasses worn behind safety goggles.

- Long hair must be tied back.

Improperly dressed students will not be permitted to work in the lab.

Disability disclosure statement

Any student who has a need for accommodation based on the impact of a disability should contact me privately to discuss the specific situation as soon as possible. Contact Disability Resources and Services at 215-204-1280 in 100 Ritter Annex to coordinate reasonable accommodations for students with documented disabilities.

Temple Policy on Student and Faculty Academic Rights and Responsibilities

Freedom to teach and freedom to learn are inseparable facets of academic freedom. The University has adopted a policy on Student and Faculty Academic Rights and Responsibilities

(Policy # 03.70.02) which can be accessed through the following address:

http://policies.temple.edu/getdoc.asp?policy_no=03.70.02
Note of Student Coursework
Temple University is committed to providing excellent and innovative educational opportunities to its students. To help us maintain a quality academic offerings, it may retain representative examples or copies of student work from all courses. This might include papers, exams, creative works, or portfolios developed and submitted in courses or to satisfy the requirements for degree programs as well as surveys, focus group information, and reflective exercises.

Important Registration Dates

Drop/Add: Without special approval from the instructor as long as the desired section(s) are open by Monday, January 27th, 2020. Students should check the Diamond Line (215-204-2525) phone registration system frequently or Temple's On-line Course Schedule. Both systems will allow students to determine which sections are currently open. Note that a section that was closed in the early morning may have opened up by the afternoon, so check frequently.

Withdrawal: Students may withdraw from the course without penalty (Grade of "W") any time up to Drop/Add deadline, Tuesday March 17th, 2020. After that grace period the "W" grade is only given in accordance with institutional procedure. The procedure to obtain a "W" grade after 12 September is governed by the Temple University Policy (#03.12.12) on Withdrawal.

Incomplete: Incomplete ("I") Grades will only be given in accord with Temple procedures. The "I" grade cannot be given until the specific requirements have been met and forms filled out, signed and submitted. This course is governed by the Temple University Policy (#03.12.13) on Incompletes. http://policies.temple.edu/getdoc.asp?policy_no=02.10.13

Make-up Exams
There will be no make-up exams except as explicitly designated by official written Temple policy.