

# AOM 2063: Chocolate Science and Engineering for a More Just Society (12/08/25 version) Quest 2

## I. General Information

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### Class Meetings

- Spring 2026
- M-W-F period 3, 9:35 am – 10:25 am
- Location Larsen Hall 310.

### Instructor

- Jose I. Reyes De Corcuera
- Frazier-Rogers 273
- M-W after class (11:00 am – 12:00 noon) or by appointment
- [jireyes@ufl.edu](mailto:jireyes@ufl.edu)

### Graduate Teaching Assistant

- Matt Chang
- [szuchengchang@ufl.edu](mailto:szuchengchang@ufl.edu)

### Course Description

A large portion of the foods that we eat comes from other countries. We worry about the safety and quality of the food we buy, but we do not reflect very often on where and how it was produced. Unaware, we enjoy food that is produced by individuals who live in poverty. ***How can innovations in biology and engineering contribute to more equitable modes of food production (e.g., chocolate)? How can each of us contribute to the effective deployment of practical technologies to improve the livelihood of people we may never directly interact with?*** Using cacao and chocolate as an example, this Quest 2 course will provide you with a holistic view of the global food supply chain. With an emphasis on biological sciences, you will learn how different fields of science and engineering are applied to produce sound agricultural practices and to develop the processing technologies used today to make fine flavor chocolate. You will identify opportunities for technology development at the interface of biological sciences, chemistry, engineering, economics, and social sciences. You will also gain a critical understanding of the socioeconomic

and political hurdles that exist both, in developing and developed countries. Through a set of active learning activities and reflections focused on plant biology, biochemistry, microbiology, and biological engineering, you will meet and interact with other UF students from different majors but with a common passion for humanity and chocolate to address these pressing questions. You will have the opportunity to interact remotely with researchers and students from other countries, and yes, you get to eat chocolate in this course. As a group, we will make our own chocolate bar starting from cacao beans and use this experience as a metaphor for building a more just society.

## Quest and General Education Credit

- Quest 2

*This course accomplishes the [Quest](#) objectives of the subject areas listed above. A minimum grade of C is required for Quest credit. Courses intended to satisfy Quest requirements cannot be taken S-U.*

## Required Readings and Works

Coe, S.D, and Coe, M.D. (2013) *The True History of Chocolate* (3<sup>rd</sup> ed). Thames & Hudson Ltd. London. ISBN 978-0-500-29068-2.

Brenner, J.G. (2000) *The Emperors of Chocolate: Inside the Secret World of Hershey and Mars*. Broadway Books, NY. ISBN 0-7679-0457-5

Materials and Supplies Fees: n/a

## II. Graded Work

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### Description of Graded Work

All graded work must be submitted by the deadline indicated in Canvas. Late submissions will be penalized as follows:

10% for submissions submitted within 24 hours of the deadline

50% for submissions submitted between 24 and 72 hours

No submissions will be accepted 72 hours after the deadline.

### Theme Reflection Assignment

Theme reflections are designed to help students realize the broad multidisciplinary nature of and to understand the contribution of science and technology to the food supply chain in the historical and current context of cacao and chocolate. Students will be able to identify gaps of knowledge in science as well as the needs for the development and/or transfer of technology. With that understanding, students will be able to formulate hypotheses or statements of need and propose strategies that mitigate poverty and social inequities through the use of technology. The historical perspective will help students recognize how societal factors influence the outcomes of technological interventions, including unintended consequences and unanticipated human reactions to well-intentioned contributions. Theme reflections are

**one-page**, 12-size font, single-spaced, 1-inch margins all around. The student's name must appear on the top margin. Use one separate paragraph for each of the items that appear on the grading rubric for this assignment.

All reflections must be submitted, but only three of the submitted reflections will be graded. You will be told in advance which reflections will be graded. Failure to submit a non-graded reflection will result in a 50% deduction of your grade on the following or previous reflection.

## Short Reading Assignments and Storytelling.

Reading assignments are intended to complement and contextualize what is taught in the course. Scientific and technological developments occur within a historical context. To better understand that context, two books will be covered: **The True History of Chocolate** (THC) by Sophie D. Coe and Michael D. Coe (3<sup>rd</sup> Edition) and **The Emperors of Chocolate: Inside the Secret World of Hershey and Mars** (EC) by Joël Glenn Brenner. Teams of 3 or 4 will be randomly created by the instructor on week 2 after the drop/add deadline. At that time, each team will be assigned the presentation of one of the reading assignments. At the beginning of the second period of this course, teams will present their reading using the following format:

