CHEMICAL ENGINEERING, PH.D.

The Department of Chemical and Biological Engineering (CBE) (https://engineering.wisc.edu/departments/chemical-biological-engineering/)at UW-Madison was established in 1905. It has a tradition of excellence dating back to its founding and consistently ranks among the best programs in the world (https://engineering.wisc.edu/facts-and-stats/). The department has 20 core faculty and 8 affiliate faculty (https://directory.engr.wisc.edu/che/faculty/) who conduct experimental and theoretical research to address pressing societal, economic, and environmental challenges. R (https://engineering.wisc.edu/departments/chemical-biological-engineering/research/)esearch in CBE (https://engineering.wisc.edu/departments/chemical-biological-engineering/research/) is highly collaborative and often involves diverse teams from within the department, across campus, at other campuses, and in industry. CBE researchers address the most pressing challenges facing society including developing approaches to sustainably produce new fuels and chemicals, combat the plastic pollution crisis, create new therapeutic molecules and materials, optimize energy infrastructure, computationally design new materials and chemical processes, understand transport in complex environments, engineer bacteria to produce biofuels, and more.

Research on campus is highly interdisciplinary, benefiting from prominent centers such as the Center for the Chemical Upcycling of Waste Plastics (CUWP) (https://cuwp.org/), Center for Cell Manufacturing Technologies (CMaT) (https://cellmanufacturingusa.org/), Materials Research Science and Engineering Center (MRSEC) (https://mrsec.wisc.edu/), Great Lakes Bioenergy Research Center (GLBRC) (https://www.glbrc.org/), Wisconsin Institute for Discovery (WID) (https://wid.wisc.edu/), and the Stem Cell and Regenerative Medicine Center (https://stemcells.wisc.edu/).

CBE is strategically located in Engineering Hall (https://map.wisc.edu/s/p82kgyxu/) at the heart of the science and engineering areas of campus, facilitating interactions with students and researchers in other leading departments.

Graduate students in the department are encouraged to participate in international research experiences, industry internships, and entrepreneurial activities. For research interests and activities of faculty members, please see the department's research website (https://engineering.wisc.edu/departments/chemical-biological-engineering/research/) and faculty directory (http://directory.engr.wisc.edu/che/faculty/).

ADMISSIONS

Please consult the table below for key information about this degree program's admissions requirements. The program may have more detailed admissions requirements, which can be found below the table or on the program's website.

Graduate admissions is a two-step process between academic programs and the Graduate School. ***Applicants must meet*** the minimum requirements ***(***https://grad.wisc.edu/apply/requirements/***) of the Graduate School as well as the program(s).*** Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/apply/).

Requirements	Detail
Fall Deadline	December 1
Spring Deadline	September 1
Summer Deadline	The program does not admit in the summer.
GRE (Graduate Record Examinations)	Not required.
English Proficiency Test	Every applicant whose native language is not English or whose undergraduate instruction was not in English must provide an English proficiency test score and meet the Graduate School minimum requirements (https://grad.wisc.edu/apply/requirements/#english-proficiency).
Other Test(s) (e.g., GMAT, MCAT)	n/a
Letters of Recommendation Required	3

Students with a strong background in chemical engineering or related field and a strong interest in research are encouraged to apply for admission. Most applicants accepted into the program have grade-point averages well above the Graduate School minimum of 3.0 on a 4.0 scale. Applications are evaluated on the basis of previous academic record, letters of recommendation, and personal statement. The Department of Chemical and Biological Engineering does not consider applications for a terminal M.S. degree; the department admits only to the Ph.D. An M.S. degree can be awarded post admission as an alternative to the Ph.D. degree. The M.S. degree is not a prerequisite for the Ph.D. degree.

Applicants with degrees in the physical or life sciences or other engineering fields are encouraged to apply for admission into the Ph.D. graduate program. These students should contact the chair of the graduate admissions committee to discuss their preparation for the graduate program. Students are not accepted for spring semester except when space is available. Fall applications and supporting materials **must be received by December 1**.

FUNDING

GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (https://grad.wisc.edu/funding/) is available from the Graduate School. Be sure to check with your program for individual policies and restrictions related to funding.

PROGRAM RESOURCES

Students admitted to the graduate program are guaranteed financial support from the department in the form of research assistantships, teaching assistantships and fellowships. Support will continue as long as the student maintains satisfactory progress toward their degree.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/#policiesandrequirementstext), in addition to the program requirements listed below.

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

Face to Face	Evening/ Weekend	Online	Hybrid	Accelerated
Yes	No	No	No	No

Mode of Instruction Definitions

Accelerated: Accelerated programs are offered at a fast pace that condenses the time to completion. Students typically take enough credits aimed at completing the program in a year or two.

