



ICE IGERT sponsored *Graduate Certificate in Cellular Engineering*

The mission of this graduate certificate program is to exploit the synergistic interface between engineering and the life sciences to enable novel graduate training in areas of cellular form, function, and processing. Students, in addition to satisfying core requirements of their “home” department, commit to additional, interdisciplinary cellular engineering curricular requirements. Exposing students to this enhanced, interdisciplinary training curriculum early in their graduate experience instills a strong foundation for future interdisciplinary research success. Students who complete this curriculum will earn a *Graduate Certificate in Cellular Engineering*, in addition to their home department doctoral degrees.

Graduate Certificate in Cellular Engineering (minimum of 19 credits)

Curricula promotes broad-based graduate training in cellular engineering through the following curricular requirements:

1. Cellular engineering required courses (4 credits)

- *Fundamentals of Cellular Engineering* (ChemEng 680, 3 credits)
- *Ethical Conduct of Research* (Biochem 797A/Chem 797J, 1 credit – there are multiple course substitution options)

2. Cellular engineering elective courses (6 credits)

- One Life Sciences elective (3 credits) and one Engineering/Physical Sciences elective (3 credits)

3. Cellular engineering Lab Modules (4 credits)

Through single credit lab modules, students step outside of their primary expertise area to gain high-level, interdisciplinary perspective across a broad range of topics.

4. ICE IGERT Graduate Seminar (2 credits)

Students may satisfy these two credits by participating in two semesters of *ICE IGERT Graduate Seminar* (ChemEng 797D, 1 credit). This seminar is a compilation of cellular engineering relevant seminars from ICE affiliated departments and programs.

5. ICE IGERT Student Research Seminar (1 credit)

Students participate in one semester of *ICE IGERT Student Research Seminar* (ChemEng 797R, 1 credit). In this student-run seminar, students take turns presenting their research to an audience of interdisciplinary peers (no faculty). Students are provided presentation feedback through constructive peer evaluation. The seminar offers a comfortable forum for expanding knowledge and strengthening interdisciplinary communication skills.

6. ICE IGERT Journal Club (1 credit)

Students participate in one semester of *ICE IGERT Journal Club* (ChemEng 797S, 1 credit). Similar to the Research Seminar, this journal club is student-run, with an emphasis on interdisciplinary communication and exchange of ideas.

7. Professional development (1-2 credits)

- The required *Professional Seminar* (ChemEng 797E, 1 credit) advises students on such subjects as diversity in the workplace, grant/technical writing, keys to successful communication, team problem-solving, and career path opportunities. This seminar is offered each summer (students participate once).
- Students are required to earn an additional elective credit, which they may choose in accordance with career path goals. Examples include industrial internships, additional coursework/seminars, curriculum development, and mentoring undergraduate and/or REU students.

8. Interdisciplinary research report

ICE IGERT students summarize interdisciplinary activity through an annual report, referencing such things as cross-functional electives, lab modules, research projects, internships, etc. The goal of this report is to further the interdisciplinary spirit and reinforce the value and importance of collaborative research, as well as assist the program with annual assessment and improvement.

Graduate Certificate in Cellular Engineering (Minimum of 19 Credits)

1. REQUIRED COURSES (4 CREDITS)

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|---|-----------|--|-------------|
| <input type="checkbox"/> ChemE 680 - Fundamentals of Cellular Engineering
(offered in the Fall semester) | 3 credits | <input type="checkbox"/> Ethics requirement, to be satisfied through one of the below courses: | |
| | | <input type="checkbox"/> Biochem 797A/Chem 797J – Ethical Conduct of Research | 1-2 credits |
| | | <input type="checkbox"/> Biol 791B – Responsible Conduct of Research in Life Sciences | |
| | | <input type="checkbox"/> Physics 690E – Ethics for Scientist and Engineers | |

2. ELECTIVE COURSES (6 CREDITS): Choose **one course from each column** to satisfy the Life Science and Engineering/Physical Science requirements.
NOTE: Students may not fulfill BOTH elective requirements with home department courses (one is acceptable).
(*past term offerings are indicated for reference, but are not a guarantee of future availability)

