

SPU-27

Final Project Guidelines

This document summarizes the basic guidelines and policies for Final Projects.

- (1) **Laboratory.** The last formal lab for this course takes place during the week of October 31st to Nov 6th. After this, you are still required to attend your assigned section each week, but there will be no planned labs. Instead, you and your group will use section time to work on your project with supervision and guidance from your TF. When arriving to section you should have a clear idea what experiments you plan to complete that day.

This week you should form your team with others in your laboratory section, and start to formulate ideas about what you will do. This week one of the homework questions will ask for your initial ideas. We will then have a chance to provide feedback at an early stage to ascertain that your project is feasible.

We encourage all of you to obtain as much feedback from the course staff as possible during the early stages of your final projects. In addition, Harold McGee has generously offered to meet with student groups over skype. Getting the initial question to be something that is feasible is an important part of your project, and it is our strong advise to take the initial stages seriously.

To complete the final project you should also expect having to work on it outside of section. The course website will have a list of times when the lab room is open, and you and your group can sign up ahead of time using the accompanying sign-up tool. You must check in with the TF in charge upon arrival to one of these “open lab sections”, and also before leaving. We also encourage you to take advantage of your dorm kitchens as much as possible for work outside of section.

- (2) **Lab notebook.** Each student is required to keep a record of their group’s progress in a provided notebook. Your recordkeeping will be a part of your grade, and your TF will check it in section every week while discussing the project with you.
- (3) **Homework.** Problem set 7 includes questions asking you to define your final project idea. Problem set 8 will ask you to refine your idea based on input from the course staff. After this, there will be four progress reports total, due on Thursdays at 1 pm, Nov 14th, 2st, 28th, and Dec 5th). The progress report is a one page form with questions

about your project and will be made available on the course website every week.

- (4) **Equipment.** If your question requires equipment not available in the cooking lab, such as a rheometer or confocal microscope, we will do our best to make the necessary arrangements. Your TF will provide guidance about the use of laboratory equipment, and you are encouraged to seek input from the entire staff.

If you need to use equipment in the cooking lab or in other Harvard labs, you must come prepared, knowing what measurements you want to make, and understand that you will have only a limited amount of time to use the equipment.

- (5) **Supplies.** There are several ways for you to get supplies for your final project:

- a. Each team will be eligible for \$50 of reimbursements from GenEd for project expenses. Forms and procedures are available on the course website.
- b. If there are extra items that you need, or if you need to exceed this budget, you can request it by emailing Michael and Pia—who will consider these on individual bases.
- c. We provide basic ingredients as well as thickeners and gelling agents in the lab (lists are available on the course website). If there are types of gelling agents that you need that we do not have, just ask and we will order them.
- d. If there is something else you need, you should ask. We may not be able to accommodate everything but we will try!

- (6) **Grading.** Your final project grade will be based on:

- a. Weekly progress reports (4 in total), due at 1 pm every Thursday. A form with questions will be available online.
- b. Three-page report due on **Monday, December 9th at 5 pm.**
- c. Presentation at the Science Fair on **Tuesday, December 10th.**

- (7) In addition you should turn in the notebooks of all group members on Tuesday December 10th.

- (8) **Science Fair.** The Science Fair will take place on **Tuesday, December 10th. There will be a single session scheduled from 12-3 pm – half of the groups will present from 12-1.30 and the other half from 1.30-3 pm.** This is an opportunity for your group to showcase your project to the teaching staff and class mates. In order to present your project, you will need some visual description and summary of what you have done. For example:

- i. A poster presentation. We can supply a poster board to mount the poster.
- ii. A powerpoint summarizing your project, including any data you have collected.
- iii. A video you have prepared that summarizes your project.
- iv. Or, if you have another idea, please ask!

(9) Expectations for the Final Project.

The projects will be graded on your efforts to understand in scientific terms some aspect of a recipe or culinary invention. You can also design a project based on providing a solution to a culinary problem, but you must explain in scientific terms why or how your solution solves the problem. Clearly explaining your motivation for selecting a particular topic will be part of your final grade, and the majority of your grade will be based on the scientific design of your project as described in the template below.