Evening/Weekend: Courses meet on the UW–Madison campus only in evenings and/or on weekends to accommodate typical business schedules. Students have the advantages of face-to-face courses with the flexibility to keep work and other life commitments.

Face-to-Face: Courses typically meet during weekdays on the UW-Madison Campus.

Hybrid: These programs combine face-to-face and online learning formats. Contact the program for more specific information.

Online: These programs are offered 100% online. Some programs may require an on-campus orientation or residency experience, but the courses will be facilitated in an online format.

CURRICULAR REQUIREMENTS

Requirement	Detail
Minimum Credit Requirement	51 credits
Minimum Residence Credit Requirement	32 credits
Minimum Graduate Coursework Requirement	26 credits must be graduate-level coursework. Details can be found in the Graduate School's Minimum Graduate Coursework (50%) policy (https://policy.wisc.edu/library/UW-1244 (https://policy.wisc.edu/library/UW-1244/)).
Overall Graduate GPA Requirement	3.00 GPA required. This program follows the Graduate School's GPA Requirement policy (https://policy.wisc.edu/library/UW-1203 (https://policy.wisc.edu/library/UW-1203/)).
Other Grade Requirements	At least two of the core graduate classes must be taken in the first semester of residence in the graduate program, and at least four core graduate classes must be completed with grades of B or better, preferably by the end of the second semester of residence. A student who receives one grade of BC or lower in a core class but who wishes to remains in the PhD program must take the fifth core course or re-take the low graded core course preferably in the third semester, and the student must receive a B or better. A student who receives more than one grade of BC or lower in core graduate classes will be placed in the M.S. program. Upon successful completion of the M.S. program, the student may petition the full faculty for readmission to the Ph.D. program. A student who receives an average of 3.0 or higher on their preliminary exam becomes a candidate for the Ph.D. program. A student who does not receive an average score of 3.0 or higher in the qualifying process is placed in the M.S. program. Upon successful completion of the M.S. program, the student may petition the full faculty to be readmitted to the Ph.D. program.
Assessments and Examinations	A Ph.D. candidate who has met the grade requirements must complete a preliminary exam consisting of a written report and oral examination. During the fall semester of the fourth year of the program, candidates will participate in a mandatory research progress meeting with their thesis committee. The Ph.D. candidate defends a written thesis in a final oral examination.
Language Requirements	No language requirements.
Graduate School Breadth Requirement	All doctoral students are required to complete a doctoral minor or graduate/professional certificate. The Ph.D. candidate is required to undertake a program of coursework in a field other than chemical and biological engineering. This requirement may be satisfied by an external minor (option A), a distributed minor (option B), or a Graduate/Professional certificate (option C). The minor/certificate, whether Option A, B, or C, is designed to represent a coherent body of work, and should not be simply an after-the-fact ratification of a number of courses taken outside the major department. To ensure coherence, the student must consult with his or her advisor. The minor/certificate should be submitted for approval at an early date, before the student is halfway through the proposed course sequence. All Graduate School students must utilize the Graduate Student Portal in MyUW to add, change, or discontinue any doctoral minor or Graduate/Professional certificate. To apply to a minor or certificate, log in to MyUW, click on Graduate Student Portal, and then click on Add/Change Programs. Select the information for the doctoral minor or Graduate/Professional certificate for which you are applying.

REQUIRED COURSES

Students must complete at least six semester courses (totaling at least 18 credits) in the CBE department. Four courses will be core CBE courses and two will be CBE electives, chosen at the discretion of the student in consultation with their advisor. These classroom courses shall be in the range numbered 500-899 and will not be laboratory courses, Independent Studies or Research. Grades of B or better are required in all CBE courses used towards degree requirements.

At least four of the six CBE courses shall be selected from these core graduate courses:

Code	Title	Credits
CBE 620	Intermediate Transport Phenomena	3
CBE 660	Intermediate Problems in Chemical Engineering	3
CBE 710	Advanced Chemical Engineering Thermodynamics	3
CBE 735	Kinetics and Catalysis	3
CBE 781	Biological Engineering: Molecules, Cells & Systems	3

At least two of the core graduate courses must be taken in the first semester of residence in the graduate program, and at least four core graduate courses must be completed with grades of B or better, preferably by the end of the second semester of residence. A student who receives one grade of BC or lower in a core class but who wishes to remains in the PhD program must take the fifth core course or re-take the low graded core course preferably in the third semester, and the student must receive a B or better. Students are expected to take a total of four courses in their first semester of residence.

The requirement of four core CBE graduate courses shall not be met by substitution of other courses. Students matriculating with an M.S. degree from another university may, with department approval, use up to two courses from their M.S. work toward the requirement of six CBE graduate courses.

Students taking advanced courses outside the department in excess of breadth requirements may, with department approval, use up to two of these courses toward the requirement of six CBE graduate courses. Seminar courses may not be used to satisfy CBE course requirements.

