



GSCI-FSST 325 - The Science of Italian Food

Course Syllabus
Fall Semester 2023

Instructor: Giulia Brufani, ABD

Credits: 3

Contact Hours: 45

Prerequisites: none

Class Meeting Days & Time: Tuesdays and Thursdays, 9:00am-10:30am

Office Hours: by appointment after class or via Zoom (see Moodle site)

Course Type: Standard Course

Course Fee: \$ 50.00

Course Description

Students will learn and test the basic scientific concepts underlying food processing and preparation. These concepts will be derived from various scientific fields such as biology, microbiology, and chemistry. Students will apply and examine different food preservation techniques in a historical context. The course is divided into a classroom and a lab component. Students will alternate between the two activities. During the laboratory module, students will learn how to apply the scientific method to food preparation and preservation, keeping a lab notebook. During the course, the student will engage with peer-reviewed literature and analyze and disseminate the results of scientific studies. The overall goal of the course is to learn about the interconnectivity of science, culture, and the environment by exploring basic food processes. No prior scientific knowledge is necessary for this course.

Learning Outcomes and Assessment Measures

By the end of this course, students will be able to:

- *Apply* the scientific method to food preparation and conservation. (Weekly Quiz, Lab Notebook, Final Essay);
- *Analyze* and *evaluate* the reliability of sources concerning food related arguments (Weekly Quiz, Final Essay);
- *Define* basic chemical, biochemical, and microbiological transformations important for food production (Weekly Quiz, Lab Notebook, Final Essay);
- *Summarize* the historical and cultural contexts for food processes in Italy (Final Essay);
- *Design* and *conduct* simple lab experiments to identify the key parameters affecting the outcome of food processing techniques (Weekly Quiz, Lab Notebook, Final Essay).

Course Materials

Readings

The course's Moodle page is the primary location for readings and assignments.

Assessment

Attendance	10%
One-on-One Professors Meetings	5%

Moodle Quizzes	15%
Midterm Presentation	5%
Food Lab	22%
Food Lab Notebook	18 %
Final Paper - Peer Teaching	25%

Grading

Students are reminded that it is their responsibility to note the dates of exams and other assignments. No alternative exam dates will be offered and professors are not required to give partial credit for any late work (they do so at their discretion: the Institute's default policy is no extensions and a zero for any work turned in late). Students who book travel when they have an exam or other assessment will have to change their plans or accept a zero. Letter grades for student work are based on the following percentage scale:

Letter Grade Range	Numerical Score Equivalent	Student Performance
A	93% - 100%	Exceptional
A-	90% - 92%	Excellent
B+	87% - 89%	Superior
B	83% - 86%	
B-	80% - 82%	
C+	77% - 79%	Satisfactory
C	73% - 76%	
C-	70% - 72%	
D+	67% - 69%	Low Pass
D	63% - 66%	
D-	60% - 62%	
F	59% or less	Fail (no credit)

Please note: decimal numerals between 1-4 are rounded down while 5-9 are rounded up: e.g., expect 89.4 to be 89.0 while 89.5 to round up to 90.

Course Requirements

Grades are based on the following criteria.

Attendance (10%)

Attendance is an essential part of this course. If you attend all the meetings, you will receive 10% for this part of your grade. There are no make-ups offered for attendance.

One-on-One Professors Meetings(5%)

Getting to know your professor makes you more comfortable with that person and, therefore, more likely to ask for help. It also might help to ask questions about the various assignments or discuss a paper idea. You get 5% of your grade in this course for coming one time before Week 9 during office hours. See the prompt in Moodle for more information.

Quizzes (15%)

Students will be assigned a short quiz every week, which will be due before class time and will not be reopened. The quiz will be on Moodle and it is not timed. Students can take the quiz as many times as they like, with the recorded grade being the highest grade they receive. There will be a combination of *methodological, content, and administrative questions*. The content questions will help students zoom in on the most important ideas of the readings. The methodological questions will test on skills that will pop up every week from the arguments studied in class. While administrative questions will help the students to know the school and its policy better.

