



## Master Syllabus SCI 125SC

### The Science of Cooking

#### Course Description:

This course aims to introduce students to topics in biology and chemistry through an examination of the many facets of the science of cooking. Students will learn and use methods of scientific discovery / inquiry, as well as disciplinary methods of chemistry, biology, and physics, to better understand the molecular basis of and importance of science in food, nutrition and cooking. 3 credit hours

#### Prerequisite:

None

#### Textbook:

Provost, J.J., Colabroy, K.L., Kelly, B.S., and Wallert, M.A. *The Science of Cooking: Understanding the Biology and Chemistry Behind Food and Cooking*, 1<sup>st</sup> edition. Hoboken, New Jersey: John Wiley and Sons, Inc., 2016. ISBN: 978-1-118-67420-8

#### Learning Outcomes:

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

1. Apply basic scientific principles and processes in the context of learning biological and chemical content on *guided inquiry activities, lab reports and exams*.
2. Develop knowledge and practice in how science is conducted on *guided inquiry activities and lab reports*.
3. **Support decisions using rigorous arguments based on criteria and evidence using science-related concepts and their applications** on *guided inquiry activities and lab reports*. **CT 3**
4. **Interpret data presented in tables or graphs** to arrive at evidence-based conclusions on *guided activities assignments, lab reports and exams*. **QS 2**
5. **Analyze biological systems and their interrelationships** using scientific theory and experimental results on *guided activities assignments, lab reports and exams*. **SC 1**
6. **Evaluate scientific theories using scientific principles** on *guided activities assignments, lab reports and exams*. **SC 3**
7. Demonstrate the Saint Leo core values of Community and Respect while working with classmates to share data, communicate scientific findings and provide constructive feedback to peers on *guided inquiry activities and lab reports*. **Community and Respect**

#### Core Value:

This class will focus on the core values of **respect** and **community**. Students will explore the core value of **community** and how this core value applies to the sharing of scientific data,

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communication of that data with others and the **respect** required when working with fellow scientists. These values foster an understanding of the natural world around us as well as the scientific community that studies the natural world.

**Assessment Method:**

<b>Assignment:</b>	<b>Points:</b>	<b>Percentage:</b>
Guided Inquiry Activities	10 @ 20 points each	35%
Discussion Posts	8 @ 10 points each	10%
Laboratory Reports	3 @ 50 points each	15%
Exams	4 @ 100 points each	40%
<b>Total:</b>	830 points	100%

A final course grade will be based upon the following:

A	94 – 100%	C-	70 – 73%
A-	90 – 93%	D+	67 – 69%
B+	87 – 89%	D	60-66%
B	84 – 86%	F	Less than 60%
B-	80 – 83%	FA	Failure to Absences
C+	77 – 79%	I	Incomplete
C	74 - 76%		

**Guided Inquiry Activities** – Each module students will complete 1-2 process-oriented guided inquiry activities (POGILs). These specially-designed activities are intended to guide students through an exploration to construct understanding of material. Each activity selected will complement the readings for that module to increase understanding of the material. Learning Outcomes 1-7.

**Discussion Posts** – There is a total of one Discussion per module. Discussion posts will be assessed based upon: the comprehension of the content under discussion, language conventions, grammar and mechanics and how well you engage with your peers. Three of your discussions during the term will require you to carry out a lab “experiment” at home. For these discussions, you will additionally be assessed on your contribution to the laboratory data for your classmates as well as the timeliness of your contributions.

**Laboratory Reports** – During the term there will be 3 “experiments” conducted in either the classroom or home kitchens. While not a true “laboratory,” the expectation is that students will apply critical thinking and data analysis skills as though they were working in a true laboratory setting. Results will be reported in laboratory reports upon completion of data collection. Please see the Laboratory Report Instructions/Rubric at the end of this document for more details. Learning Outcomes 1-7.

**\*\*UE Key Assignment will be Lab Report 3 \*\***

You must submit your Lab Report 3. Students who do not submit the assignment will receive a zero. This is a key assignment assessment; the results are used to ensure students are meeting University Exploration program goals.

**Lab Report Instructions:**

**A. Title of exercise**

Describe in a single sentence the experiment that you carried out; making sure that the title is fully descriptive of the exercise you carried out.

**B. Aim/Objectives/Hypothesis**

Provide sufficient background information to orient your reader to the laboratory that you performed. Then, describe in a couple of sentences the aim(s) of the experiment. Please don't restate what you did; however, mention WHY you did it. For example, “This lab was

performed to assess the effect of sunlight exposure on tomato plants.” Your hypothesis should be an if/then statement. “If tomato plants are given unlimited sunlight, then we would expect them to grow to taller compared to plants that are only exposed to 12 hours of sunlight per day.”