Elective course requirement: Students must complete at least one course totaling at least three credits. Courses must be numbered 300 and above. A *B average* is required. Pass/fail or audit courses may not be used for the elective course requirement. Courses used to satisfy the breadth program may not be used for the elective course requirement. Advisor approval is required and secured through submission of the Ph.D. Elective Course Approval Form. Elective courses can be foreign language courses.

Teaching assistantship: Each student in the Ph.D. program is required to serve as a teaching assistant (TA) for two semesters. Under normal circumstances, each student should serve as a TA one semester of the second year and one semester of the third year. Requests for alternate arrangements, partial or full waiver of the requirement, should be submitted in writing to the Graduate Program Committee.

POLICIES

GRADUATE SCHOOL POLICIES

The Graduate School's Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy/) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

MAJOR-SPECIFIC POLICIES

PRIOR COURSEWORK

Graduate Work from Other Institutions

This program follows the Graduate School's policy for Satisfying Requirements with Prior Graduate Coursework from Other Institutions. (https://policy.wisc.edu/library/UW-1216/)

UW–Madison Undergraduate

This program follows the Graduate School's policy for Satisfying Requirements with Coursework from Undergraduate Career at UW–Madison. (https://policy.wisc.edu/library/UW-1216/)

UW–Madison University Special

This program follows the Graduate School's policy for Transfer from UW–Madison University Special Student Career at UW–Madison. (https://policy.wisc.edu/library/UW-1216/)

PROBATION

A student who receives more than one grade of BC or lower in core graduate courses will be placed in the M.S. program. Upon successful completion of the M.S. program, the student may petition the full faculty for readmission to the Ph.D. program.

A student who receives an average of 3.0 or higher becomes a candidate for the Ph.D. program. A student who does not receive an average score of 3.0 or higher in the qualifying process is placed in the M.S. program. Upon successful completion of the M.S. program, the student may petition the full faculty to be readmitted to the Ph.D. program.

Students placed in the M.S. program are expected to finish the M.S. program within five semesters of admission into the Ph.D. program.

ADVISOR / COMMITTEE

This program follows the Graduate School's Advisor policy (https://policy.wisc.edu/library/UW-1232/) and the Graduate School's Committees policy (https://policy.wisc.edu/library/UW-1201/). Students should refer to the departmental Graduate Handbook of Academic Policies and Procedures for more information.

CREDITS PER TERM ALLOWED

15 credits

TIME LIMITS

The CBE department expects students to complete their Ph.D. degree within five years. Any student unable to defend her or his thesis in this period must petition the faculty for an extension by July 1 of the fifth year, specifying reasons for the request and length of requested extension.

GRIEVANCES AND APPEALS

These resources may be helpful in addressing your concerns:

- Bias or Hate Reporting (https://doso.students.wisc.edu/bias-or-hate-reporting/)
- Graduate Assistantship Policies and Procedures (https://hr.wisc.edu/policies/gapp/#grievance-procedure)
- Hostile and Intimidating Behavior Policies and Procedures (https://hr.wisc.edu/hib/)
  - Office of the Provost for Faculty and Staff Affairs (https://facstaff.provost.wisc.edu/)
- Dean of Students Office (https://doso.students.wisc.edu/) (for all students to seek grievance assistance and support)
- Employee Assistance (http://www.eao.wisc.edu/) (for personal counseling and workplace consultation around communication and conflict involving graduate assistants and other employees, post-doctoral students, faculty and staff)
- Employee Disability Resource Office (https://employeedisabilities.wisc.edu/) (for qualified employees or applicants with disabilities to have equal employment opportunities)
- Graduate School (https://grad.wisc.edu/) (for informal advice at any level of review and for official appeals of program/departmental or school/college grievance decisions)
- Office of Compliance (https://compliance.wisc.edu/) (for class harassment and discrimination, including sexual harassment and sexual violence)
- Office of Student Conduct and Community Standards (https://conduct.students.wisc.edu/) (for conflicts involving students)
- Ombuds Office for Faculty and Staff (http://www.ombuds.wisc.edu/) (for employed graduate students and post-docs, as well as faculty and staff)
- Title IX (https://compliance.wisc.edu/titleix/) (for concerns about discrimination)

Grievance Procedures

If a student feels unfairly treated or aggrieved by faculty, staff, or another student, the University offers several avenues to resolve the grievance. Students' concerns about unfair treatment are best handled directly with the person responsible for the objectionable action. If the student is uncomfortable making direct contact with the individual(s) involved, they should contact the advisor or the person in charge of the unit where the action occurred (program or department chair, section chair, lab manager, etc.). For more information see the Graduate School Academic Policies & Procedures: https://grad.wisc.edu/acadpolicy/?policy=grievancesandappeals The Assistant Dean for Graduate Affairs (engr-dean-graduateaffairs@engr.wisc.edu) provides overall leadership for graduate education in the College of Engineering (CoE), and is a point of contact for graduate students who have concerns about education, mentoring, research, or other difficulties.