Midterm Presentation (5%)

You will be evaluated based on a short presentation about the health and record keeping of your pasta madre during the lab section of Week 5;

Finally, you will turn in a detailed outline of the topic you will focus on for the final paper/peer teaching project. See the full prompt on Moodle.

Food Lab (22%)

Food labs account for a large percentage of the total grade. During some labs, students will be responsible for maintaining the health of their cultures and reporting their observations. For the lab activities that include an experimental aspect students will discuss their hypotheses, predictions and observations, following the scientific method. Such assessments serve to reiterate the objectives of the course and are important for the overall development of the students. See the full prompt on Moodle.

Food Lab Notebook (18%)

Students will be required to keep a food lab notebook during the semester. Students must keep accurate notes during the food labs. In addition, students must record progress of their food cultures and variables impacting these cultures. The food lab notebook will be provided during the first class. A fuller description and a prompt for the Food Lab Notebook will be provided on the Moodle page.

Final paper (25%)

Students, in agreement with the teacher, will choose a food preparation procedure or a specific ingredient and they will prepare a short essay focused on the scientific, cultural, and environmental aspects linked to the specific topic. Finally, during the last two lessons students will present their work through a 10-minute presentation in front of the class. See the full prompt on Moodle.

Extension & Submitting Late Work

Work submitted after the deadline will receive a grade of zero, not partial credit. Each student is allowed one extension of 24 hours over the entire semester. This can be used for any assignment but the final project. Students need to email the instructor before the deadline and inform the instructor of their use of the extension. Any work submitted after the 24-hour extension will be marked zero. As for all policies, exceptions can be made by the Director for students with special accommodations or in case of medical emergencies, etc.

Attendance & Lateness Policy

Attendance is expected and mandatory for classroom times and co-curricular activities. Regular attendance is a critical component of academic success and students are expected to attend all scheduled classes unless there is a legitimate reason for absence. Students are also expected to be on time for all classes and co-curricular activities. Each unexcused absence will affect the final grade by 1.5% up to a maximum of 10%. Each incident of tardiness (late arrivals to or early departures from class) is 0.5% off the final grade. Excessive unexcused absences (8 or more) may result in a failing grade or disciplinary action. It is the student's responsibility to be aware of the number of absences or late arrivals for each course, and to ask the instructor when in doubt.

If students miss class, they are responsible for obtaining class notes from other students and/or for meeting the professor during office hours. Any work missed in class because of an excused absence may be made up within one week of the return to the class. Any work missed that was a quiz or other test must be made up outside of class time and will, in the interest of intellectual honesty, be a slightly different test than the one given in class. Presence during mandatory field trips is especially important. Missing a mandatory field trip for a course, unless for a very serious reason that is communicated to Umbra staff in a timely manner, will be considered the equivalent of two unexcused absences. As such, absence from the co-curricular field trip will lower students' final grade in that course by 3% (the equivalent of two unexcused absences).

Legitimate reasons for an excused absence or tardiness includes: death in immediate family, religious observances, illness or injury, local inclement weather, medical appointments that cannot be rescheduled. Absences relating to illness may be excused by the Director but only if a medical certification is provided.

Students who request an approved absence to observe a religious holiday must submit a formal request to the Institute's Director within one week after the add/drop period when course schedules, including any field trips, are finalized. No exceptions will be made after this deadline.

Except in the case of medical emergencies, absences are not accepted when tests are scheduled; tests cannot be made up. Furthermore, scheduled times and dates indicated for exams, quizzes, oral presentations, and any other graded assignments cannot be changed for any reason. Even if more sections of the same class are activated, students may only take exams during the scheduled times and dates for the section they are enrolled in.

Academic Integrity

All forms of cheating (i.e., copying during exam either from a fellow student or making unauthorized use of notes) and plagiarism (i.e., presenting the ideas or words of another person for academic evaluation without acknowledging the source) will be handled according to the Institute Academic Policy, which can be found in the Umbra Institute Academic Policies and Conduct Guidelines.