### **C. Methods**

Describe how you conducted your experiment. The methods section should be a detailed description of the methods you used for investigating your hypothesis. It should include a description of any equipment used, the timing of your experiments, the protocol for your experiments, etc. You want to include enough detail that another scientist could replicate your experiments following the information you provide.

### **D. Results**

The results section will include any observations made, data collected, etc. You should both describe the observations, data, etc. in words, and include graphs, photographs, and/or figures to enhance your results section. The narrative part of this section should be brief. Concisely state what you did, how you did it, and the experimental results you obtained. Do not restate the methods used. Start with an overview statement of the general trend in your data and then go into more detail about individual data points, averages, etc. that will present a full picture of your results. You should use the text to describe the patterns, trends, etc. that you observe in your visuals (graphs, figures, etc.) and draw the reader's attention to these trends. It is helpful to clue the reader into the fact that you're discussing one of your figures by using notations such as "As illustrated in Figure 2...." You should NOT discuss whether or not your results support your hypothesis or not in the results section; save this assessment for the discussion section of your report. Here you would report a trend in the growth of tomato plants, but not what those results mean in terms of your hypothesis (sunlight did or did not help the tomato plants grow taller).

### **E. Discussion**

Critically evaluate the results & discuss their significance. The discussion section should begin with a discussion of how/if your results support or reject your hypothesis. Following this sentence, you should discuss the major results of the experiment/investigation and go into more detail about how these results support, reject, or modify your original hypothesis. Present a rational analysis of your results. The idea is not to summarize your results (you should have already done that in the previous results section), but instead consider reasons underlying your results. What do your results tell you? Did the experiment work as planned? If not, explain why not? Pay particular attention to any positive or negative controls that were used! Were the values observed higher or lower than expected? Did any errors occur, or were there inherent problems in the experimental procedure? Discuss the significance of the experiment. Finish this section with conclusions that “wrap up” your report. Are there any remaining questions? Were there new questions raised by your investigation? What might you have done differently if you had the chance to do the experiment again?

**Exams** – There will be four exams during the term covering the previous two modules' material. Exams may include multiple choice, fill in the blank, true or false, and short answer essay questions. Learning Outcomes 1, 4-6.

### **Assessment of the Learning Outcomes:**

Course Learning Outcome	Assessment Method
1	Guided inquiry activities, lab reports, exams
2	Guided inquiry activities, lab reports
3	Guided inquiry activities, lab reports
4	Guided inquiry activities, lab reports, exams

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5	Guided inquiry activities, lab reports, exams
6	Guided inquiry activities, lab reports, exams
7	Guided inquiry activities, lab reports

## Course Schedule

### Module 1 Science of Food and Cooking

**Objectives** When you complete this module, you should be able to:

- Compare and contrast elements, compounds and molecules.
- Distinguish between different types of bonds that are important in cooking.
- Describe hydrogen bonds and their importance in water. Discuss water's unique characteristics and how they can affect cooking

**Readings** Chapter 1

### Assignments

Items to be Completed:	Due No Later Than:
Post an introduction to the class	Thursday 11:59 PM EST/EDT
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Guided Inquiry: Elements, Compounds and Molecules	Sunday 11:59 PM EST/EDT
Submit Guided Inquiry: Bonding	Sunday 11:59 PM EST/EDT

### Module 2 Milk and Ice Cream (Carbohydrates and Fat)

**Objectives** When you complete this module, you should be able to:

- Explain pH and how it relates to acids and bases.
- Differentiate intermolecular forces in fats (hydrophobic molecules) from previous bonds that have been discussed.
- Relate milk's properties to its proteins, sugars and fats.
- Develop knowledge and practice in how science is conducted by completing the data collection step for a laboratory report.
- Apply basic scientific principles and processes in the context of discussing: elements, bonds, milk and ice cream.

**Readings** Chapter 3

A review of Chapter 1, especially pages 26-54, may be helpful.

### Assignments

Items to be Completed:	Due No Later Than:
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Guided Inquiry: pH	Sunday 11:59 PM EST/EDT

Submit Guided Inquiry: Fat Structure and Properties	Sunday 11:59 PM EST/EDT
Complete Exam 1 (Modules 1 and 2 only)	Sunday 11:59 PM EST/EDT

### Module 3 Eggs, Custards and Foams (Protein Structure, Protein Denaturation, Fats, Pasteurization)

**Objectives** When you complete this module, you should be able to:

- Describe the structure of fats and how this structure dictates its behavior in food and cooking.
- Classify the different parts of the egg, relating this to what an egg is from a biological standpoint.
- Discuss protein denaturation that results from cooking and agitation and how this can be used to make particular egg-based foods.
- Support decisions using rigorous arguments based on criteria and evidence using science-related concepts and their applications and interpret data presented in tables or graphs to arrive at evidence-based conclusions in the analysis and reporting of lab report data.

