

# PH.D IN BIOENGINEERING

A Ph.D. in Bioengineering student performs original research guided by an advisor and contributes to the knowledge base in the scientific community. Students may be involved in the design and regulatory approval of advanced medical technologies, as well as the manufacturing of health care products. Funding opportunities include research or teaching assistantships and fellowships. Lab rotations, funded as graduate research assistantships, are available for top Ph.D. candidates and offer a one-year opportunity for students to rotate through research labs within the School of Biomedical Engineering to find the ideal match of research project and advisor for their dissertation research.

The Ph.D. curriculum includes core courses in advanced mathematics and statistics, biomedical engineering, and biotechnology, as well as technical electives chosen from numerous engineering and life science courses. The curriculum is designed to provide flexibility and support the chosen research specialty. Students are required to complete a Ph.D. qualifying process, present a research plan in a preliminary exam, and defend completed research in a final exam/dissertation defense.

Students interested in graduate work should refer to the Graduate and Professional Bulletin (<http://catalog.colostate.edu/general-catalog/graduate-bulletin/>) or visit the School of Biomedical Engineering (<https://www.engr.colostate.edu/sbme/>) website.

Strengths of the program include the following:

- Opportunities to develop major advances in the health care field
- Nationally and internationally recognized faculty from over a dozen departments
- Practical and academic experience with regulatory issues and approval processes with animal and human subjects
- Conducting research in state-of-the-art facilities, including the nationally renowned Veterinary Teaching Hospital
- Community of innovators on the cutting edge of research in cancer, orthopedics, cardiovascular disease, nanotechnology, biosensors, and more

## Learning Objectives

The Ph.D. program in bioengineering aims to produce graduates who:

1. Demonstrate technical mastery of the bioengineering disciplines of advanced engineering mathematics, biomolecular tools, bioengineering, physiology, and statistics.
2. Advance the theory and practice of bioengineering by making original research contributions that are both novel and significant.
3. Maintain high standards of scholarly excellence and responsible research conduct.
4. Demonstrate competency at assimilating information from other related fields of science and engineering to inform their intellectual pursuits and to expand the areas of application of their bioengineering expertise.
5. Effectively and professionally disseminate their research in the primary peer-reviewed and patent literature, and through technical conferences and symposia.

## Requirements

Intra-University in Colleges of Health and Human Sciences, Engineering, Natural Sciences, Veterinary Medicine and Biomedical Sciences

## Effective Fall 2021

Code	Title	Credits
<b>Core Course Requirements</b>		
BIOM 533/CIVE 533	Biomolecular Tools for Engineers	3
BIOM 570/MECH 570	Bioengineering	3
BIOM 576/MECH 576	Quantitative Systems Physiology	4
BIOM 592	Seminar <sup>1</sup>	4
BIOM 799	Dissertation	15-18
Select three credits from the following:		3
MATH 530	Mathematics for Scientists and Engineers	
MATH 535	Foundations of Applied Mathematics	
MATH 545	Partial Differential Equations I	
MATH 550/ ENGR 550	Numerical Methods in Science and Engineering	
MATH 560	Linear Algebra	
MATH 569A	Linear Algebra for Data Science: Matrices and Vectors Spaces	
MATH 569B	Linear Algebra for Data Science: Geometric Techniques for Data Reduction	
MATH 569C	Linear Algebra for Data Science: Matrix Factorizations and Transformations	
MATH 569D	Linear Algebra for Data Science: Theoretical Foundations	
Select four credits from the following:		4
STAR 501	Data Wrangling/Visualization for Researchers	
STAR 502	Multivariate Analysis for Researchers	
STAR 512	Design and Data Analysis for Researchers II	
STAR 513	Regression Models for Researchers	
STAR 514	Experimental Design/Analysis for Researchers	
STAR 531	Generalized Regression Models for Researchers	
STAR 532	Mixed Models for Researchers	
STAR 534	Machine Learning for Researchers	
M.S. Earned		30
Electives <sup>2</sup>		6-12
<b>Program Total Credits:</b>		<b>72</b>

A minimum of 72 credits are required to complete this program.<sup>3</sup>

<sup>1</sup> BIOM 592 must be taken in four semesters.

<sup>2</sup> Select a minimum of 6 credits of Engineering courses 500-level or above (either as a master's student or Ph.D. student) with approval of advisor.

<sup>3</sup> Program Total Credits must include a minimum of 42 semester credits earned at CSU (while in the graduate program), a minimum of 32 semester credits earned after admission to CSU, and a minimum of 12 semester credits earned at CSU (post-master's degree) in 500-level or above courses (not including dissertation and independent study). 10

credits earned after a master's degree is acceptable with approval from the student's advisor, the Bioengineering program, and the Graduate School. Completion of the Ph.D. also requires successfully completing a qualifying exam, a preliminary exam, and a dissertation defense.

## Requirements for All Graduate Degrees

For more information, please visit Requirements for All Graduate Degrees (<http://catalog.colostate.edu/general-catalog/graduate-bulletin/graduate-study/procedures-requirements-all-degrees/>) in the Graduate and Professional Bulletin (<http://catalog.colostate.edu/general-catalog/graduate-bulletin/>).

## Summary of Procedures for the Master's and Doctoral Degrees

NOTE: Each semester the Graduate School publishes a schedule of deadlines. Deadlines are available on the Graduate School website (<https://graduateschool.colostate.edu/deadline-dates/>). Students should consult this schedule whenever they approach important steps in their careers.

Forms (<https://graduateschool.colostate.edu/forms/>) are available online.

Step	Due Date
1. Application for admission (online)	Six months before first registration
2. Diagnostic examination when required	Before first registration
3. Appointment of advisor	Before first registration
4. Selection of graduate committee	Before the time of fourth regular semester registration
5. Filing of program of study (GS Form 6)	Before the time of fourth regular semester registration
6. Preliminary examination (Ph.D. and PD)	Two terms prior to final examination
7. Report of preliminary examination (GS Form 16) - (Ph.D. and PD)	Within two working days after results are known
8. Changes in committee (GS Form 9A)	When change is made
9. Application for Graduation (GS Form 25)	Refer to published deadlines from the Graduate School Website
9a. Reapplication for Graduation (online)	Failure to graduate requires Reapplication for Graduation (online) for the next time term for which you are applying
10. Submit thesis or dissertation to committee	At least two weeks prior to the examination or at the discretion of the graduate committee
11. Final examination	Refer to published deadlines from the Graduate School Website
12. Report of final examination (GS Form 24)	Within two working days after results are known; refer to published deadlines from the Graduate School website

13. Submit a signed Thesis/ Dissertation Submission Form (GS Form 30) to the Graduate School and Submit the Survey of Earned Doctorates (Ph.D. only) prior to submitting the electronic thesis/ dissertation	Refer to published deadlines from the Graduate School website.
14. Submit the thesis/dissertation electronically	Refer to published deadlines from the Graduate School website
15. Graduation	Ceremony information is available from the Graduate School website