Undergraduate Research Expectations – Esposito Group Updated Sept. 2025

While your primary responsibility as an undergraduate student is to focus on your coursework and learn the fundamentals of Chemical Engineering, research provides an excellent opportunity to i.) see how that core knowledge can be applied to cutting-edge, real-world problems, ii.) get hands-on laboratory experience with state-of-the-art equipment, and iii.) gain experience honing your critical and creative thinking skills. The expectations for research production as an undergrad researcher are below those of a Ph.D. and M.S. student, but it is important to recognise that the extra time that you put in to your research can go a long way towards advancing your personal development and strengthening your position to reach the next stage in your career (e.g. internships, graduate school, industry, medical school).

1. Work hours and scheduling – If you are doing research for credit through CHEN E3900 (3 credits), you are expected to spend at least ~ 8-10 hours per week on research-related activities. This is consistent with effort expected for a 3-credit hour class. Many/most research experiments require a continuous chunk of time (e.g. at least 4 hours) to set-up and conduct experiments, and you should plan your schedule accordingly. Although there is no formal "class time" for research like there is for lecture-based classes, I highly recommend that you get in the habit of going into the lab on the same day(s) every week. If there is a week or two where you are very busy (e.g. midterm week) and cannot get into the lab, that is ok, but remember that is important that you continue to learn and make progress throughout the semester.

2. Laboratory citizenship and safety – We are a *team* and, while I do not expect everyone to be best friends, I do expect maturity, civility, and respect at all times. I also expect that you maintain a spirit of helpfulness when working with other students in the lab (e.g., ask for and offer help). You are furthermore expected to contribute to a clean and safe lab environment by i.) thoroughly cleaning up your workspace and glassware after completing experiments ii.) returning tools / supplies to the location that you found them, and iii.) notifying senior group members if you find anything broken or in need of replacement. Finally, it is important that you follow the guidelines for reserving instruments (listed on google calendars).

3. Group and subgroup meetings – Our research group holds monthly "all-hands" group meetings or journal clubs (1 hr), as well as weekly or biweekly sub-group meetings. You are expected to attend these meetings, but if something comes up or it is exam week, be sure to let your PhD/postdoc mentor and I (Dan) know ahead of time and we can reschedule if needed. If you have exciting successes or unexpected challenges, please continue to find me outside of these allotted times. You should come to sub-group meeting *prepared* to give an update on your research efforts from the previous 1 or 2 weeks and with ideas to discuss for the following week. If you are sharing data/results, you should bring key plots / images that are clearly labelled.

4. Reading scientific literature – While your primary goal is to get hands-on research experience, a secondary goal is to get a better "big picture" view of the field you are working in and understand the significance/novelty of the research project that you are a part of. Besides asking other researchers in the group lots of questions, a useful means of gaining this knowledge is through reading scientific journal articles. Talk to your mentor and I for suggestions about how to get started with a literature search.

5. Research production – Many undergrads have very little true research experience, so it is understood that much of your first semester may be spent learning new laboratory instruments/methods, learning about the fundamentals of your project, and developing new procedures and/or experimental set-ups. By your second semester of research, you are expected to be relatively independent in your ability to run experiments that are central to your project and analyse and interpret data. Every project comes with its own separate challenges and opportunities, but if you continue to make progress every week for at least 2 semesters, you should be well-positioned to contribute as a co-author on a journal publication. Being able to list publications on your resume looks great to grad school and future employees alike!

6. End-of-semester slide deck "report" – At the end of the semester, you are expected to email Dan and your research mentor(s) a PowerPoint slide deck that serves as an informal "report" containing a summary of the research you have done throughout the semester. This will be used to help assess the progress you've made, but I hope this will also be a valuable exercise to reflect on the research you've done over the course of the semester and be beneficial to you and other researchers who continue working on the research project in future semesters. The submitted slide deck should contain (i) several slides describing the background, motivation, and research question(s) that are central to your project, (ii) slides describing the research approach, methods, set-ups, and/or procedures that were especially important for your research, (iii)

a detailed list of experimental conditions/chemicals/materials/modelling assumptions (when applicable), (iv) 5-15 slides summarizing key results (not all results) obtained throughout the semester, v.) a conclusions slide, and (vi.) a "Future work" slide with bullet point list of next steps you recommend taking in the research project. You are encouraged to develop these slides throughout the semester as a part of updates that you give as a part of weekly subgroup meetings, which will hopefully make assembling the final slide deck a light lift at the end of the semester. I ask that you turn these slides in before the first day of exams.

7. Course work – Excelling in the classroom and balancing a social life without sacrificing your research activities can be a challenge. Discuss your exam schedule and learning strategy with me and/or your graduate student mentor.

8. Have fun – While learning and carrying out open-ended research requires dedication and hard work, it should not be dull and lonesome. You are encouraged to socialize with your friends, fellow students, and faculty in and outside of Chemical Engineering, in addition to other students in the lab. You should do your best to make progress on your research, but also make a point to enjoy this learning experience and maintain a balanced, happy life!

Undergraduate Thesis in Esposito Research Group (Seniors only)- Some of you may decide to use research through CHEN E3900 (performed over at least 2 semesters) to count for two technical electives on your study plan. Usually, the undergraduate thesis will be written in the Fall of senior year. Basic guidelines are listed below. Every project and student is different, so be sure to talk to Dan regarding questions that you might have and to come up with a plan that best suits your academic study plan and career goals. **General guidelines**:

- **Timing/Eligibility to write an undergrad thesis:** You must have conducted research for 2 semesters, but it is generally better if the thesis is written at the end of a 3rd semester of research since your project will be further along and the thesis easier to write.
- **Due Dates:** Your thesis will be due to Dan by the last day of exams in the Fall semester of your senior year. In special cases a thesis may be submitted after this point, or at the end of junior year (talk to Dan). An outline of your thesis will be due to Dan within 1 month of the start of the semester, and should be discussed in a one-on-one meeting.
- **Format:** your thesis should take the format of a scientific journal article with the following sections:
  - ***Cover page*** – Name, title of project, date, etc.
  - ***Table of Contents-*** List the following sections and the page number that they start on.
  - ***Introduction and Motivation***
  - ***Experimental and/or computational methods***
  - ***Results and discussion*** (complete with sub-sections)
  - ***Future work*** – describe future experiments that you would conduct if you were to continue working on the project.
  - ***Conclusions*** – Summarize the major findings from your research experience and highlight the significance of those findings.
  - ***Bibliography*** – Include a complete list of all references used in the thesis. You are encouraged, but not required to use a reference manager software such as Mendeley or Endnote (a grad student can show you the basics –it's very easy to learn!)
  - ***Appendices*** (if needed to include plots of secondary importance).
- **Odds and Ends**:
  - **Main text**: use Times New Roman font size 12, double spaced.
  - **Length:** Including figures but excluding references, the thesis should be in the range of 20-30 pages. This may seem like a lot, but remember that this document is meant to represent 2-4 semesters worth of credit, and if you continually work on this throughout the semester you will be finished before you know it!
  - Number all pages except the cover page.
  - All figures must be numbered with captions and all text and labels within those figures should have an appropriate font size. It should be very clear which labels / legend entries belong to which curves in the plot.

- Use standard scientific writing best practice. Avoid excessive use of “I”, “we”, “our”, “us”. Be short and concise in your descriptions, without excessive use of adjectives. This is technical writing, not a creative writing class! For more pointers on figure formatting and scientific writing, see various references on our group’s google drive folder under “Guides for presentations and papers”.