1. Ten-minute narrative of the chapter(s) using a PowerPoint presentation (**no notes allowed**, students must stand away from the computer). The narrative should include the historical context. In other words, the time period that is covered with examples of what was known or discovered in the fields of biology, chemistry, physics, and/or human health at that time. Students are encouraged to highlight items that are particularly unexpected or surprising because of their novelty, originality, or obsolescence. This will help us understand how science and technology, in particular, biological sciences, have evolved.
2. Slide presentation consisting of:
  - **Slide 1:** Title of the assigned reading, names, and majors of the students presenting.
  - **Slide 2:** Infographic that illustrates the reading. The goal of the infographic is to help the rest of the class understand and learn as much as possible about the content of that reading at a glance. The infographic should also help guide the storytelling of the theme. **Students must create the infographic.** Infographics downloaded from the internet are **not** acceptable. This item assesses students' creativity and **ability to synthesize ideas**. While this slide is on, students must summarize the reading and explain how each component of the infographic relates to the book chapter. The infographic can have **at most 50 words, including articles, pronouns, and prepositions**. One to five items in the infographic must represent a historical event, discovery or invention not mentioned in the book chapter but that occurred at about the same time of the chapter that is being discussed and must not have been presented by others.
  - **Slide 3:** Take-home message: the single most important aspect of the reading. Students must analyze, discuss, and interpret a few important things that they read, and they must explain **why the one thing that they selected is the most important**. In other words, why would the class want to learn the content of the assigned reading? All teams must start by stating **verbatim: "This is important because..."**. Students can expect exam questions that ask: Why is \_\_\_\_\_ discussed in \_\_\_\_\_ reading is important?
  - **Slide 4:** Your personal connection to the topic. A brief anecdote, cultural dimension, or story that makes you connect to the topic. Each team member must make an individual connection. Students must:
    - Start by making a statement about the aspect of the chapter covered he/she/they is/are referring to
    - Describe the personal experience or connection
    - Briefly clarifying the connection between the two.

All the chapters deal with cacao and/or chocolate. **Do not make trivial connections** such as: "The chapter reminded me of my grandma serving me hot cocoa" unless the chapter specifically describes a grandma serving her grandchild hot cocoa. An example of a good connection is: "I saw

- how difficult it was for \_\_\_\_\_ to set up his business. I also tried to set up a business and experienced first-hand some of the challenges just like when \_\_\_\_\_ tried to sell his chocolate to grocery stores.
- **Slide 5:** One multiple-choice question and one fill-in-the-blank question that are adequate for the exam. At least 10% of the grade for each exam will come from these questions. When you formulate the questions, ask yourself **why anyone would want to know this**. Make sure the answer is interesting to as many people as possible. When this slide is up, please explain why you chose these questions. You must also include the answers to these questions.

Presentations must be uploaded onto the Canvas **before class presentations** to share with the rest of the group. **All documents uploaded onto Canvas must be typed and saved in .pptx or .pdf format.** I cannot read other formats. At least one representative of students presenting **must show up to class 10 min before the beginning**, bring a portable USB drive to upload the presentation to the computer or must be able to download the presentation from the cloud and be ready by the time class begins.

Presentations will be judged by student peers using a survey that follows the rubric below. 50% of the grade will be based on peer assessment, and 50% will be based on the instructor's assessment

Students who listen to the presentation should formulate good questions for the presenters. At least one student from each team scheduled to present one week later must ask a good question to the presenters. The instructor will take off points from teams who do not ask questions.

## Other Short Assignments

Other short assignments are due every other week, alternating with theme reflections. These assignments must be done in teams of 2 or 3. Students must take a selfie picture of the team doing the assignment together. Remote collaboration does NOT count. Only one submission is needed. Use the cover page template for this assignment, which can be found in Canvas. Make sure that you include all the names on your submission. Also, each assignment must be done with different people. This assignment is intended for each student to meet and “work” with at least 6 individuals.

## Exams

Written exams have four sections. Section I is designed to assess your **knowledge** in the form of 10 multiple-choice and fill-in-the-blank type questions. Section II is designed to assess your **knowledge** and your **ability to communicate** clearly and concisely in the form of 10 short full-sentence answers to specific questions. Section III has 5 questions designed to assess your understanding of concepts through **associations and connecting concepts to themes**, grouping, and classifying elements of the lectures. Section IV is designed to assess your critical thinking and communication skills in the form of short paragraph answers to 4 thematic and application questions. In other words, I will assess whether you can **analyze, extend, and apply concepts** learned in class to scenarios not covered in class.

## Non-Graded Items: “My Questions” and “Quizzes”

Each theme starts with students formulating a set of questions that are intended to trigger curiosity, enhance student learning, and inform the instructor of student interests. “My Questions” assignment will be filled out and submitted in class.