Procedures

1. The student is encouraged to speak first with the person toward whom the grievance is directed to see if a situation can be resolved at this level.

2. Should a satisfactory resolution not be achieved, the student should contact the CBE Graduate Associate Chair, or Department Chair if the grievance involves the Graduate Associate Chair, to discuss the grievance. The Graduate Associate Chair or Department Chair will facilitate problem resolution through informal channels and facilitate any complaints or issues of students. The first attempt is to help students informally address the grievance prior to any formal complaint. Students are also encouraged to talk with their faculty advisors regarding concerns or difficulties if necessary. University resources for sexual harassment, discrimination, disability accommodations, and other related concerns can be found above.

3. If the issue is not resolved to the student's satisfaction the student can submit the grievance to the Graduate Associate Chair in writing, within 60 calendar days of the alleged unfair treatment.

4. On receipt of a written complaint, a faculty committee will be convened by the Graduate Associate Chair to manage the grievance. The faculty committee will obtain a written response from the person, organization, or governing committee toward whom the complaint is directed. This response will be shared with the person filing the grievance.

5. The faculty committee will determine a decision regarding the grievance. The Graduate Associate Chair will report on the action taken by the committee in writing to both the student and the person, organization, or governing committee toward whom the complaint was directed within 20 working days from the date the complaint was received.

6. At this point, if either party (the student or the person, organization, or governing committee toward whom the grievance is directed) is unsatisfied with the decision of the faculty committee, the party may file a written appeal. Either party has 10 working days to file a written appeal to the College of Engineering. The Assistant Dean for Graduate Affairs (engr-dean-graduateaffairs@engr.wisc.edu) provides overall leadership for graduate education in the College of Engineering (CoE), and is a point of contact for graduate students who have concerns about education, mentoring, research, or other difficulties.

7. Documentation of the grievance will be stored for at least 7 years. Significant grievances that set a precedent will be stored indefinitely.

The Graduate School has procedures for students wishing to appeal a grievance decision made at the College of Engineering level. These policies are described in the Graduate School's Academic Policies & Procedures (https://grad.wisc.edu/documents/grievances-and-appeals/).

OTHER

Admitted students are offered research assistantships to support the pursuit of dissertation or degree research in chemical engineering. The stipend, after tuition and fees, is guaranteed for the duration of a student's graduate studies provided satisfactory progress is made toward their degree. Support for students receiving external funding or other program opportunities are reviewed case by case. Although students can be awarded M.S. degrees, there is no direct admission to the M.S. program.

PROFESSIONAL DEVELOPMENT

GRADUATE SCHOOL RESOURCES

Take advantage of the Graduate School's professional development resources (https://grad.wisc.edu/pd/) to build skills, thrive academically, and launch your career.

PROGRAM RESOURCES

The CBE Graduate Program office coordinates on-going professional development workshops. Topics have included: life in industry, ethical decision making, intellectual property agreements, maintaining self-motivation, how to utilize software in creating figures, effective management of undergraduate researchers, effective management of your thesis advisor and individual development plans (IDPs).

Also, the Graduate School Office of Professional Development offers training opportunities for graduate students and this information is e-mailed to all of the CBE grad students on a regular basis. Examples of these training offerings include sharing of information about DELTA, dissertation writing, grant writing and job search strategies.

In order to foster effective teaching among our graduate students, all students are required to serve as a TA for two semesters. Before graduate students are allowed to TA, each must participate in the New Educator's Orientation (NEO) training offered each semester. They are also encouraged to connect with the University's DELTA program.

LEARNING OUTCOMES

1. Demonstrate an ability to synthesize knowledge from a subset of the biological, physical, and social sciences to help frame problems critical to the future of their discipline.
2. Conduct original research.
3. Demonstrate an ability to create new knowledge and communicate it to their peers.
4. Fosters ethical and professional conduct.

PEOPLE

PROFESSORS

Eric V. Shusta (Chair)
Michael David Graham
George Huber
Daniel J. Klingenberg
David M. Lynn
Manos Mavrikakis
Regina Murphy
Sean P. Palacek
Brian F. Pfleger
Thatcher Root
John Yin
Victor Zavala

ASSOCIATE PROFESSORS

Ross E. Swaney

ASSISTANT PROFESSORS

Styliani Avraamidou
Matthew Gebbie
Siddarth Krishna
Whitney Loo
Marcel Schreier
Reid Van Lehn

TEACHING FACULTY

Brendan Blackwell
Eric Codner
Kate Dahlke
Andrew Greenberg

RESEARCH PROFESSOR

William Banholzer

See also Chemical and Biological Engineering Faculty Directory (https://directory.engr.wisc.edu/che/faculty/).