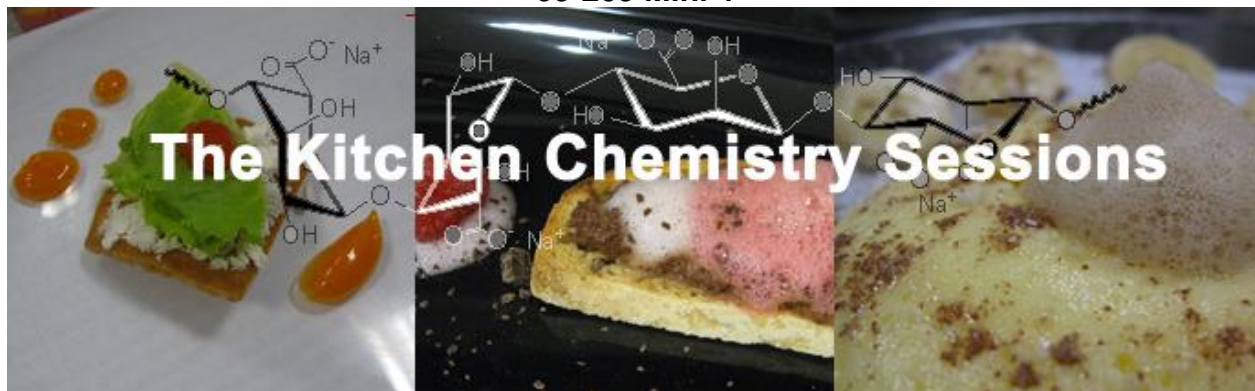


Carnegie Mellon University
Department of Chemistry
Fall 2016

09-209 Mini-1



*“The future of gastronomy belongs to chemistry.” Brillat Savarin, 1825**

Instructor: Subha R. [Das](#)

Office: Mellon Institute MI-740

Telephone: 268-6871

e-mail: srdas@andrew.cmu.edu

Teaching Assistant: Yao Li

Class Schedule: Mellon Institute MI-348 (Conference Room)

09-209 Tuesday 6:30 pm - 9:20 pm;

(09-109 is Wednesday 6:30 pm - 9:20 pm)

Office Hours: by appointment (email to schedule) – see also blackboard discussion board

Course Description:

Ever wanted to boil water in ice? Cook an egg so the yolk is set but the white still runny? Lick a lemon or vinegar but taste...sweet? Make “caviar” from fruit juice and noodles from yogurt? In this course we will explore the science of molecular gastronomy through the lectures and demonstrations that reveal the chemistry and biochemistry of food ingredients and their preparation. Then we will use a kitchen as a “laboratory” to test hypotheses and delve into molecular cooking – often you will get to eat your lab results. Note that this is a Chemistry and Science focused course – not a cooking class, although the context of food is used and the information and knowledge gained through the class may enhance your culinary potential.

Course Goals Upon completion of this course, students should be able to:

- Identify the key chemical features and characteristics of basic food ingredients and explain how these properties affect and determine their handling, use, and taste
- Analyze and compare ingredients, recipes and protocols and be able to predict the purpose of and test the effectiveness of ingredients in recipes and dishes
- Use scientific principles to produce dishes using novel techniques and explain how they were constructed
- Exemplify the scientific process and inquiry driven research by designing, implementing, and documenting experiments (edible or otherwise)
- Work effectively in a laboratory groups

* via Chef Chad Galiano – chadzilla.typepad.com

Course format:

We will meet once a week to go over concepts, observe demonstrations, and give you an opportunity to practice running experiments in a laboratory group. Each student will learn how to keep a lab notebook and write-up their experiments in a scientific manner. Because the main activities in this course will occur in class, attendance is critical to your learning the material and developing the necessary skills. Outside of class you will also be expected to do readings, complete assignments and write up 'lab' reports, individually.

This is a 3 credit mini hence the expected load aside from the 3 hrs in class is 3 hrs outside class (on average) per week.

Course Materials:

Lecture Notes and reading material – will be handed out in class or can be downloaded from the Blackboard site.

Blackboard Site: A course site has been created on Blackboard (www.cmu.edu/blackboard/). You can view announcements and download copies of selected notes and articles and find links relevant to class material on the site. In addition a discussion forum has been set up. You are welcome to use that to post your observations, comments, pictures and questions to the class (including me) on topics of your choice. Participation in this forum will not be graded, but will enhance your learning and enjoyment from discussions about both food and science. I will check the forum occasionally, perhaps a few times a week so if you have an urgent need to contact me do so by email.

Useful references

Wolke, R. L. (2002). What Einstein Told His Cook. New York, W. W. Norton & Company
ISBN-13: 978-0393329421

McGee, H. (2004). On Food and Cooking: The Science and Lore of the Kitchen. New York, Scribner
ISBN-13: 978-0684800011

Barham, P. (2000). The Science of Cooking. Berlin, Springer-Verlag.
ISBN-13: 978-3540674665

Schedule of Topics

The course organization reflects the major types of molecules in food: water, fats/oils, carbohydrates, proteins, and flavor and aroma molecules. We will spend at least one session on each – learning the chemical and biochemical concepts that will aid in cooking and/or doing other experiments with foods.