Practice multiple-choice quizzes are not graded but will help students prepare for the exam. The first week of classes will not require passing a quiz. You only have five attempts to pass the quizzes. Therefore, taking the quizzes indirectly will help you prepare for the exams.

- Attendance (taken at least once a week) 5%
- Assignments [3 graded theme reflections (12%, 4% each) + 7 short assignments (13%, ~1.9% each)] 25%
- Reading assignments/presentations (They should be awesome!) 20%
- Peer assessment of participation in presentation assignment 5%
- Exam 1 15%
- Exam 2 15%
- Exam 3 (Final) 15%

## Grading Scale

For information on how UF assigns grade points, visit: <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

Calculated decimal grades will be rounded up or down using a two-digit criterion. In other words, if your calculated final grade is 93.50 your grade will be 94 or A. If your grade is 93.49 your grade will be 93 or A-.

A	94 – 100%		C	74 – 76%
A-	90 – 93%		C-	70 – 73%
B+	87 – 89%		D+	67 – 69%
B	84 – 86%		D	64 – 66%
B-	80 – 83%		D-	60 – 63%
C+	77 – 79%		E	<60

## Grading Rubric(s)

### Theme Reflection Rubric

Item	Grading		
	In your own words state the theme that was discussed over the last two weeks of lectures.	The theme is correctly stated (1 point).	The theme is inaccurately stated (0.5 points).
List the biological, biochemical, chemical, physical, and/or engineering principle that was/were covered	At least one of the scientific or engineering principle(s) is correctly listed (1 point).	A scientific principle is listed but somewhat incorrectly. (0.5 points).	No scientific or engineering principle is listed (0 points).
Reflect on how that principle contributes to the quality and economic value of cacao and or chocolate	A clear reflection of the contribution of the scientific or engineering principle to the quality and economic value of cacao is written (2 points).	An unclear reflection of the contribution of the scientific or engineering principle to the quality and economic value of cacao is written (1 point).	No reflection of the contribution of the scientific or engineering principle to the quality and economic value of cacao is written (0 points).

Reflect on any historical event that affected our understanding of these principles	A clear reflection of historical events that led to the discovery and use of these principles (2 points).	An inaccurate or incomplete reflection of historical events that led to the discovery and use of these principles (1 point).	No reflection of historical events that led to the discovery and use of these principles (0 points).
Briefly discuss how these principles apply to other biological systems, including other agricultural products	A clear discussion of how these principles apply to other biological systems (2 points).	A vague discussion of how these principles apply to other biological systems (1 point).	No discussion of how these principles apply to other biological systems (0 points).
Identify gaps of knowledge or needs for technology development or transfer of technology or the creation of infrastructure that would help increase the incomes of cacao smallholders	A gap of knowledge or a need for technology development or transfer of technology or the creation of infrastructure that would help increase the incomes of cacao smallholders is clearly identified (1 point).	A gap of knowledge or a need for technology development or transfer of technology or the creation of infrastructure that would help increase the incomes of cacao smallholders is vaguely identified (0.5 points).	No gap of knowledge or a need for technology development or transfer of technology or the creation of infrastructure that would help increase the incomes of cacao smallholders is identified (0 points).
Briefly state any additional learning that caught your attention from student presentations, other assignments, or experiential learning activities.	Additional relevant learning is reported clearly (1 point).	Additional learning is reported but it is not very relevant, or it is not reported clearly (0.5 points).	No additional learning was reported (0 points).

### Short Presentation Rubric

Each student in the team must present a part of the reading and all students must participate equally. The presentation must be logical and must be completed in 10 ± 1 min. One point will be taken off for each minute difference from 10 ± 1 min. If any of the required items are absent, a grade of “0” will be given to that item. 50% of the grade will be based on peer assessment and 50% on the instructor’s assessment.

Item	Grading			
<b>Presentation Quality</b>	Very clear (verbal and graphic), logical, and engaging (2 points).	Somewhat clear (verbal and graphic). Some of what the presenters said was not very clear and/or some of the items on the slides were not easy to read. There is logic and the presentation is engaging (1.5 points).	Not very clear (verbal and graphic). I could not understand an important part of what the presenters were saying or could not read their slides very well. The organization was not very logical or engaging (1 point).	Unclear (verbal and graphic), illogical, or not engaging (0.5 points).
<b>Critique the bullet points that were provided as a take-home message</b>	Excellent take-home message. It is an excellent critical reflection of the importance of the reading and how one can potentially apply the content of the reading (2 points).	Good take-home message. It interprets very well the importance of the reading and how someone would be interested in this reading (1.5 points).	Take-home message not clearly connected to the narrative of the presentation or simply repeats what was presented without analysis or interpretation (1 point).	Very poor take-home message. It does not reflect any analysis of the importance of the reading. It would not trigger any interest in anyone (0.5 points).
<b>Personal Connection</b>	Excellent and clear connections between the topic and the personal experience of	Good connections presented by the students helped me to	The connections between the topic and the personal experiences are not clear or	The connections confused me. They do not appear to be related