Utilizing ChatGPT or other artificial intelligence (AI) tools for the generation of content submitted by a student as their own as part of any assignment for academic credit at the Institute constitutes a form of plagiarism. Should the Institute become aware of a student's use of such platforms and services, the student will be subject to the same consequences and judicial proceedings as are in place for plagiarism (defined above).

Classroom Policy

Students are expected to follow the policy of the Institute and demonstrate the appropriate respect for the historical premises that the school occupies. Please note that cell phones must be set on silent mode before the beginning of each class. Computers and other electronic devices cannot be used during class lectures and discussions, unless there has been a specific academic accommodation.

I as an instructor and as a person am dependent on both my computer and my telephone. That said: An ever-increasing body of research shows that open laptops and telephones in the classroom create distraction (both visual and auditory) for those using them and those around them. You can type faster than you can write, and as a result you end up processing less when you're simply typing notes. For this reason, I have a physical notebook policy: I ask you to leave your computers in your bags and phones in your pockets and use a regular notebook. There are four exceptions: 1) if you have an accommodation related to your vision; 2) if you are using a tablet for taking notes, but which is not connected to the internet, 3) if I ask you to bring your computer for a research workshop, or 4) if you make an office hours appointment with me to discuss the use of a computer.

Schedule of Topics, Readings, and Assignments

WEEK 1

Meeting 1: Course Introduction

Background Knowledge Probe and group activity: “How to read a scientific paper”

Meeting 2: Lab introduction: Equipment, Cultures and the Garden

Food lab: Lievito madre

Lab activity: Students will prepare their individual lievito madre and receive instructions for its long-term care and use. We will use a portion of this lievito madre to prepare dough in Week 2.

Readings:

- McGee, H. *On Food and Cooking: The Science and Lore of the Kitchen*, 2nd ed.; Scribner, 2004; pp. 531-534.
- Arora K.; Ameer H.; Polo A.; Di Cagno R.; Rizzello C. G.; Gobbetti M. Thirty years of knowledge on sourdough fermentation: A systematic review. *Trends in Food Science and Technology*, **2021**, *108*, 71-83
- Reese A. T.; Madden A. A.; Joossens M.; Lacaze G.; Dunn R. R. Influences of ingredients and bakers on the bacteria and fungi in sourdough starters and bread. *American Society for Microbiology* **2020**, *5*, e00950-19.

WEEK 2

Meeting 1: Gluten and leavening

We will discuss the factors controlling the structure and texture of bread: gluten, flours and gluten free.

Activity: Practical evaluation and comparison of the different types of bread

Readings:

- Borghi, B.; Corbellini, M.; Minoia, C.; Palumbo, M.; Di Fonzo, N.; Perenzin, M. Effects of Mediterranean Climate on Wheat Bread-Making Quality. *European Journal of Agronomy* **1997**, *6*, 3, 145–154.
- McGee, H. *On Food and Cooking: The Science and Lore of the Kitchen*, 2nd ed.; Scribner, 2004; pp. 536-539, 778 [gluten, bread rising, Maillard reactions].
- Riley, G. *The Oxford Companion to Italian Food*, 1st ed.; Oxford University Press, 2007, pp. 65-69 [bread].
- Edelstein, S. *Food Science: An Ecological Approach*. 2nd ed.; Jones & Bartlett learning, 2013; pp. 336-338 [Going Green with Grains].

Meeting 2: Food Lab: Introduction to Bread making

- Techniques – yeast breads versus quick breads, kneading
- Alternative flours – comparison with gluten free dough and bread
- Leavening agents – natural yeasts, fresh yeast, dried yeast, baking soda/baking powder

Lab activity: Students will prepare 3 different types of bread dough - one with instant yeast, one using a portion of their lievito madre prepared in Week 1, and one gluten free variation, and making observations in their lab notebooks on the relevant characters. Several different flours and yeast types will be available to choose from.

