

Chemistry 401: Food Chemistry

Course Description

In this course we will examine the chemistry of food from farm to fork. The discussion- and literature-based format is designed to probe, perhaps the oldest area of applied chemistry, cooking. We will explore ideas such as phase changes, extractions, denaturation, and chemical reactivity in such a way that you can alter a cooking/baking reaction and confidently predict the outcome.

What To Expect

From the course – to be surprised, challenged, and informed about the chemistry of food. Students can expect to improve their primary literature reading and interpretation skills, apply and extend their chemical knowledge to the area of food composition and transformation (cooking/baking), and enhance their written and oral communication skills. One or two class periods will be spent on each topic and we will discuss and analyze literature that structures the area of study.

From the instructor – to treat each person with respect, be enthusiastic about the subject, arrive to class on time and prepared, return graded and assessed items in a timely manner, reply to emails in a timely manner (however, I will not reply after 9 PM), and be available outside of class for questions or further discussion.

Of the students – to respect others, be on time (when arriving to class, turning in assignments, etc.), be prepared for class (have read related course material **before** class, be alert, etc.), and participate during class (participate in small group activities, answer/ask questions, etc.).

Instructor and Course Resources

Instructor:	Prof. Matthew Rouhier ("Roo-yer")
Email:	rouhierm@kenyon.edu
Office:	208 Tomisch Hall
Office Hours:	M (4-5 pm), T (1-2 pm), W (3-4 pm), or by appointment
Class location:	Tomsich 206
Class time:	9:40 -11:00 AM; Tuesday & Thursday
Suggested materials:	On Food and Cooking: The Science and Lore of the Kitchen Revised Ed. (2004) by Harold McGee
Course websites:	moodle.kenyon.edu (CHEM 401.00)



Course Policies

Attendance – Since this is a seminar course, your presence and participation in class discussions is necessary. If you are unable to attend a class, please notify the instructor by email as soon as possible. More than three unexcused absences will result in a grade reduction by 1/3 (e.g. from B+ to B). Note: **only the Dean of Students offers an Excused Absence** (see Course of Study 2019-2020 for details).

“Absences for reasons of illness are not ordinarily excused: only when a student is declared by the College physician to be infirm (in a hospital or at home) will a health report be sent from the Health and Counseling Center to the dean of students, giving the days when each patient is judged infirm and recommending that the student's class absences be excused. When released from confinement, the student is expected to resume regular required attendances unless otherwise advised.”

Athletics and Extracurricular Activities – If your participation in athletics or extracurricular activities conflicts with a class, scheduled exam time, or project due date; please let me know as soon as possible, at least two weeks in advance. Typically, you will be expected to complete your work **before** (not after) the deadline for the rest of the class.

Accommodations – A student with a disability who thinks he or she may need an accommodation to access a campus program, activity, or service should contact **Erin Salva, in Student Accessibility and Support Services** (SASS) at salvae@kenyon.edu to discuss specific needs. Advanced notice is required to review documentation, evaluate requests and provide notice or arrangements for any accommodation.

Academic Honesty – At Kenyon we expect all students, at all times, to submit work that represents the highest standards of academic integrity. It is the responsibility of each student to learn and practice the proper ways of documenting and acknowledging those whose ideas and words they have drawn upon (see **Academic Honesty and Questions of Plagiarism in the Course Catalog**). Ignorance and carelessness are not excuses for academic dishonesty. If you are uncertain about the expectations for this class, please ask for clarification. Note: this class encourages collaborative work; however your work must still be your own.

Title IX – As a faculty member, I am deeply invested in the well-being of each student I teach. I am here to assist you with your work in this course. If you come to me with other non-course-related concerns, I will do my best to help. It is important for you to know that all faculty members are mandated reporters of any incidents of harassment, discrimination, and intimate partner violence and stalking. Meaning, I must report any such discussion to the Civil Right/Title IX coordinator. I cannot keep information involving sexual harassment, sexual misconduct, interpersonal violence, or any other form of harassment or discrimination based on a protected characteristic, confidential. The Health and Counseling Center, the College chaplains, and the staff at New Directions Abuse Shelter and Rape Crisis Center are confidential resources.

Late work – Late work will be accepted with a penalty of 10% per 24 hours late (including weekends). Work more than 5 days late will not be accepted.

Technology use – You may, and often will, use laptops or similar devices during class. Please refrain from using it to email, message, play games, or any other activity unrelated to class. If your use of technology is a distraction to the instructor or others in the class, this privilege may be revoked. Cell phones are not to be used during class. Please have them turned off or set to silent.

Course Details

Course Objective - Understand the chemical reactions in baking/cooking such that one can predict the likely outcome of a baking/cooking reaction.

How this is accomplished?

1. We will examine a series of "simple concepts" that lead to success in the kitchen (according to America's Test Kitchen, Cook's Illustrated, or myself) by re-defining the statement in the language of chemistry (chemical verbiage) and applying chemical understanding to the phenomenon described.
2. We will examine literature that relates to the concepts and develop the skills needed to critically analyze primary sources.