	the presenting team. These connections helped me to make my own connection (2 points).	better recall the importance of the reading (1.5 points).	are trivial. It does not reinforce my learning or interest (1 point).	to the theme of the reading (0.5 points).
<b>Infographic quality</b>	Excellent infographic. In a snapshot, it synthesizes and interprets the reading. It will definitely help me remember the narrative (2 points).	The infographic represents very well the topic. I can see the key elements of the reading and it will help my learning (1.5 points).	The infographic somewhat represents the topic, but not all the key elements of the reading are clearly represented. I can readily suggest improvements (1 point).	The infographic poorly represents the topic and the important information is missing or it is difficult to link the image to the concepts of the reading (0.5 points).
<b>Quality of the questions</b>	Excellent questions and answers. They truly assess the learning of something important (2 points).	The question and answers are clear and fair (not too easy, not too difficult). They are relevant (1.5 points).	The questions and answers are not perfectly clear. They focus on an aspect of the reading that is not very important (1 point).	The questions and answers are not appropriate for the exam (0.5 points).

### Participation Rubric

Part of your participation grade will be based on your contribution to your team assignment, which requires a PowerPoint document and its presentation. Your peers will assess your performance using a survey that your peers will fill out online. Your participation grade will be 5% for 17-20 points, 4% 13-16 points, 3% 9-12 points, 2% 5-8 points, 1% 1-4 points, and 0% for 0 points or no show for the presentation or for not submitting a peer evaluation.

	<b>Excellent (4 points)</b>	<b>Good (3 points)</b>	<b>Average (2 points)</b>	<b>Insufficient (1 points)</b>	<b>Unsatisfactory (0 point)</b>
<b>Quality of the contribution:</b> Provided sound insights to the discussion(s). His/her participation was very valuable to the preparation of the report and presentation.	Always and more than the rest of the team	Most of the time AND like everybody else on the team	Sometimes AND a little less than the rest of the team	Rarely AND much less than the rest of the team	Never
<b>Commitment to Team / Project:</b> Attends all meetings. Arrived on time or early. Prepared. Ready to work. Dependable, faithful, reliable. Positive attitude.	Always and more than the rest of the team	Most of the time AND like everybody else on the team	Sometimes AND a little less than the rest of the team	Rarely AND much less than the rest of the team	Never
<b>Leadership:</b> Took initiative, makes suggestions, and provides focus. Energetic? Has a "can do" attitude. Sparks creativity in others. Seeks consensus. Encourages and brings out the best in others	Always and more than the rest of the team	Most of the time AND like everybody else on the team	Sometimes AND a little less than the rest of the team	Rarely AND much less than the rest of the team	Never
<b>Responsibility:</b> Gladly accepted work and gets it done. Spirit of excellence. Makes the most of his or her abilities. Gives fully, doesn't hold back.	Always and more than the rest of the team	Most of the time AND like everybody else on the team	Sometimes AND a little less than the rest of the team	Rarely AND much less than the rest of the team	Never
<b>Communication:</b> Communicated clearly in writing and orally during the preparation and delivery of the presentation	Always and more than the rest of the team	Most of the time AND like everybody else on the	Sometimes AND a little less than the rest of the	Rarely AND much less than the rest of the	Never

		team	team	team	
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Modified From: <http://www.engr.sjsu.edu/nikos/courses/engr10/teamcard.htm>

