

SPU 27.1x

Science and Cooking: From Haute Cuisine to Soft Matter Science

This course will discuss concepts from the physical sciences, especially chemistry, that underpin both everyday cooking and haute cuisine. Each week we will visit, or be visited by, one or more world-famous chefs, who will show us the secrets of some of their remarkable creations. We will use these as inspiration to delve into the fundamental chemistry behind food and cooking. The chefs include José Andrés (*ThinkFoodGroup, Minibar, Jaleo*), Joanne Chang (*Flour Bakery, Myers and Chang*), Dominique Crenn (*Atelier Crenn*), Daniel Humm (*Eleven Madison Park*), Joan and Jordi Roca (*El Celler de Can Roca*), Enric Rovira (Master Chocolatier), Carme Ruscalleda (*Sant Pau*), and Bill Yosses (former White House Pastry Chef). There will also be demos and lectures by other leaders in the field, including Ferran Adrià (*El Bulli Foundation*), Dan Souza from America's Test Kitchen, authors Harold McGee (*On Food and Cooking, Keys to Good Cooking*) and Nathan Myhrvold (*Modernist Cuisine*), as well as food scientist Dave Arnold (*Cooking Issues*).

At the end of the course, students will be able to explain how a range of cooking techniques and recipes work, in terms of the chemical transformations of food.

Instructors

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Prerequisites

Knowledge of high school physics and chemistry will be useful, but not required. We want everyone to be able to start and successfully complete this course without prior knowledge. Background material will be supplied in the form of review videos and practice problems—though the course will be more challenging without a high school level knowledge of chemistry, students are encouraged to explore the review materials and use the discussion forums to ask questions. Your fellow students can be great teachers, too!

Course Overview

The course is divided into six weeks, each focusing on a scientific topic and visiting chef(s). Every week includes interactive video sequences and practice problems, as well as a homework, and a lab. Most learners should be able to complete the course requirements in 5-7 hours per week over six weeks. There are no exams.

To pass the course, you will complete the homework and labs by the due dates. In addition, you will

carry out a final project in which you conduct your own scientific study of some recipe or aspect of cooking. You will perform both the labs and final project in your own kitchen, or visit a friend or family member to complete the experiments together! Once you have finished the experiment for the week, you can eat the results of your lab and share them with your friends and family.

Weekly Schedule

The table below outlines the scientific topics, visiting chefs, and labs for each week.

Week	Visiting Chefs	Lab
Week 1: Food components and flavor	Daniel Humm (Eleven Madison Park) Joann Chang (Flour bakery)	Calibrate your equipment, and make a cola drink!
Week 2: Energy, temperature, and heat	Dave Arnold (Booker and Dax)	Heat transfer in beverages
Week 3: Phase transitions	Joan Roca (el celler de can Roca)	Phase transitions of fats
Week 4: Diffusion and spherification	Jose Andres (minibar) Dominique Crenn (Atelier Crenn)	Ceviche, diffusion in eggs
Week 5: Heat transfer	Carme Ruscalleda (Sant Pau) Nathan Myhrvold (author, <i>Modernist cuisine</i>)	Molten chocolate cake
Week 5: Candy and Chocolate	Joann Chang (Flour bakery) Enric Rovira (master chocolatier)	Final Projects!

Interactive Lectures

Each week we present an interactive video sequence, interspersed with online exercises and practice problems to help you test your learning as you watch the videos. Participation in these online exercises does not contribute to your grade.

Textbooks

Two texts will be useful for this course; both are supplemental, not required. Each week, **recommended, but not required**, readings will be posted from these books.

On Food and Cooking, Harold McGee, Scribner, 2004 (2nd edition)
Science and Cooking: A Companion to the Harvard Course, 2015

On Food and Cooking will significantly enhance your understanding of this subject and serve as a truly invaluable resource and reference, both for this class and beyond. Harold McGee will join us throughout the class and give his insight into the subjects that we are studying.

Science and Cooking: A Companion to the Harvard Course is based on transcripts of the science videos and serves as a summary of the science that is covered in the course.

Homework

This class has five weekly homeworks. We encourage you to work through one homework every

week since this is the pace at which new lectures are being released. However, most due dates are set at the end the cours, ie Wednesday, May 31 at 11:59 pm UTC ([UTC time converter](#)), to give everyone a chance to submit their work for credit despite busy schedules or having enrolled in the class late. The one exception is that there are a few labs that have peer-graded assessments; these are due on Wednesday, May 24 at 11:59 pm UTC.

You can drop your lowest homework when calculating your final grade.

Labs

The first 8 weeks of the semester include a weekly lab that allows you to experiment with the scientific concept of the week in your own kitchen. As part of the lab you will make measurements and observations, and you will then be asked to submit these for credit. You will also complete different parts of a lab report each week, so that you can think more about the labs and practice scientific writing, which you will need for the final project report. You can also opt to take a picture of your lab and share it with your peers. Since the labs illustrate concepts discussed in the lecture material for each week, we encourage you to work through them in conjunction with watching the lectures.

Final Projects

The last week of the course will have no labs, but will instead be devoted to final projects. You will carry out your own scientific study of some recipe or aspect of cooking in your own kitchen. Guidelines and further information about the final projects will become available during week 6 of the course.

Discussion Forum

Participation in the discussion forums is optional, and we encourage students to use the discussion forum to ask questions about concepts from lectures, lecture exercises and labs, and to post photos of their lab results each week. You should *not* directly discuss answers to homeworks or post walk-throughs of the solutions.

The course staff and Community Teaching Assistants who have taken the course in the past moderate the forum, and we encourage students to answer each other's questions and upvote helpful answers. For some useful tips on how to navigate the discussion forum, please see, ["Participating in Course Discussions" in the EdX Learner's guide](#).

Grading

A passing grade in this class corresponds to successful **completion of 60%** of the assignments. The grade breakdown is as follows:

<i>Homework (5 total, drop lowest score)</i>	35%
<i>Lab (5 total, drop lowest score)</i>	35%
<i>Final project</i>	30%

Certification

Online learners who demonstrate mastery of SPU27x course materials with a passing grade may earn an ID verified certificate of completion, which EdX will issue for a fee.

Other books and resources

The following books cover various aspects of the science contained in the course:

The Science of Good Cooking, America's Test Kitchen

The Science of Cooking, Peter Barham

The Science of Chocolate, Stephen T. Beckett

Cookwise, Shirley Corriher

Keys to Good Cooking, Harold McGee

The Curious Cook, Harold McGee

Modernist Cuisine, Nathan Myhrvold, Chris Young, and Maxime Billet

Ratio, Michael Ruhlman

Several of the guest lecturers have written cookbooks, which may be of interest:

A Day at El Bulli, Ferran Adrià

A Perfect Finish: Special Desserts for Every Occasion, Bill Yosses

Atelier Crenn: Metamorphosis of Taste, Dominique Crenn

Eleven Madison Park, Daniel Humm and Will Guidara

CR20: 20 Years of Sant Pau, Carme Ruscalleda

Flour: Spectacular Recipes from Boston's Flour Bakery + Café, Joanne Chang

Flour, too: Indispensable Recipes for the Café's Most Loved Sweets and Savories, Joanne Chang

I Love New York: Ingredients and Recipes, Daniel Humm and Will Guidara

Liquid Intelligence: The Art and Science of the Perfect Cocktail, Dave Arnold

Made in Spain, José Andrés

Sous vide Cuisine, Joan Roca

For a more advanced discussion of the scientific topics in the course:

Physical Chemistry of Foods, Pieter Walstra