Session 1: Water; Basics of bonding, polarity, hydrophobicity

Session 2: Fats and oils; hydrogenation, emulsions and foams

Session 3: Carbohydrates; Structures, pH, metal ions, polymers, liquid food spheres

Session 4: Carbohydrates (contd.) + Proteins: protein structure, denaturation, enzyme action

Session 5: Functional groups; flavor/aroma molecules, receptors and the perception of taste

Session 6: Final dishes & recipe evaluation

Course Requirements

For the course there will be an in-class quiz as well as short assignments. You will have to also work in groups for the laboratory portion of the class and maintain your own notebook - at least one experiment from each session will be evaluated (digital submission). For the final group project, each of you will have to provide your own written explanation of the underlying chemistry in the recipe(s).

Performance Assessment

The grade in the course will be based on:

Preparing for and participating in class

1. Working to understand the materials for each class
2. Participating in the class activities - **G 10%**
3. In-class quiz & homework assignments (individual) **G 40%** [best 4 of 5; Assignment #3 counts as two]

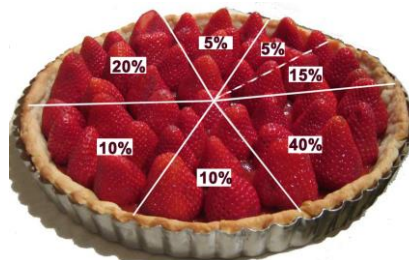
Learning and documenting your development of expertise

Practicing your skills

4. Lab work (group) - **G 10%**
5. Lab documentation (group) - **20%**

Final project

- 6a Creating a novel dish & documentation/recipe (groupwork) - **15%**
- 6b Explanation of the underlying principles of dishes (individual) - **5%**



Students who earn an "A" will have scored 90% of the total available points, a "B" 80%, a "C" 70% and a "D" 60%.

The schedule below should give you a general framework for how the work for this course will be distributed throughout the mini-semester. A continually updated version of this schedule will be available on the website. When in doubt, resort to the website version of the schedule. In addition, the website version will have details on the readings assigned for each class meeting and helpful documents to accompany those readings.

Experimental write-ups (lab reports) and Assignments are due by Noon on Saturday following the in class session. All submissions should be online via blackboard as per the following schedule

Session	Topic	Lab notebook and Assignment Due (via blackboard)
Tuesday Aug 27	Water, bonding [In class Quiz #1] [+Taste: Salt]	Individual Lab report #1 (due Sat Sept. 3)
Tuesday Sept 06	Lipids - Fats & Oils In class Quiz #2 G [+Taste: Bitter]	Group Lab report #2 G (due Sat Sept 10) Assignment #2 G
Tuesday Sept 13	Carbohydrates [+Taste: Sugar]	Group Lab report #3 G Assignment #3 G (due Sat Sept 17)
Tuesday Sept 20	Carbohydrates II	Group Lab report #4 G Assignment #4 G (due Sat Sept 24)
Tuesday Sept 27	Proteins [+Taste: Umami]	<i>Time to discuss final dish with group</i>
Tuesday Oct 04	Aroma molecules and flavor perception [+Taste: Sour]	Idea(s) and 'sketch' for Group Final Dish – Ingredients, materials & equipment list due Sat Oct 8 Noon
Tuesday Oct 11	Final Dishes & Presentation G	Explanations (individual) G Final Dishes Write-up (group) G due Sat Oct 15 Noon

Note that items annotated with a "G" will be submitted for a grade and factor into your final course grade as indicated (see percentages & tart chart).

Course policies and expectations

Please read your student handbook on policies for cheating and definitions of plagiarism. Cheating and plagiarism are defined in the CMU Student Handbook, and include (1) submitting work that is not your own for papers, assignments, or exams; (2) copying ideas, words, or graphics from a published or unpublished source without appropriate citation; (3) submitting or using falsified data; and (4) submitting the same work for credit in two courses without prior consent of both instructors. Any student who is found cheating or plagiarizing on any work for this course will receive no credit for that work. Further action will also be taken if necessary.

It is expected that all work will be submitted on time. Indeed, lab notebooks and assignments represent cumulative work, so the most effective way to do well on assignment n is to refine your work based on feedback for assignment n-1. Based on this idea, work not submitted on time is still very important to complete and submit for feedback – even if late. However, there is a late penalty that increases linearly with lateness: each day after the due date, an additional 20% is subtracted from the score.

So, if you submit a perfect assignment a day late, you earn $100\% - 20\% = 80\%$; two days late, you earn $100\% - 40\% = 60\%$ and so forth.

Take care of yourself. *College is a place for learning and that can only occur in a fun and encouraging environment. Please do your best to maintain a healthy lifestyle this semester by eating well, exercising, avoiding drugs and alcohol, getting enough sleep (and sleep deficit is cumulative). Taking some time to relax. This will help you achieve your goals and cope with stress.*

*We all benefit from support during times of struggle. **You are not alone.** There are many helpful resources available on campus and an important part of the college (and life) is learning how to ask for help. Asking for support sooner rather than later is often helpful.*

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call [412-268-2922](tel:412-268-2922) and visit their website at <http://www.cmu.edu/counseling/>. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

If you or someone you know is feeling suicidal or in danger of self-harm, call someone immediately, day or night:

CaPS: [412-268-2922](tel:412-268-2922)

Re:solve Crisis Network: [888-796-8226](tel:888-796-8226)

If the situation is life threatening, call the police:

On campus: CMU Police: [412-268-2323](tel:412-268-2323)

Off campus: 911

If you have questions about this or your coursework, please let me know.