



GSCI-FSST 250 - The Science of Italian Food

Course Syllabus

Fall Semester 2022

Instructor: Daniele Sciosci, Ph.D.

Credits: 3

Contact Hours: 45

Prerequisites: none

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

Course Type: Standard Course

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 site is the primary location for readings and assignments.

Assessment

Attendance	10%
Office Hours	5%
Moodle Quizzes	15%
Midterm Presentation	5%
Food Lab	22%
Food Lab Notebook	18 %
Final Paper	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)

Course Requirements

Grades are based on the following criteria.

Attendance (10%)

Attendance is an essential part of this course. You have two "sick days," per Institute policy. If you attend all the other meetings, you will receive 10% for this part of your grade. There are no make-ups offered for attendance.

Office Hours (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 minutes keynote 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

Class attendance (in person) is mandatory. Students are allowed two “sick days,” which do not need to be justified. However, it is considered common courtesy to inform the instructor of your absence when possible. It is the students’ responsibility to keep them in case of real necessity (sickness or any other unforeseen inconvenience that may prevent students from being in class). Each additional absence—even for another illness—will lower the students’ grade by half a letter grade (i.e., a final grade of a B+ would be lowered to a B). Missing a co-curricular field trip also lowers a student’s final grade by half a letter grade. It is the policy of the Institute that any student who has eight or more absences automatically fails the class.

If a student misses a class, it is ultimately their responsibility to find out what has been missed. Ideally, they should find out what they missed from a classmate. 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.

Except in the case of medical emergencies with a doctor's certificate and approved by the Director, 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.

Consistent lateness (or leaving class early) is a sign of disorganization and lack of respect both for your instructor and for your fellow students. Umbra instructors are empowered to count three late arrivals as the equivalent of an absence.

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.

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 for anything other than note-taking, unless there has been a specific academic accommodation.

Schedule of Topics, Readings, and Assignments

WEEK 1

Meeting 1: Course Introduction

Readings and Think-Pair-Share (in class):

- Edelstein, S. *Food Science: An Ecological Approach*. 2nd ed.; Jones & Bartlett learning, 2013; pp. 4-17

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

Food lab: Lievito madre (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: Factors controlling the structure and texture of bread; gluten, flours, leavening agents

Activity: Practical evaluation of the different characteristics 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 – the importance of gluten
- Leavening agents – natural yeasts, fresh yeast, dried yeast, baking soda/baking powder

Lab activity: Students will prepare 2 different types of bread dough - one using a portion of their lievito madre prepared in Week 1, and one 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: Primary Fermentation: wine production

Wine in Italian food culture is a pivotal element. The peculiar wine scents and notes can enhance food tastes and perceptions. The chemical and biochemical aspects of wine making will be discovered and discussed.

Readings:

- Ebeler S.E.; Thorngate J.H. Wine chemistry and flavor: looking into the crystal glass. *J. Agric. Food Chem.* **2009**, *57*, 8098-8108
- Polaskova P.; Herszage J.; Ebeler S.E. Wine flavor: chemistry in a glass. *Chem. Soc. Rev.* **2008**, *37*, 2478-2489
- Ebeler S.E. Analytical chemistry: unlocking the secrets of wine flavor. *Food reviews international* **2001**, *17*, 1, 45-64

Meeting 2: Food lab: Making wine

Students will prepare small samples of wine starting from grape must.

WEEK 4

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

We will explore the factors that affect the texture of gelato – fat content and stabilizers making gelato following three different recipes.

WEEK 5

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 6

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)

The 15-20 minutes of this lecture will be dedicated to the primary fermentation of the kombucha.

Readings:

- McGee, H. *On Food and Cooking: The Science and Lore of the Kitchen*, 2nd ed.; Scribner, 2004; pp. 296-98
- 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)

We will explore different sources of the thickening agent pectin on the texture and preparation of jam.

Semester Break

WEEK 7

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

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!

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 on the different processing steps; Cupping: scent/flavor profiles; panel test trial

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
- Uylaşer, 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.

Learners will perform a panel test evaluating some samples of EVO Oil.

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 Liqueurs (Limoncello). *J. Agric. Food Chem.* **2003**, *51*, 4978-4983
- Śliwińska, M.; Wiśniewska, 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.

In the kitchen lab students 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.

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 final exam see “*course requirement*” section