### III. Annotated Weekly Schedule

Week	Topics, Homework, and Assignments
Week 1 1/12 – 1/16	<ul style="list-style-type: none"> <li>• <b>Topics:</b> Introduction – Syllabus From Rural Ecuador to Manhattan – A Trip to the Dissonant Economics of the Cacao/Chocolate Supply Chain. Part II.</li> <li>• <b>Summary:</b> This is an introduction to the history of cacao production and commerce. We will analyze the evolution of the economic value of cacao and chocolate and reflect spectrum of social realities of all the participants in the supply chain, and the globalization of the chocolate industry. We will reflect on the impact of science and technology on the cacao and chocolate industries. We will also overview the current sociopolitical situation of the major cacao-producing countries and the major chocolate-consuming countries.</li> <li>• <b>Required Readings/Works:</b> None.</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 1 lectures 10-question quiz on the syllabus and the topic. 2) Find a cacao or a chocolate book in the library.*</li> </ul>
Week 2 1/19 MLK Holiday 1/21 – 1/23	<ul style="list-style-type: none"> <li>• <b>Topic:</b> Under the Tropical Sun: Climate, Soil, Nutrients, and the Cacao Tree. Part I</li> <li>• <b>Summary:</b> We will cover the phylogenetics of cacao and its evolution as influenced by climate, and cacao pod physiology. We will overview the different systems of cacao production and recognize the need.</li> <li>• <b>Required Readings/Works:</b> The True History of Chocolate, Chapters 1 (16 pages) &amp; 2 (32 pages)</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 2 lectures 5-question quiz. 2) One-page reflection on Theme 1.</li> </ul>
Week 3 1/26 – 1/30	<ul style="list-style-type: none"> <li>• <b>Topic:</b> Under the Tropical Sun: Climate, Soil, Nutrients, and the Cacao Tree. Part II</li> <li>• <b>Summary:</b> We will discuss the organic and non-organic production of cacao in the context of economic and environmental sustainability, and overview international cacao breeding programs in response to demand for quantity, quality, and tolerance to diseases. Believe it or not, UF has developed excellent cacao varieties used in many cacao-producing countries. Finally, we will describe precision agriculture and identify opportunities to apply precision agriculture technologies to cacao production.</li> <li>• <b>Required Readings/Works:</b> The True History of Chocolate, Chapters 3 (41 pages) &amp; 4 (18 pages)</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 3 lectures 5-question quiz. 2) Use the Web of Science database to find a review paper on any of the dimensions of cacao production discussed in class. Upload the pdf file of that paper to Canvas.*</li> </ul>

Week	Topics, Homework, and Assignments
Week 4 2/2 – 2/6	<ul style="list-style-type: none"> <li>• <b>Topic:</b> Witches Broom and Other Scary Bugs and the Magic Potions that Destroy Them. Part I.</li> <li>• <b>Summary:</b> We will describe the main cacao pests, some mechanisms of plant infection as well as some mechanisms of plant defense, and how international multidisciplinary research in the U.S. and Europe has contributed to the fight against cacao diseases.</li> <li>• <b>Required Readings/Works:</b> The True History of Chocolate, Chapter 5 part I (26 pages) &amp; part II (25 pages)</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 4 lectures 5-question quiz. 2) One-page reflection on Theme 2</li> </ul>
Week 5 2/9 – 2/13	<ul style="list-style-type: none"> <li>• <b>Topic:</b> Witches Broom and Other Scary Bugs and the Magic Potions that Destroy Them. Part II.</li> <li>• <b>Summary:</b> Students will learn the pesticides and fungicides used in cacao production and the existence of different pesticide use regulations in different countries that have led to questionable practices. We will discuss how cacao diseases spread, and the need for mathematical modeling of biological systems. Students will discuss the impact of humans on the spread of cacao diseases.</li> <li>• <b>Required Readings/Works:</b> The True History of Chocolate, Chapters 6 (24 pages) &amp; 7 (33 pages)</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 5 lectures 5-question quiz. .2) Find a disease of a crop (not cacao) associated with your favorite food (other than chocolate). In 100 to 200 words, explain the impact of that disease. Consider impacts on hunger and malnutrition and other economic impacts.* <b>Exam 1 (on Friday)</b></li> </ul>
Week 6 2/16 – 2/20	<ul style="list-style-type: none"> <li>• <b>Topic:</b> Yeasts and Bacteria Gone Wild – A Well-Fermented Bean. Part I.</li> <li>• <b>Summary:</b> An overview of the history of fermentation across centuries and countries will be used to introduce the fundamentals of yeast and bacterial fermentations. Students will be introduced to microbial and plant enzymes, their mechanisms, kinetics, and their role in the development of chocolate flavor.</li> <li>• <b>Required Readings/Works:</b> The True History of Chocolate Chapters, 8 &amp; 9, (35 pages) The Emperors of Chocolate, Author Notes, and Chapter 1. (20 pages)</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 6 lectures 5-question quiz. 2) One-page reflection on Theme 3.</li> </ul>
Week 7 2/23 – 2/27	<ul style="list-style-type: none"> <li>• <b>Topic:</b> Yeasts and Bacteria Gone Wild – A Well-Fermented Bean. Part II.</li> <li>• <b>Summary:</b> We will discuss spontaneous and controlled fermentations and introduce students to “-omic” tools to characterize microbial fermentations. We will also discuss the need for biostatistics and bioinformatics. We will discuss different cacao fermenter designs and the scientific myths that have emerged from not applying the scientific method in the development of pseudo-knowhow.</li> <li>• <b>Required Readings/Works:</b> The Emperors of Chocolate, Chapters 2-4 (30 pages) &amp; 5 (22 pages).</li> </ul>