WEEK 3

Meeting 1: Ethyl Alcoholic Fermentation: Grape must fermentation

We will discuss the chemical principles behind ethyl alcohol fermentation, with specific reference to the preparation and chemical composition of wine and vinegar and the differences between the two processes. We will discuss the role and the production of wine in Italian culture.

Readings:

- Ruiz, J.; Kiene, F.; Belda, I.; Fracassetti, D.; Marquina, D.; Navascués, E.; Calderón, F.; Benito, A.; Rauhut, D.; Santos, A.; Benito, S.; Effects on varietal aromas during wine making: a review of the impact of varietal aromas on the flavor of wine *Applied Microbiology and Biotechnology*, **2019**, *103*, 7425–7450

- H. Claus, K. Mojsov Enzymes for Wine Fermentation: Current and Prospective Applications. *Fermentation* **2018**, 4, 52.
- P. Polášková, J. Herszage, S. E. Ebeler Wine flavor: chemistry in a glass, *Chem. Soc. Rev.*, **2008**, 37, 2478-2489.

Meeting 2: Food Lab: Historical wine tasting

Sensorial Lab activity: students will test and compare Greek wine with Roman wine and farmer wine, analyzing the differences from the chemical point of view. There will be ample time to discuss the properties of the principal ingredients and to perform the initial measurements of specific gravity and pH that will be used at the end to fully understand the chemical differences.

WEEK 4

Meeting 1: Ethyl Alcoholic Fermentation; hops and preservation

We will discuss the chemical principles behind ethyl alcohol fermentation, with specific reference to the preparation of beer, and the antibacterial and distinct flavor properties of hops. The role of beer in Italian culture will also be briefly explored in juxtaposition with wine production and consumption.

Readings:

- McGee, H. *On Food and Cooking: The Science and Lore of the Kitchen*, 2nd ed.; Scribner, 2004; pp. 739-753 [beer]
- Riley, G. *The Oxford Companion to Italian Food*, 1st ed.; Oxford University Press, 2007, pp. 262-263 [wild hops]
- De Keukeleire, D. Fundamentals of Beer and Hop Chemistry. *Quím. Nova* **2000**, 23, 1, 108–112.
- Bocquet, L.; Sahpaz, S.; Hilbert, J.L.; Rambaud, C.; Riviere, C. Humulus Lupulus L., a very popular beer ingredient and medicinal plant: Overview of its phytochemistry, its bioactivity and its biotechnology. *Phytochem. Rev.* **2018**, 17, 5, 1047-1090 (Optional Reading)

Meeting 2: Food Lab: Beer Primary Ferment

Lab activity: Working in groups, students will prepare the primary fermentation of individual beer samples. There will be ample time to discuss the properties of the principal ingredients and to perform the initial measurements of specific gravity and pH that will be used at the end to fully understand the fermentation process.

Midterm presentations of cultures and lab notebooks - Lievito madre show -and- tell! (The prompt is available on Moodle)

WEEK 5

Meeting 1: Food Preservation Part 1: Salt, Acidity and Pectins

We will look at the chemical processes behind the preparation of three common foods in Italian culture that epitomize the long-term preservation of seasonal food resources: prosciutto (salt), pomodori pelati (acidity) and marmellata (pectins)

Readings:

- Thakur, B. R.; Singh, R. K.; Handa, A. K., Chemistry and Uses of Pectin — A Review *Critical Reviews in Food Science and Nutrition*, 1997, 37, 47-73
- Edelstein, S. *Food Science: An Ecological Approach*. 2nd ed.; Jones & Bartlett learning, 2013; pp. 336-338 [Going Green with Fruits & Vegetables]
- Riley, G. *The Oxford Companion to Italian Food*, 1st ed.; Oxford University Press, 2007, pp. 263 [jam and jelly].

Meeting 2: Food Lab: Jams & Preserves (seasonal fruit: apple)

Lab activity: We will use different sources of the thickening agent pectin on the preparation of jam with apple, exploring the differences in the texture.

