SPU 27.2x
Science and Cooking:
From Haute Cuisine to Soft Matter Science

This course will discuss concepts from the physical science that underpin both everyday cooking and haute cuisine. During each module, 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 physical principles behind food and cooking. The chefs include Bill Yosses (former White House Pastry Chef, *Perfect Pie*), Mark Ladner (*Pasta Flyer*), Joanne Chang (*Flour Bakery, Myers and Chang*), Carles Tejedor (*By*, *Oillab*), Nandu Jubany (*Can Jubany*), Joan and Jordi Roca (*El Celler de Can Roca*), Enric Rovira (Master Chocolatier), Carme Ruscalleda (*Sant Pau)*, and Wylie Dufresne (Du's Donuts, formerly of *wd~50* and *Alder*). There will also be demos and lectures by other leaders in the field, including Dan Souza of America's Test Kitchen, Ted Russin of the Culinary Institute of America, authors Harold McGee (*On Food and Cooking, Keys to Good Cooking)* and Nathan Myhrvold (*Modernist Cuisine* and *Modernist Bread*), and Harvard University Dining Service's own Martin Breslin.

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 physical and 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 modules, each focusing on a scientific topic and visiting chef(s). Every module 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 end of the course. 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 each module (or your final project), you can eat the results and share them with your friends and family.

Schedule
The table below outlines the scientific topics, visiting chefs, and labs for each module in the course.

Module	**Visiting Chefs**	**Lab**
Module 1: Elasticity	Bill Yosses Mark Ladner	Measure the elastic modulus of foods
Module 2: Viscosity	Martin Breslin Carles Tejedor	Viscosity of macaroni and cheese
Module 3: Emulsions and Foams	Nandu Jubany	Volume fraction in mayonnaise, egg white foam
Module 4: Advanced phase behavior	Joan Roca Enric Rovira	Ice cream and freezing point depression
Module 5: Enzymes	Wylie Dufresne Ted Russin	Browning reactions in fruits and vegetables
Module 6: Baking	Joann Chang Christina Tosi	Final Projects!

Interactive Lectures
In each module, 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 practice problems and other exercises does not contribute to your grade.

Textbooks
Two texts will be useful for this course; both are supplemental, not required. **Recommended, but not required**, readings will be posted from these books for each module.

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 homework assignments. We encourage you to work through one homework each week if you want to complete the course in six weeks. However, all due dates are set at the end the course to give everyone a chance to submit their work for credit despite busy schedules or

having enrolled in the class late.

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

Labs
The first 5 modules of the course include labs that allow you to experiment with the scientific concept in your own kitchen. As part of each 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 in each module, 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 module, we encourage you to work through them in conjunction with watching the lectures.

Final Projects
The last module 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 are posted alongside the materials for Module 6.

Discussion Forum
Participation in the discussion forum 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 result. 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:

Homework (5 total, drop lowest score)	35%
Lab (5 total, drop lowest score)	35%
Final project	30%

Certification
Online learners who demonstrate mastery of SPU27.2x 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