Week	Topics, Homework, and Assignments
	<ul style="list-style-type: none"> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 7 lectures 5-question quiz. 2a) Type a list of 5 fermented foods and indicate the microorganism involved in the fermentation. 2b) For one of these foods, state the culture and geographic location where that food is believed to have originated. Provide one refereed reference that supports the information you provide for item 2b.*.</li> </ul>
<p>Week 8</p> <p>3/2 – 3/6</p>	<ul style="list-style-type: none"> <li>• <b>Topic:</b> Chocolate - a Processed Food yet Nobody Complains About It! The Engineering Behind Modern Chocolate-Making. Part I.</li> <li>• <b>Summary:</b> Students will learn all the unit operations involved in chocolate making including drying, roasting, winnowing, and size reduction. Students will be introduced to the principles of heat transfer and Maillard reaction. These unit operations will be demonstrated in class.</li> <li>• <b>Required Readings/Works:</b> The Emperors of Chocolate, Chapters 6-8 (32 pages) &amp; 9 (28 pages).</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 8 lectures 5-question quiz. 2) One-page reflection on Theme 4.</li> </ul>
<p>Week 9</p> <p>3/9 – 3/13</p>	<ul style="list-style-type: none"> <li>• <b>Topic:</b> Chocolate - a Processed Food yet Nobody Complains about It! The Engineering Behind Modern Chocolate-Making. Part II.</li> <li>• <b>Summary:</b> Students will learn ingredient mixing, production of cocoa powder and cocoa butter, chocolate tempering, and 3D printing. The physics and chemistry of these processes will be discussed within the context of the manipulation of biological materials. Further demonstrations will be done in class.</li> <li>• <b>Required Readings/Works:</b> The Emperors of Chocolate, Chapters 10-11 (32 pages) &amp; 12-13 (32 pages).</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 9 lectures 5-question quiz. 2) Find UF experts in any of the 7 themes from this course and identify their research and the classes they teach.* <b>Exam 2 (on Friday)</b></li> </ul>
<p>Week 10</p> <p>3/23 – 3/27</p>	<ul style="list-style-type: none"> <li>• <b>Topic:</b> From Bean to Bar – The Physics and Chemistry of Chocolate. Part I.</li> <li>• <b>Summary:</b> We will cover cacao composition and discuss the chemistry of biological molecules. Students will be introduced to the need of analytical techniques to characterize complex biological matrices. This will complement the lecture on “-omics”. We will also discuss the role of ingredients in chocolate from a formulation perspective. We will have our first chocolate-tasting exercise in class.</li> <li>• <b>Required Readings/Works:</b> The Emperors of Chocolate, Chapters 14-15 (24 pages) and 16-17 (24 pages).</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 10 lectures 5-question quiz.2) One-page reflection on Theme 5.</li> </ul>
<p>Week 11</p> <p>3/30 – 4/3</p>	<ul style="list-style-type: none"> <li>• <b>Topic:</b> From Bean to Bar – The Physics and Chemistry of Chocolate. Part II.</li> <li>• <b>Summary:</b> Students will be introduced to the nutritional properties of chocolate. They will learn how to calculate nutrition facts based on composition. We will also discuss the role of ingredients and chocolate components from a nutritional perspective. Differences in chocolate product labeling requirements and differences in</li> </ul>

