

Northwestern | McCORMICK SCHOOL OF ENGINEERING

Chemical and Biological Engineering

Essay Writing Support for Prospective Students

Hello prospective graduate students!

We are thrilled you are interested in applying to the Northwestern Chemical and Biological Engineering (ChBE) Ph.D. Program! To make the application process as equitable and supportive as possible, we have provided a list of resources to help. [These resources are not rubrics or templates.](#) Rather, they provide writing guidance on organizing and displaying your experiences. Critically, your academic and personal statements should emphasize the following:

1) Why are you pursuing an advanced degree?

2) What are your short and long term goals?

3) Why is Northwestern the right place to advance your academic training?

Answering these key questions with your relevant experiences will support a strong application. Overall, your experiences and goals should align with the two pillars of academia, emphasizing perseverance, intellectual rigor, and creativity:

Pillar 1: Resilient Research Potential - Throughout graduate school, students will experience and overcome setbacks. As a result, research requires flexibility and innovative solutions. We look for students that have demonstrated a significant ability to learn new skills, persevere, and be resilient. This can be shown through research activity (e.g. papers, presentations, awards), navigating collaborations, or developing creative solutions.

Pillar 2: Academic Rigor - Diligent academic investigation indicates potential success in graduate coursework and research. We look for students that will succeed in an academically rigorous environment. Mentoring or communication experiences, such as teaching assistantships, group project leadership, research presentations, or teamwork in industry could highlight your ability to succeed in graduate coursework.

Keep in mind, we look for applicants that highlight these qualities, not just high GPAs. Please avoid relisting your resume, such as lab techniques. Additionally, as an enhancement to your application, you may highlight service activities that have supported your decision to attend graduate school, but this is not required. Faculty, staff, and students are deeply engaged in service roles within the department at Northwestern. Graduate students hold committee roles inside and outside the department. Showcasing your service activities in both the academic and personal statements offers insight into your acclimation to the well-rounded culture of our department.

We encourage all applicants to review the academic statement guide, personal statement guide, essay writing tips, and the additional resources provided below! We would also like your feedback on this resource by completing a short, anonymous survey to help us understand if this resource was helpful in your writing process using this [link](#). You can also find the survey on the ChBE prospective student page. The information collected in this anonymous survey will only be used to analyze the effectiveness of our resource and is **not** a part of your graduate application nor will it be used in the evaluation process.

Please note that the ChBE Department values each unique experience shared by prospective students. The experiences provided in these documents are meant to spur thoughtful writing and we expect students to adhere to the principles of academic integrity including those concerning plagiarism, fabrication, and cheating. Please refer to the [Principles of Academic Integrity](#) from the Office of the Provost for more information. We hope these resources embolden applicants to present their authentic selves.

The ChBE Department embraces diverse backgrounds, approaches, and perspectives. We aim to foster inclusion throughout the application process by providing these resources. These resources are a part of the ChBE Anti-Racism, Diversity, Equity, and Inclusion (ARDEI) Committee's efforts to bring positive change within the graduate application process. To learn more about the ARDEI Committee and other student-led organizations, please visit this [link](#). We look forward to reviewing your application!

Thank You,

NU Chemical and Biological Engineering Department

Academic Statement Guide

The outlines presented here offer key questions that may be answered in your application. The material below is **not** a template. We encourage diverse writing styles and recognize many other writing strategies will lead to successful applications.

Key Questions:

- 1) Why are you pursuing an advanced degree?**
- 2) What are your short and long-term goals?**
- 3) Why is Northwestern the right place to advance your academic training?**

Remember to connect to the two pillars of academia:

Pillar 1: Resilient Research Potential

Pillar 2: Academic Rigor

Outlines:

Experience 1: Undergraduate Research

Description/overview of experience

- At XYZ University, worked with Professor XYZ to study synthetic biology and specialize in the Build-A-Cell project
- My senior thesis project involved studying cell-free extract metabolism
- Mentored rising undergraduate students
- Supported their projects by facilitating discussions and teaching experimental techniques

Your specific contributions

- Studied a glucose metabolic pathway and an ATP synthase mechanism as methods for probing XYZ
- Explored equipment options outside of immediate facilities and developed a novel method to collect XYZ data
- Considered details to better understand the underlying chemical reactions and parameter dependencies
- I successfully combined my model with another DNA export model. This combined model strategy was a significant development that is typically difficult to achieve in synthetic biology due to the lack of literature.

- Validated simulations experimentally, and collaborated with individuals in the biology department

Emphasizes the unique contributions of the student. The student shows perseverance, resilience, improvisation and scientific creativity. Additionally, the applicant shows expertise in a complicated area of research and communicates that effectively to the audience (Pillar 1, Pillar 2). The student collaborates with individuals outside the department, showcasing their collaborative work.