**Readings** Chapter 9

Feel free to review Chapter 1 if you need a refresher on acids/bases/pH, proteins, or lipids/fats.

#### Assignments

Items to be Completed:	Due No Later Than:
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Guided Inquiry: Eggs	Sunday 11:59 PM EST/EDT
Submit Lab: Ice Cream – Report Due	Sunday 11:59 PM EST/EDT

### Module 4 Browning (Enzymes/Chemical Reactions)

**Objectives** When you complete this module, you should be able to:

- Relate chemical reactions and enzymatic processes to the different browning that occurs in food.
- Develop knowledge and practice in how science is conducted by completing the data collection step for a laboratory report.
- Apply basic scientific principles and processes in the context of discussing: protein denaturation, fats, chemical reactions and enzymes.

**Readings** Chapter 6

#### Assignments

Items to be Completed:	Due No Later Than:
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Guided Inquiry: Browning	Sunday 11:59 PM EST/EDT

Complete Exam 2 (Modules 3 and 4 only)	Sunday 11:59 PM EST/EDT
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## Module 5 Meat and Fish (Muscle Fibers, Protein Denaturation, etc.)

**Objectives** When you complete this module, you should be able to:

- Describe the structure of proteins and their amino acid building blocks.
- Relate meat structure to its functional properties.
- Discuss the changes to meat that occur during cooking.
- Compare and contrast red meats to the organization of “meat” from fish.

**Readings** Chapter 8

### Assignments

Items to be Completed:	Due No Later Than:
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Guided Inquiry: Amino Acids and Proteins	Sunday 11:59 PM EST/EDT
Submit Lab: Fruit Browning – Report Due	Sunday 11:59 PM EST/EDT

## Module 6 Bread, Cake and Pastry (Protein Structure, Fermentation, Gas Laws, Leavening Agents)

**Objectives** When you complete this module, you should be able to:

- Describe the structure of proteins.
- Detail the features of carbohydrates: monosaccharides, disaccharides, and polysaccharides.
- Relate bread structure and properties to its protein and carbohydrate components.
- Develop knowledge and practice in how science is conducted by completing the data collection step for a laboratory report.
- Apply basic scientific principles and processes in the context of discussing: amino acid and protein structure, carbohydrates, and bread structure and organization.

**Readings** Chapter 10

### Assignments

Items to be Completed:	Due No Later Than:
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Guided Inquiry: Carbohydrates	Sunday 11:59 PM EST/EDT
Complete Exam 3 (Modules 5 and 6 only)	

## Module 7 Sweets: Chocolates and Candies (Carbohydrates, Candy making temperatures)

**Objectives** When you complete this module, you should be able to:

- Detail the components of chocolate and how this relates to its properties.
- Describe the process of chocolate tempering on a molecular level.

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- Classify the different types of sugars and how they can be used in different types of cooking/baking.
- Support decisions using rigorous arguments based on criteria and evidence using science-related concepts and their applications and Interpret data presented in tables or graphs to arrive at evidence-based conclusions in the analysis and reporting of lab report data.

## Readings Chapter 13

### Assignments

Items to be Completed:	Due No Later Than:
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Guided Inquiry: Chocolate Properties	Sunday 11:59 PM EST/EDT
Submit Lab: Cookies – Report Due <b>** UE Key Assignment **</b>	Sunday 11:59 PM EST/EDT

## Module 8 Metabolism of Food: Microorganisms and Beyond (Cell structure, respiration)

**Objectives** When you complete this module, you should be able to:

- Relate chemical reactions and enzymatic processes to the different browning that occurs in food.
- Develop knowledge and practice in how science is conducted by completing the data collection step for a laboratory report.
- Apply basic scientific principles and processes in the context of discussing: protein denaturation, fats, chemical reactions and enzymes.

## Readings Chapter 4

### Assignments

Items to be Completed:	Due No Later Than:
Post an initial response to the discussion question	Thursday 11:59 PM EST/EDT
Post responses to at least two classmates	Sunday 11:59 PM EST/EDT
Submit Guided Inquiry: Cells and Metabolism	Sunday 11:59 PM EST/EDT
Complete Exam 4 (Modules 7 and 8 only)	Sunday 11:59 PM EST/EDT