Week	Topics, Homework, and Assignments
	<p>the tolerance to the presence of heavy metals in chocolate in different countries will be discussed.</p> <ul style="list-style-type: none"> <li>• <b>Required Readings/Works:</b> The Emperors of Chocolate, Chapters 18-9 (23 pages) and 20-21 (30 pages).</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 11 lectures 5-question quiz. 2) On the Internet find the list of ingredients of 5 different chocolate bars with different cocoa percent, including white chocolate, milk chocolate, ~60% ~70% and ~90%. Make sure that these 5 bars are from different brands. In the form of a table, indicate the weight of the bar and record the following information from the nutrition facts panel: serving size, calories per serving, total fat, total carbohydrates, and total protein. In 100 to 200 words discuss your findings to answer the questions is chocolate a healthful food? How much chocolate should I eat every day?*</li> </ul>
<p>Week 12 4/6 – 4/10</p>	<ul style="list-style-type: none"> <li>• <b>Topic:</b> Chicken Soup or Chocolate for the Soul – The Psychophysics of Chocolate. Part I.</li> <li>• <b>Summary:</b> Students will be introduced to sensory science. They will learn the physiology and the psychology of taste. We will cover the principles of taste, texture, and aroma characterized by the human senses. We will discuss the most commonly used sensory analysis tests and carry out in class two tests.</li> <li>• <b>Required Readings/Works:</b> The Emperors of Chocolate, Chapters 22-23 (26 pages).</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 12 lectures 5-question quiz. 2) One-page reflection on Theme 6.</li> </ul>
<p>Week 13 4/13 – 4/17</p>	<ul style="list-style-type: none"> <li>• <b>Topic:</b> Chicken Soup or Chocolate for the Soul – The Psychophysics of Chocolate. Part II.</li> <li>• <b>Summary:</b> We will contrast how our human senses function and compare them to laboratory instruments. We will discuss the challenges associated with obtaining quantitative data from subjective measurements. We will further discuss the cultural and experiential factors that affect human sensory perceptions.</li> <li>• <b>Required Readings/Works:</b> Makeup presentations for teams wanting to raise their presentation grade.</li> <li>• <b>Assignments due on Friday by 5:00 pm:</b> 1) Week 13 lectures, 5-question quiz. 2) Go to your favorite grocery store and make a list of all the dark chocolate bars that you can find. Make sure you explore the ethnic or specialty foods aisle as well as the candy aisle. In a table format, record their brand, their price, their percent cocoa, their origin, their weight, and any designation such as “organic”. Using Excel, calculate their price per kilogram, and organize the data in increasing price per kilogram. In 100 to 200 words analyze and discuss your findings in particular in relation to price. Take a picture of yourself at the grocery store, holding one of the chocolate bars.*</li> </ul>
<p>Week 14</p>	<ul style="list-style-type: none"> <li>• <b>Topic:</b> What Tastes Better than Chocolate? – The Flavor of Global Social Justice and Equity.</li> </ul>

Week	Topics, Homework, and Assignments
4/20 – 4/22  4/24 Reading day	<ul style="list-style-type: none"> <li> <b>Summary:</b> Students will be introduced to development engineering. With the participation either live or through a recorded lecture, colleagues with extensive development experience, including members of the Global Food Systems Institute, students will discuss what was learned throughout the semester, and list the current sociopolitical and economic conditions of the cacao and chocolate supply chain. They will summarize the state-of-the-art technologies discussed in class and that are used across the cacao/chocolate supply chain and identify opportunities for improvement or for the transfer of technologies. This instructor and guest-guided reflection will lead to the recognition of the societal and political hurdles and provide resources to address them. </li> </ul>

\*Additional details, requirements, and an extended description of the assignment can be found on Canvas. Grading rubrics are also published on Canvas. Make sure you follow the details, including formatting (cover page), for all assignments.

## IV. Student Learning Outcomes (SLOs)

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At the end of this course, students will be expected to have achieved the [Quest](#) learning outcomes as follows:

**Content:** *Students demonstrate competence in the terminology, concepts, theories, and methodologies used within the discipline(s).*

- Identify, describe, and explain a) the terminology** associated with plant sciences, horticultural sciences, plant pathology, postharvest, food science, and process engineering used for the transformation of cacao into chocolate as well as the basic food and agricultural economics terminology; **b) the concepts** of plant genetics and physiology including biological, chemical, and physical, principles that drive cacao metabolism, the major components of chocolate and chocolate quality, plant pathogens, microbial growth and fermentations, heat and mass transfer during processing, and the economic and political forces that affect cacao producers' livelihoods **c) the theories** of climate-driven plant evolution, fundamentals of genetics for plant improvement, plant infection and spread of diseases, microbial growth, transport phenomena, sensory perception, enzyme function, engineering design, and transfer of technology, and **d) the methodologies used in** horticultural practices to maximize yield and ensure sustainability, pest and pathogen management, breeding for plant improvement, fermentation processes, chocolate processing technology, sensory analysis, and technology-driven humanitarian interventions (Gen Ed: Identify, describe, and explain the basic concepts, theories and terminology of natural science and the scientific method; the major scientific discoveries and the impacts on society and the environment; and the relevant processes that govern biological and physical systems. Quest: Identify, describe, and explain the cross-disciplinary dimensions of a pressing societal issue or challenge as represented by the social sciences and/or biophysical sciences incorporated into the course.) Student competency will be assessed through quizzes, exams sections I and II, written reflections, short presentations, and assignments.