Connect to the key questions

- The Northwestern Chemical and Biological Engineering department shows strengths in XYZ fields, in particular Professors XYZ who pursue research in ABC, which aligns with my interest in pursuing research in simulation techniques
- Motivated to collaborate with experimentalists by providing comprehensive chemical reaction pathway modeling
- Hope to continue innovative modeling research within industry after graduate school

The applicant describes the short-term and long-term goals in both what the applicant will accomplish in graduate school.

Additionally, the applicant shows interest in the ChBE department at Northwestern and highlights specific professors they are interested in. Elaborating on why these faculty members may be a good fit for you would also show strong interest in Northwestern!

Experience 2: Full-time work experience at XYZ Company

Description/overview of experience

- Engineering associate at XYZ, a biotechnology company that develops therapeutics
- Worked with a team of scientists and process engineers to develop optimized metabolic pathways to generate XYZ active compound in mammalian cell culture

Your specific contributions

- Recognizing flaws in laboratory procedures, I self-initiated and created standard operating procedures for cell culture operational parameters
- Conducted synthetic drug output quantification studies to monitor production quality, presenting my data and analysis to executive teams. As a result of my work, additional production quality measures were implemented by various laboratory groups.
- Encouraged STEM careers through poster presentations, in-person science experiments, and networking lunches
- Provided a mentoring relationship with high school students

Identifies specific contributions to the team and key results of the experience. The evidence connects back to Pillar 1 and Pillar 2 as the applicant has taken initiative to address a scientific issue. The

applicant served as a mentor, indicating teaching potential, which could contribute to the department in the future.

Connect to the key questions

- Improved my ability to conduct thorough literature review to understand cell culture optimization techniques and effectively communicated scientific findings to a broad audience
- Excited to learn about and apply new concepts
- Seeking and successfully completing projects that are out of my comfort zone allowed me to pursue innovative scientific questions that will ultimately help me make an impact in my research journey
- Inspired by this experience to pursue unrestricted academic research
- I am interested in XYZ labs at Northwestern because they study this at various scales by looking at XYZ mechanisms

Highlights their ability to quickly grasp and apply concepts, a quality that will be useful in graduate school (Pillar 1).

Connects experience to specific areas of interest in research (Pillar 1) and also answers why the applicant is interested in attaining an advanced degree as opposed to staying in their current role (key question 1).

Shows that the student has done some research on the department and identified potential mentors and PIs they could work with if they pursue their PhD at NU. This is critical in showing interest in Northwestern and answers key question 3.

Experience 3: Senior capstone project

Description/overview of experience

- Co-developed the winning design for a desalination plant
- Successfully applied principles from thermodynamics, process control, and mass transfer to meet safety and production requirements for plant design
- Mastered and effectively utilized Aspen to design and scale up all process units

The applicant highlights their ability to learn and effectively apply new concepts and/or tools in an academic setting (Pillar 2).

Your specific contributions

- Served as the team lead for 4 weeks over the duration of the project
 - Effectively coordinated with all team members to assemble design components and ensure cohesive plant operation
 - Led weekly presentations delivered to instructors and fellow classmates
- Hypothesized and validated key operational assumptions, ran Aspen simulations, optimized and scaled up the design of a key plant component - a 12-stage flash unit

- Developed a cost-benefit calculation scheme that was used by my team to estimate profits generated from the desalination plant

The applicant has shown leadership potential and great communication skills, which will prove to be useful in pursuing independent research and scientific communication. They have also highlighted their ability to develop a hypothesis and seek a meaningful solution, a quality that is important in pursuing research questions in graduate school.

Connect to key questions

- Developed my ability to effectively lead, work with and coordinate a team of fellow engineers, a skill which will be useful when working with collaborators and researchers in graduate school
- Honed my ability to craft presentations and effectively deliver findings to a broad audience

The applicant highlights a direct connection to Pillar 1 and shows how their communication and leadership skills will be useful in a research setting.

- Researching and developing a capital investment and profitability calculation framework indicates that I take the initiative to learn and successfully apply new concepts, go above and beyond what is expected and master new skills in a short period of time.
 - This will be useful in graduate school when developing and executing on new research questions.

The applicant shows initiative and highlights that they have a growth mindset when it comes to learning and applying new concepts (Pillars 1 and 2).

Personal Statement Guide

The Chemical and Biological Engineering Department at Northwestern values diverse backgrounds, approaches, and perspectives, understanding them as essential ingredients for true academic success. We invite you to use this space to tell us how you will contribute to equity, inclusion, belonging and cultural humility in the Chemical and Biological Engineering Department. The personal statement offers another lens to evaluate your alignment with the 2 pillars of academia: Resilient Research Potential and Academic Rigor.

Individuals from various backgrounds and experiences have overcome adversities. The personal statement offers an opportunity to elaborate on how you have learned from challenges and the impact they've made on your decision to pursue a graduate degree. The personal statement can further highlight that the applicant will be able to overcome potential setbacks posed by graduate study. The Chemical and Biological Engineering Department values and wishes to hear these experiences from each applicant. We are excited to hear about your experiences and look forward to reviewing your application.

General Essay Writing Tips

These writing tips are designed to facilitate your writing journey. These are suggestions that may work for some, but not all. We encourage diverse writing styles and outlines.