How is progress measured?

1. Re-defining statements accurately to reflect the chemical phenomenon that underpin them.
2. Effectively predict the outcome of baking/cooking reactions
3. Successfully articulate the strong and weak attributes of primary literature and experimental methods utilized.

What are the measurement items and how are they weighted?

Outside regular class meetings	Concept Rewrite	10%
	Chemical Concept Link	10%
	Response-To-Reading	10%
During regular class meetings	Evaluations of Discussions	10%
	Student-Led Discussions	20%
	Participation	20%
	Oral Final Exam	20%

Outside of regular class time:

Concept Rewrite & Chemical Concept Link – Cook's Illustrated has a series of simple concepts that are written in lay-language. We will rewrite these concepts using the chemical terms that Cook's Illustrated has simplified. In addition, we will link the food transformation (macroscale phenomenon) to the underlying chemical properties. Concept Rewrites and Chemical Concept Links will be due on the day the topic and will be submitted using Moodle (linked to a Google Form).

Response-To-Readings (RTR) – In preparation for each class, students will be asked to write a short response on one or more of the upcoming assigned readings, or generate the conclusion(s) of a study based on the presented results. It is intended to help guide your reading as well as provide the class with initial discussion points. It is unlikely that these assignments will ever exceed one page. Response papers will be due on the day the topic or article is covered in class and will be submitted using Moodle.

During regular class time:

Student-Led Discussions & Evaluations – Pairs of students will be presenting on weekly topics. The pair will select at least two pieces of primary literature related to that week's topic. They will discuss those articles with the professor at least two weeks in advance for guidance and approval. They will then assign the Response-To-Readings (RTR) assignment by emailing the questions to Dr. Rouhier one week prior to presenting. The students will then lead the class to discuss those articles. Each student will present two times, with a different partner for each presentation.

Every student will fill out an evaluation for the student-led discussion, with the exception of two weeks before you present. Evaluations will be submitted using Moodle (linked to a Google Form). Students who led the discussion will complete a self-evaluation.

Participation – Regular and productive comments (or questions) are expected during every class meeting. Productive comments broaden or deepen the material, whereas unproductive comments will distract from the course objective. If you are unclear about your level of participation, please ask for and I will provide feedback.

Final Exam (Oral) – The final exam will be conducted in small groups with 2-3 question/answer rounds. The exam will be based on a published research article with associated questions provided one week before the exam date. Additional details will be provided closer to the exam date, December 17th at 8:30 am.

College and Departmental Learning Goals

Kenyon is institutionally committed to promoting a liberal arts education and as such has outlined the learning goals for your college-wide education that promoted and developed skills that are useful to any career but also essential for a fulfilling and valuable life. In addition, the community of students and faculty in the Chemistry Department are dedicated to achieving skills interlaced with the chemical world. The learning goals of this course are grounded on those suggested by both the college and the department. If you would like to learn more about Kenyon's learning objectives or the Chemistry Department's learning objectives, visit: <https://www.kenyon.edu/directories/offices-services/registrar/course-catalog-2/administrative-matters/kenyon-college-its-mission-and-goals/> or <https://www.kenyon.edu/directories/offices-services/office-of-the-provost/faculty-resources-information/department-mission-statements-and-assessment-plans/chemistry/>

Chemistry Departmental Goals:

Learning Goal/Objective	Learning Assessment	Details
1. Each student should learn sufficient chemistry to serve her or him well in life after Kenyon.	Chemistry Concept Links	Students will link a cooking/baking concept with the underlying chemistry each week.
2. Each student should learn to write well by being required to answer essay exam questions, write term papers, problem set answer sheets, laboratory and research reports, all critically evaluated by faculty.	Response-To-Readings	Students will submit short answers for each set of readings.
3. Each student should learn effective oral communication skills by being encouraged to ask questions in all classes and converse frequently with faculty, and required to make extended oral presentations in more advanced classes as well as in the departmental Senior Capstone.	Participation Student-Led Discussions	Students will present twice on primary literature during the course and discuss as a class all readings.
4. <i>Each student become skilled at formulating and solving problems, both qualitative and quantitative, through the working of problem sets and exam questions and by engagement with laboratory and research projects.</i>		
5. <i>Each student should learn to access, evaluate and use information from computerized information sources.</i>		
6. Each student should be encouraged to relate chemistry to other areas of inquiry and knowledge by enrolling in courses in other sciences, the fine arts, social sciences and humanities.	Concept Rewrite	Students will relate cooking/baking to chemistry and food changes each week.