WEEK 6

Meeting 1: Food Preservation Part 2: Drying and milling

Throughout Italian history, up until the Second World War, working class families relied heavily on alternative carbohydrate sources, sometimes with detrimental effects to their health. The lecture will focus on the processing and nutritional properties of chestnut and corn (polenta), two foods that were important to the culture of Tuscany and Northern Italy, respectively.

Readings:

- Conedera, M.; Krebs, P. History, Present Situation and Perspective of Chestnut Cultivation in Europe. *Acta Horti* **2008**, 784, 23–28.
- Ginnaio, M. Pellagra in late nineteenth century Italy: Effects of a deficiency disease. *Population* **2011**, 66, 3, 583-610

Meeting 2: Food Lab: Secondary Ferment of beer

Lab activity: we will complete the fermentation of the beer

Semester Break

WEEK 7

Meeting 1: Energy and Temperature

The physical and chemical aspects of food preparation will be introduced, with specific reference to gelato. The instructor will lead a discussion on the culture of gelato in Italy and with students compare that with ice cream in the US.

Readings:

- Thompson K.; Delores R.; Chambers H.; Chambers E. Sensory Characteristics of Ice Cream Produced in the U.S.A. and Italy. *J. Sens. Stud.* **2009**, 24, 3, 396–414.
- Riley, G. *The Oxford Companion to Italian Food*, 1st ed.; Oxford University Press, 2007, pp. 255-260 [ice cream].
- McGee, H. *On Food and Cooking: The Science and Lore of the Kitchen*, 2nd ed.; Scribner, 2004; pp. 39-44 [ice cream; atoms, energy, chemical bonds].

Meeting 2: Food lab: Gelato

Lab activity and Sensorial Lab: We will explore the factors that affect the texture of gelato tasting different types of gelato, fat content and stabilizers. We will prepare our home-made gelato.

WEEK 8

Meeting 1: Fermentation of lactose: cheese production cheese production and the factors that affect it; regional differences in a historical context

We will explore the chemical process that governs the production of cheese and the various factors that can affect the texture and flavor. We will also discuss the enormous variety of cheeses that exist in Italy and the regional differences in a historical context.

Readings:

- Gobbetti, M.; Neviani, E.; Fox, P. The history and culture of Italian Cheeses in the Middle Ages. *The Cheeses of Italy: Science and Technology* **2018**, 13-37.
- Gobbetti, M.; Neviani, E.; Fox, P. Classification of Cheese. *The Cheeses of Italy: Science and Technology* **2018**, 55-60.
- Lovarelli, D.; Bava, L.; Zucali, M.; D'Imporzano, G.; Adani, F.; Tamburini, A.; Sandrucci, A. Improvements to dairy farms for environmental sustainability in Grana Padano and Parmigiano

Reggiano production systems. *Italian Journal of Animal Science* **2019**, 18, 1035-1048.

Meeting 2: Food Lab: Milk fats, rennet and citric acid
Mozzarella and ricotta!

Lab activity:

Readings:

- Sales, D.C.; Urbano, S.A.; Lima Júnior, D.M.; Galvão Júnior, J.G.B.; Brito, A.F.; Cipolat-Gotet, C.; Borba, L.H.F.; Rangel, A.H.N. Factors affecting buffalo Mozzarella cheese yield: a study using regression analysis. *Food Sci. Technol.* **2021**, 41, 4, 852-855.

WEEK 9

Meeting 1: Coffee culture in Italy

Italy is known for its coffee breaks and the quick espresso while standing at the bar. However coffee is not grown in Italy. This lecture will look at the complex cultivation and sourcing of coffee, and the roasting process. We will also address the current push towards ethical sourcing, the term 'fair trade', and environmental concerns related to coffee cultivation.