1) Start early

- Give yourself adequate time to brainstorm, outline, and draft your essay. You will likely go through multiple iterations before submission.
- Make sure you know the deadlines for the schools to which you plan to apply. Most schools, including Northwestern, will have deadlines around December, but this can vary. Note that the letter of recommendation deadlines may be different as well.
- Set milestones and deadlines for these milestones. This **may** look like:

Milestone 1: Research the schools you want to apply to, gather materials, brainstorm, and begin outline. Note: Asking mentors (such as principal investigators, coworkers, or graduate students) for which programs best suit your goals may be useful to narrow down your search.

Milestone 2: Finish outline, write first draft

Milestone 3: Finalize first draft, begin to polish

Milestone 4: Send draft for feedback

Milestone 5: Collect feedback, work on final draft

Milestone 6: Submit!

2) Read the prompt carefully

Highlight/underline key words and specific questions in the prompt. Use these to guide your answers.

3) Make an outline

While outlines are useful for both statements, this outline provides specific tips for the academic statement.

- At this point in the brainstorming process, focus on getting your ideas down on paper. Worry less about structure, flow, or grammar.
- Make a list of relevant experiences or personal traits that will help you highlight the following **key questions**: (Note: each experience may not answer all of these questions)

a) Why are you pursuing an advanced degree?

b) What are your short and long-term goals?

c) Why is Northwestern the right place to advance your academic training?

- TIP: Learning as much as you can about the department will help you craft why Northwestern is the perfect fit:
 - Feel free to talk with current graduate students to gain more information about the department. Graduate students are happy to discuss with prospective students!
 - Look into training programs, departmental events, facilities, outreach events as well as other opportunities and activities that you would be interested in.
 - Find unique attributes that you like about the department or Northwestern as a whole.
 - TIP: Discussing how you may contribute to a specific research lab is a great way to show interest.
- For each experience/trait you listed above, write down:

a) What did you specifically contribute? Provide details and quantify whenever possible.

b) What was the outcome of the experience and your work?

c) A connection to one or more of the questions listed above.

- Select 3-4 experiences from the above that let you answer the questions meaningfully. Remember to be unique and try to write a story that threads your experiences together!

4) Draft your essay

Relay what you developed in your outline in detail by elaborating on the experiences you identified and ensuring you are providing specific responses to the key questions provided above. Outlining is important to communicate ideas in an effective and organized way. Once the outline is complete, most of the work should be done.

5) Review your essay

- Once you have developed a first draft, step away from your essay. Come back to it in a few days and start revising for organization and structure. Then, revise grammar and spelling. TIP: reading your essay out loud is a good way to find spelling and grammatical errors.
- Get feedback
 - Feedback from your research advisor, professors as well as current graduate students is crucial. They have gone through the process themselves and likely have a sense of what a good essay could look like. Seeking feedback from family and friends can also provide an outside perspective on your writing.
 - It will be especially useful for recommendation letter writers to read your essay so that their letter can complement, and not just repeat, what you have written.
 - At the same time, be open to assessing whether a particular point of feedback will make your essay better – be cognizant of the fact that everyone will have specific opinions and not every opinion may be right for your essay.
- Revise your essay and incorporate feedback – don't be scared to edit, add or remove sentences or paragraphs - that's how your essay gets better! As you iterate through versions, ask yourself if you've answered the key questions.

6) Prepare for submission

- Print out your essay and proofread it (it is much easier to catch errors this way!)

- Submit! Ensure that you are submitting the right essay to the right school.

Additional Resources

General admissions-specific resources

1. [Purdue University academic statement of purpose guide](#)
2. [MIT personal statement writing guide](#)

Opportunities at Northwestern

Northwestern promotes interdisciplinary graduate experiences through academic centers, fellowships, teaching apprenticeship programs, service, and much more. Please explore these incredible opportunities to see if Northwestern is the right fit for you!

Fellowships

Graduate students can engage in various fellowship programs throughout their time at Northwestern. A few of these programs can be found below:

1. [Biotechnology Training Program](#)
2. [Chemistry of Life Processes](#)
3. [Molecular Biophysics Training Program](#)
4. [Synthetic Biology Across Scales](#)
5. [Northwestern Institute on Complex Systems \(NICO\)](#)

Academic Centers

Academic centers provide collaborative, interdisciplinary research opportunities to graduate students. Research activities and characterizations may be a fundamental part of your graduate experience at Northwestern. Here are a few of those academic centers:

1. [Center for Synthetic Biology](#)
2. [Center for Catalysis and Surface Science](#)
3. [Integrated Molecular Structure Education and Research Center \(IMSERC\)](#)
4. [Materials Research Science and Engineering Center](#)
5. [International Institute for Nanotechnology \(iinano\)](#)
6. [Robert H. Lurie Comprehensive Cancer Center](#)
7. [Center for Engineering and Sustainability Research](#)
8. [Synchrotron Research Center, DND CAT at Argonne National Laboratory](#)