There are many ways to confront something in scientific terms that we have seen in this course: You can look at something under a microscope or use some other piece of scientific equipment to help you answer your question. For example, we learned a lot about emulsions by looking at them and describing what we saw with equations. You have access to the microscopes in the lab—and also have the opportunity to access more sophisticated microscopes and equipment, if they are required for your project. In many of the labs, we varied one parameter and saw how a recipe changed when the parameter was varied—we then used this to argue that our scientific picture was reasonable. Examples of this include: thickness of chocolate cake crust; thickness of alginate layer; effect of different acids on the cooking of ceviche; etc. *Thus, one reasonable way to make a scientific argument is to vary aspects of your recipe and try to understand why they are tuned to be the way they are. Indeed, this is what chefs do in inventing the recipes in the first place!*

Template for Final Project Reports

Abstract: This should be a short summary of your project, on the order of 100-200 words. Describe the motivation for your project; what is the main question you are addressing; what you did to answer it, and the conclusion.

Example: Buffalo meat noodles are delicious to eat, but their texture is highly variable making this dish difficult to prepare. We systematically studied the buffalo noodle elasticity, varying both concentrations of transglutaminase and gelatin. We find that gelatin has little effect on the extensibility of buffalo noodles, while transglutaminase can be used in small concentrations to enhance noodle elasticity. These findings suggest that preparation with transglutaminase can be used to reproducibly make buffalo noodles that have consistent textures.

Motivation: Summarize here the motivation for your project. Why is it an interesting question to investigate? Why is it an interesting question in a culinary context? Why is it an interesting question in a scientific context? What can you learn from looking at the problem from a scientific perspective?

Example: We became fascinated by Chef Bob's method for preparing buffalo noodles, and set out to recreate his recipe. Our initial efforts were not successful, however: the texture of the noodles was not at all like the pictures in Chef Bob's book. We therefore set out to understand what made the texture so variable. We experimented both with transglutaminase and also adding gelatin.

Materials & Methods: Max 1 paragraph: Describe all the materials and methods that you used in your project.

Example: Buffalo steaks were obtained from Buffalo Bill's meat farm. We used force-displacement measurements with a 50 g weight to determine the elastic modulus of buffalo noodles....Elastic modulus was calculated by $E = \dots$ Thin slices of the steaks were examined under the microscope....

Results and Discussion: Describe your experiments and the corresponding results. It is often useful to use pictures, diagrams or tables to present your data and then also explain in words what they represent. Briefly discuss what each of your results mean.

Example: The variability in the texture of buffalo meat noodles was found to be due to a very sensitive dependence on the concentration of transgutaminase. The optimal level of the enzyme is close to 1.5%; when the

concentration is above 2%, the buffalo noodles coagulate and do not have a good texture. Below 1.5% the noodles just fall apart. We have quantified this by measuring the elastic modulus as a function of transglutaminase concentration, shown in Figure 1. The elastic modulus drops precipitously below 1.5% and rises above 1.5%, due to the coagulation and tough texture of the noodles.

To explore this further we experimented with adding gelatin to the mixture. This was inspired by the fact that some of the beautiful recipes for noodles in Chef Amy's recipe book combined transglutaminase with gelatin and we wondered if this could improve the texture....

Conclusion and Future Directions: Briefly conclude by summarizing what you found, i.e briefly restate what you explained in more detail in the results and discussion. In addition, state what you think would be the most interesting questions to answer next based on what you found. For example, if you investigated the behavior of a particular thickener, some possible future directions would be to see how it behaves in combination with other thickeners, how it behaves when heated, or what happens when you add another ingredient.

Example: To conclude, we found the optimal level of transglutaminase for making buffalo noodles, and discovered that modifying the gelatin concentration can change the amount of transglutaminase requires, and discovered that modifying the gelatin concentration can change the amount of transglutaminase required and also modify noodle elastic modulus. To our palette, the best combination was at TG=1% and gelatin=0.5%--these buffalo noodles are outstanding! A photograph of our final dish is shown in Fig 3. We prepared it with olive oil and carrots, to bring out the flavors of the buffalo.

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