<u>Life Sciences Elective List</u>	<u>Term*</u>	<u>Engineering/Physical Sciences Elective List</u>	<u>Term*</u>
<input type="checkbox"/> AnimiSci 597A – Immunology	Fall/Spr	<input type="checkbox"/> ChemEng 592B – Introduction to Biochemical Engineering	Fall
<input type="checkbox"/> AnimiSci 672 – Molecular Medicine	Spring	<input type="checkbox"/> ChemEng 633– Transport Process	Fall
<input type="checkbox"/> AnimiSci 697J – Cell, Genes, and Development	Spring	<input type="checkbox"/> Chem 726 – Applied Analytical Chemistry	Fall/Spr
<input type="checkbox"/> Biochem 623 – Advanced General Biochemistry	Spring	<input type="checkbox"/> Chem 728 – Physical Biochemistry	Spring
<input type="checkbox"/> Biochem/MolclBio 642 – Advanced Molecular Biology	Fall	<input type="checkbox"/> Chem 791A or 627 – Biomolecular Structure	Fall
<input type="checkbox"/> Biology 697C – Plant Cell Biology	Spring	<input type="checkbox"/> Chem 791L – Bioanalytical Chemistry	Fall
<input type="checkbox"/> Biology 891PB – Topics in Plant Biology Research	Fall	<input type="checkbox"/> Chem 791D – Polymer Analysis & Characterization	Spring
<input type="checkbox"/> Biology 892A – Molecular Genetics & Development	Fall	<input type="checkbox"/> Microbio 697G – Genomics and Bioinformatics	Spring
<input type="checkbox"/> Chem 657 – Drug Design	Spring	<input type="checkbox"/> Physics 553: Optics	Spring
<input type="checkbox"/> Microbio 680 – Advanced Microbial Physiology	Fall	<input type="checkbox"/> Physics 590K: Biological Physics	Fall
<input type="checkbox"/> MolclBio 641 – Advanced Cellular Biology	Spring	<input type="checkbox"/> Physics 602: Statistical Physics	Spring
<input type="checkbox"/> MolclBio 690G – Adv Concepts of Genetic Analysis	Spring	<input type="checkbox"/> Physics 850: Continuum Mechanics (Section 1) or Biophysics (Section 3)	Fall
<input type="checkbox"/> Plant Bio 690A – Topics in Plant Biology Research	Fall	<input type="checkbox"/> Polymer 501: Intro to Polymer Science Engineering	Fall/Spr
		<input type="checkbox"/> Polymer 607: Intro to Synthetic Polymer Chemistry	Fall
		<input type="checkbox"/> Polymer 797CC – Colloidal Phenomena (must be taken for 3 credits)	Fall
		<input type="checkbox"/> Polymer 797TL – Polymer Translocation (must be taken for 3 credits)	Spring
<input type="checkbox"/> Other:		<input type="checkbox"/> Other:	

3. CELLULAR ENGINEERING LAB MODULES (4 CREDITS):

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|---|----------|--|----------|
| <input type="checkbox"/> Lab Module - Specify: | 1 credit | <input type="checkbox"/> Lab Module - Specify: | 1 credit |
| <input type="checkbox"/> Lab Module - Specify: | 1 credit | <input type="checkbox"/> Lab Module - Specify: | 1 credit |
| <input type="checkbox"/> Biochem 697N – X-ray Diffraction | 1 credit | <input type="checkbox"/> Polymer 797DD – Intro to 1D and 2D Spectroscopy | 1 credit |

4. ICE IGERT GRADUATE SEMINAR (2 CREDITS):

- Participate for any two semesters
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|---|----------|---|----------|
| <input type="checkbox"/> ChemE 797D – ICE IGERT Graduate Seminar (Fall) | 1 credit | <input type="checkbox"/> ChemE 797D – ICE IGERT Graduate Seminar (Spring) | 1 credit |
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5. ICE IGERT STUDENT RESEARCH SEMINAR (1 CREDIT):

- Offered in the Fall semester
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| <input type="checkbox"/> ChemE 797R – ICE IGERT Student Research Seminar | 1 credit |
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6. ICE IGERT JOURNAL CLUB (1 CREDIT):

- Offered in the Spring semester
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| <input type="checkbox"/> ChemE 797S – ICE IGERT Journal Club | 1 credit |
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7a. PROFESSIONAL DEVELOPMENT, REQUIRED SEMINAR (1 CREDIT):

- Offered in the Summer session
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| <input type="checkbox"/> ChemE 797E - Professional Development Seminar | 1 credit |
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7b. PROFESSIONAL DEVELOPMENT ELECTIVE: This requirement may be tailored to a fellow's career goals. Examples are listed below, but students are encouraged to suggest additional ideas for satisfying this credit.

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| <input type="checkbox"/> Mentor an undergraduate researcher | <input type="checkbox"/> BioChem 694A – Proposal Writing (Plant Biology focus) |
| <input type="checkbox"/> Internship (industry, government, international) | <input type="checkbox"/> Chem 591C – Preparing Future Faculty |
| <input type="checkbox"/> Other: students may propose to Academic Committee | <input type="checkbox"/> Polymer 797NN – Intro to Scientific Teaching |
| <input type="checkbox"/> Biology 791C – Writing for Graduate Students | <input type="checkbox"/> Polymer 797D – Scientific Management |

8. INTERDISCIPLINARY RESEARCH REPORT (no credits granted)

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|---|
| <input type="checkbox"/> Interdisciplinary Research Annual Report |
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