**Critical Thinking:** *Students carefully and logically analyze information from multiple perspectives and develop reasoned solutions to problems within the discipline(s).*

- **Analyze** economic, historical, and scientific data to assess the polarization of wealth and correlate economic development with access to knowledge, technology, and capital. Identify opportunities and hurdles for technological developments and transfer of technologies that could increase the incomes of smallholders. **Analyze** the entire cacao/chocolate supply chain to identify gaps in knowledge and technology needs. **Formulate** testable research hypotheses and propose sound experiments or strategies for the transfer of technology understanding social, political, and cultural constraints. (Gen Ed: Formulate empirically testable hypotheses derived from the study of physical processes or living things; apply logical reasoning skills effectively through scientific criticism and argument; and apply techniques of discovery and critical thinking effectively to solve scientific problems and to evaluate outcomes. Quest: Critically analyze quantitative or qualitative data appropriate for informing an approach, policy, or praxis that addresses some dimension of an important societal issue or challenge.) Student competency will be assessed through in-class discussions, written reflections, and responses to exam questions in sections III and IV.

**Communication:** *Students communicate knowledge, ideas and reasoning clearly and effectively in written and oral forms appropriate to the discipline(s).*

- **Formulate, share, and select questions** relevant to each of the topics of the course. **Write** short reflections that clearly identify the technological challenges describe the biological dimension of the problem and propose how engineering and technology can contribute to creating a more just society. (Gen Ed: Communicate scientific knowledge, thoughts, and reasoning clearly and effectively. Quest: Develop and present, in terms accessible to an educated public, clear and effective responses to proposed approaches, policies, or practices that address important societal issues or challenges.) Student competency will be assessed through biweekly reflections, paragraph responses to questions in section IV of exams, and final group presentations (slides and oral communication).

**Connection:** *Students connect course content with meaningful critical reflection on their intellectual, personal, and professional development at UF and beyond.*

- **Connect** the fundamentals of biology, chemistry, physics, and engineering that were learned using cacao and chocolate to other global agricultural commodities. **Identify** areas of knowledge from student's own major that can potentially influence the supply chain of agricultural commodities and reduce domestic and global inequities. **Recognize** the international origins of knowledge and its dynamic exchange as a necessary mechanism to address poverty. **Realize** the unifying power of scientific discovery and technological development. (Quest: Connect course content with critical reflection on their intellectual, personal, and professional development at UF and beyond.) Student competency will be assessed through written reflections and group presentations.

## V. Quest Learning Experiences

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### 1. Details of Experiential Learning Component

Among several active learning components, this course has several experiential learning activities. In an assignment, each student must go to a grocery store and identify different types of chocolate bars. With the information that they collect they will analyze the added value of different products based on origin,

brand, and other components. Each student will reflect on the added value based on the current price of cacao. This information along with bi-weekly reflections on the course themes will help students formulate strategies to improve the livelihood of cacao smallholders through the transfer of technology at different stages of the supply chain. We will have several chocolate tasting sessions in which students will learn how to characterize the sensory attributes of chocolate and associate them with the genetics and the physiology of cacao as well as with the biochemical, chemical, and physical changes that cacao undergoes in its conversion to chocolate. We will have in-class demonstrations of how to make a chocolate bar starting from cacao beans. Volunteers from the class will help carry out all the processing steps. All students will experience the evolution of the aroma of the beans throughout the process. Students will write a metaphor or a poem that uses cacao transformation to describe the social stratification across the cacao/chocolate supply chain. Finally, students will interact via Zoom with researchers and/or students from cacao-producing regions in the form of a roundtable. Finally, students will make group presentations on assigned book chapters. During the presentations, each student makes a personal connection to the reading.

### **From bean to bar to mouth experiences**

<b>Week</b>	<b>Date</b>	<b>Activity</b>
5	2/13	The taste of fresh cacao
6	2/20	Tasting confections
7	2/27	Tasting Milk vs. Dark Chocolate
8	3/6	Roasting
9	3/13	Bean cracking
10	3/27	Winnowing
11	4/3	Grinding
12	4/10-13	Conching
13	4/15-17	Tempering and Molding
14	4/22	Tasting – triangle test - hedonic scale tasting

## **2. Details of Self-Reflection Component**

This course has two main self-reflection components. The course is divided into seven major themes. Every other week, at the end of the theme each student will write a brief one-page reflection on the social, scientific, and technological challenges identified in the theme through lectures and optional reading resources posted on Canvas. The reflections are centered on the core question of how biological sciences and engineering can contribute to increasing incomes, bringing prosperity to the poor, and building a more just society. In other words, each reflection must describe the biological dimension of the problem, how engineering and technology can contribute to addressing the problem, and how such a contribution could improve the incomes of smallholders and create a more just society. The compilation of these reflections will be used at the end of the semester as the foundation to formulate a priority list of research themes, formulate research hypotheses, and draft a research plan. The other reflection component is the personal connection that students must share with the class when they present their assigned book chapter(s).

## VI. Required Policies

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Please refer to the following link for details on UF required policies.  
<https://syllabus.ufl.edu/syllabus-policy/uf-syllabus-policy-links/>