Readings:

- Cosmina, M.; Gallenti, G.; Marangon, F.; Troiano, S. **2016** Consumers' preferences for ethical attributes of coffee: a choice experiment in the Italian market. *Rivista di Economia Agraria* n. 1, Anno LXXI (Supplemento)
- Becchetti, L.; Constantino, M. Fair Trade in Italy: Too Much 'Movement' in the Shop?. *Journal of Business Ethics* **2010**, 92, 181-203

Meeting 2: Food Lab: Coffee cupping - panel test

Sensorial lab: Coffee filter cupping scent/flavor profiles; and panel test trial of caffè espresso

Readings:

- Lingle, T.R.; Menon, S.N. Cupping and Grading - Discovering Character and Quality. *The Craft and Science of Coffee* **2017**, 181-203
- Caprioli, G.; Cortese, M.; Sagratini, G.; Vittori, S. The influence of different types of preparation (espresso and brew) on coffee aroma and main bioactive constituents. *Int. J. Food Sci. Nutr.* **2015**, 66, 5, 505-513

WEEK 10

Meeting 1: Fatty acids and polyphenols: Olive Oil

Italy and all the Mediterranean countries are well known for massive use and production of olive oil. Within this lecture we will explore the main regional differences in olive oil organoleptic properties connecting them to olive oil chemical composition.

Readings:

- Kiritsakis, A.K. Flavor Components of Olive Oil - A Review *JAOCs* **1998**, 75, 6, 673-681
- Caponio, F.; Leone, A.; Squeo, G.; Tamborrino, A.; Summo, C. Innovative technologies in virgin olive oil extraction process: influence on volatile compounds and organoleptic characteristics. *J. Sci. Food Agric.* **2019**, 99, 5594-5600
- Uylasır, V.; Yildiz, G. The Historical Development and Nutritional Importance of Olive and Olive Oil Constituted an Important Part of the Mediterranean Diet, Critical Reviews. *Food Science and Nutrition* **2013**, DOI: 10.1080/10408398.2011.626874

Meeting 2: Food Lab - EVOO (Extra Virgin Olive Oil) panel test.

Sensorial lab: a panel test evaluating some samples of EVO Oil from north to south of Italy.

WEEK 11

Meeting 1: Solvents and solvent effects in extracting essential oils: The Sambuca's ghost and other tales. Ethanol is well known for its ability to extract aromatic essential oil from a plethora of fruits and herbs. We will investigate the evolution of liqueurs and discover some of the most important scientific aspects in the extraction of essential oils.

Readings:

- Egea, T.; Signorini, M.A.; Bruschi, P.; Rivera, D.; Obón, C.; Alcaraz, F.; Palazón, J.A. Spirits and liqueurs in European traditional medicine: Their history and ethnobotany in Tuscany and Bologna (Italy). *Journal of Ethnopharmacology* **2015**, *175*, 241-255
- Versari, A.; Natali, N.; Russo, M.T.; Antonelli, A. Analysis of Some Italian Lemon Liquors (Limoncello). *J. Agric. Food Chem.* **2003**, *51*, 4978-4983
- Śliwińska, M.; Wisniewska, P.; Dymerski, T.; Wardencki, W.; Namieśnik, J. The flavour of fruit spirits and fruit liqueurs: a review, *Flavour Fragr. J.* **2015**, *30*, 197-207

Meeting 2: Food Lab - Limoncello: a fresh taste of Southern Italy.

Lab Activity: We will prepare limoncello from fresh lemon exploring the parameters affecting the final taste and scent of this beverage. We also compare the extraction time and temperature applied for lemon with other herbs from our garden chosen by the students. We will evaluate the differences with innovative techniques to make fast limoncello.

Readings:

- Naviglio, D.; Montesano, D.; Gallo, M. Laboratory Production of Lemon Liqueur (Limoncello) by Conventional Maceration and a Two-Syringe System To Illustrate Rapid Solid-Liquid Dynamic Extraction. *J. Chem. Educ.* **2015**, *92*, 911-915

WEEK 12

Meeting 1: Peer Teaching – Students will prepare a 10-minute presentation about a topic they have chosen. See full prompt in Moodle.

Meeting 2: Peer Teaching – Students will prepare a 10-minute presentation about a topic they have chosen. See full prompt in Moodle.

WEEK 13

Final Exams and Special Academic Events Week

For further information about the final exam see “*Course Requirements*” section and the full prompt in Moodle.