College Goals:

Learning Goal/Objective	Learning Assessment	Details
a) Students acquire knowledge and understanding of fine arts, humanities, natural sciences, and social sciences.	Concept Rewrite & Chemical Concept Link	Students will deepen their understanding of natural science by taking a cooking/baking concept and rewording it in the language of the chemical reactions that are driving that food change.
b) Students learn gather information from a variety of sources and evaluate its quality.	Response-To-Readings (RTR) & Student-Led Discussions	Students will read primary literature, evaluate the merits and answer questions about what they read. Students will also select and present on related primary literature.
c) Students learn to formulate ideas rigorously and communicate them effectively, in speaking and in writing.	RTR & Student-Led Discussions & Evaluations	Students will answer questions on the readings each class. Twice a semester they will present based on a piece of primary literature, and most weeks will evaluate the presentations to gain insight into what makes an effective presentation.
<i>d) Students learn languages and engage with diverse cultures.</i>		
e) Students address ethical questions and make informed qualitative judgments.	RTR	In the readings we will encounter questions about the quality of data and the societal implications of work.
f) Students acquire quantitative skills and analyze data.	RTR & Student-Led Discussions & Final Exam	Students will be evaluating data from primary literature and discussing it with the class.
<i>g) Students develop an aesthetic sensibility through practice and critical examination of the fine, performing, and literary arts.</i>		
h) Students learn to work creatively.	Concept Rewrite	Student will rewrite lay-language concepts into scientific terms forcing concept connections.
i) Students learn to work collaboratively and across disciplines	Student-Led Discussions	Student will work in teams to present on primary literature and as a class to discuss the literature. The material and techniques of food chemistry draw heavily from the physical and biological fields.
<i>j) Prepare for leadership and for civic and community engagement</i>		

Tentative Schedule

Tuesday		Readings for Tuesday	Thursday		Experiments?
			8/29	The 4 Basic Food Molecules	C. Chip Cookies
9/03	Cooking: Methods & Materials (C1: Gentle heat prevents overcooking)	McGee - Ch. 14 p780-791 Cook's Illustrated - C1	9/05	Article - Blueberries (see Moodle page)	Caramels
9/10	Tea & Coffee (Espresso, like geology, is all about time and pressure)	McGee - Ch. 8 p433-448 HowStuffWorks - How Espresso Works	9/12	Article - Espresso (see Moodle page)	Cold-brew Vs Hot-brew
9/17	Seeds: Grains, Legumes & Nuts (Palm oil is the new trans-fat)	McGee: p37-38, 452-459, 501-513 Podcast: World hooked on palm oil	9/19	Article - Palm oil shortening (see Moodle page)	?
9/24	Eggs (C21: Whipped egg whites need stabilizers)	McGee Ch 2: p69-87, 100-116 Cook's Illustrated - C21	9/26	Student Article #1-1	Meringue Cookies
10/1	Meat (C35: Glutamates, nucleotides add meaty flavor)	McGee -Ch 3: p121-124, 147-154 Cook's Illustrated - C35	10/3	Student Article #1-2	MSG broth
10/8	<i>Flex topic</i>	TBD	10/10	<i>Fall Break</i>	Pretzels with H ₂ CO ₃
10/15	Common Fruits (C49: Sugar and time make fruit juicer)	McGee - Ch 7: p350-353 Cook's Illustrated - C49	10/17	Student Article #1-3	Proteins as Sweeteners
10/22	Common Vegetables (C17: Good frying is all about oil temperature)	McGee - Ch 5: p245-252, 261-270, 286 Cook's Illustrated - C17	10/24	Student Article #1-4	Funnel-Cakes
10/29	Herbs & Spices (C33: Bloom spices to boost their flavor)	McGee - Ch 8: p387-401 Cook's Illustrated - C33	10/31	Student Article #1-5	Spiced Rice
11/5	Milk and Dairy (C1: Young cheeses make better grilled cheese)	McGee - Ch. 1 p6-16, 19-21, 44-59 Cook's Illustrated - Young Cheese Article	11/7	Student Article #2-1	Colloid Formation
11/12	Cereal Doughs and Batters (C42: Two leaveners are often better than one)	McGee - Ch. 10: p517-550 Cook's Illustrated - C42	11/14	Student Article #2-2	NH ₄ HCO ₃ cookies
11/19	Sugars, Chocolate & Confectionary (The crystal makes the candy)	McGee - Ch. 12: p645-663, 680-694 ChemMatters - Sweet science of candy	11/21	Student Article #2-3	Rock, Fudge, & Candy Glass
11/26	<i>Thanksgiving Break</i>		11/28	<i>Thanksgiving Break</i>	
12/3	Wine, Beer & Distilled Spirits (C1: The key to crystal-clear cocktails? Milk (Really))	McGee Ch. 14 p715-720, 758-771 Cook's Illustrated - Crystal-clear cocktails	12/5	Student Article #2-4	Milk Punch
12/10	Future of Food (??? Non-browning, GM, cultured meats...?)	No McGee Assigned podcast	12/12	Student Article #2-5	?
12/17	Final Exam (Tuesday 8:30-11:30 am)	TBD			