Program Overview

The Integrated Molecular and Biophysical Chemistry PhD program emphasizes the chemistry and biochemistry of natural systems. This is an interdisciplinary program that spans biochemistry, biophysics, organic synthesis, medicinal chemistry, biological chemistry, cell biology, and molecular genetics. The curriculum is designed to develop deep technical and research skills coupled with leadership, communication, and business fundamental skills to prepare students for careers within and beyond the rapidly growing biotechnology sector.

Educational Goals

Based on the curricular areas and expectations described above, the main educational objectives of this program are to equip graduates with:

1. comprehensive technical knowledge spanning synthesis, biochemistry, and biophysics.
2. advanced research skills to allow students to design and implement experiments to test hypothesis and engage in multidisciplinary research.
3. leadership, innovation, communication, business, and entrepreneurial skills to prepare students for multiple career environments.

Application Requirements

The items listed below are required for admission consideration for applicable semesters of entry during the current academic year. Submission instructions, additional details, and changes to admission requirements for semesters other than the current academic year can be found on The Graduate College's website (http://www.gradcollege.txstate.edu). International students should review the International Admission Documents page (http://mycatalog.txstate.edu/graduate/admission-documents/international/) for additional requirements.

- completed online application
- $55 non-refundable application fee

  or

- $90 non-refundable application fee for applicants with international credentials
- completed bachelor's degree in chemistry, biochemistry, molecular biology, or a closely related discipline from an accredited college or university. At a minimum, students must have completed at least one year each of biology, organic chemistry, calculus, and physics. Additional advanced coursework and research experience is highly encouraged. Students who have earned a master's degree or completed some graduate coursework at an accredited college or university may apply to have up to 21 credits applied toward their degree.
- official transcripts from **each institution** where course credit was granted
- competitive GPA
- GRE not required
- resume/CV outlining education, work experience, scholarships/grants, publications/presentations, other accomplishments
- statement of purpose outlining the applicant's personal history, goals that are relevant to obtaining this doctoral degree, and how this degree will help the applicant achieve these goals
- three letters of recommendation evaluating the applicant's skill and potential in this degree program

TOEFL, PTE, IELTS or Duolingo Scores

Non-native English speakers who do not qualify for an English proficiency waiver:

- official TOEFL iBT scores required with a 78 overall.
- official PTE scores required with a 52 overall.
- official IELTS (academic) scores required with a 6.5 overall and minimum individual module scores of 6.0
- official Duolingo Scores required with a 110 overall.
- official TOEFL Essentials scores required with an 8.5 overall.

This program does not offer admission if these scores are not met.

Additional Information:

The program will admit full-time students for fall admission.

Degree Requirements

The Doctor of Philosophy (Ph.D.) degree with a major in Integrated Molecular and Biophysical Chemistry requires 72 semester credit hours.

Course Requirements

Code	Title	Hours
Required Courses		
CHEM 7110	Advances in Molecular and Biophysical Chemistry [1]	4
CHEM 7201	Graduate Laboratory Rotations	2
CHEM 7395	Fundamentals in Molecular and Biophysical Chemistry	3
MSEC 7301	Practical Skills in Commercialization and Entrepreneurship	3
MSEC 7302	Leadership Skills in Commercialization and Entrepreneurship	3
Prescribed Electives		
Choose 21 hours from the following:		21
BIO 7360I	Bayesian Statistics for Biology	
BIO 7360Y	Applied Bioinformatics	
CHEM 5310	Medicinal Chemistry	
CHEM 5312	Organometallic Chemistry	
CHEM 5313	Principles and Applications of Mass Spectrometry	
CHEM 5321	Advanced Organic Chemistry	
CHEM 5330	Physical Chemistry	
CHEM 5341	Inorganic Chemistry	
CHEM 5365	Separation Methods in Chemical Analysis	
CHEM 5381	Physical Biochemistry	
CHEM 5382	Enzymology	
CHEM 5383	Molecular Biology & Molecular Genetics	
CHEM 5386	Proteins	
CHEM 5387	Nucleic Acids Chemistry	
CHEM 5390	Supramolecular Chemistry	
CHEM 7200	Graduate Research [2]	
CHEM 7300	Graduate Research [2]	

CHEM 7305	Special Topics in Molecular and Biophysical Chemistry	
CHEM 7311	Natural Products, Anti-Infective, and Anti-Cancer Agents	
CHEM 7342	Bioinorganic Chemistry	
CHEM 7361	Quantitative Methods in Biophysical Chemistry	
CHEM 7385	Metabolism and Metabolomics	
CHEM 7391	Chemical Biology	
MSEC 7304	Collaborative Research/Commercialization Experience [2]	
MSEC 7340	Biomaterials and Biosensors	
Dissertation		
Choose a minimum of 36 hours from the following:		36
CHEM 7199	Dissertation	
CHEM 7299	Dissertation	
CHEM 7399	Dissertation	
CHEM 7599	Dissertation	
CHEM 7699	Dissertation	
CHEM 7999	Dissertation	
Total Hours		**72**

1 This course must be repeated each semester for the first four semesters.

2 These courses may be taken for up to 9 semester credit hours to satisfy the prescribed electives.

Candidacy Criteria

Students will advance to candidacy after they have completed all required and elective course work (except for dissertation credit hours), passed their comprehensive exam, and successfully defended their dissertation proposal. This should be done after the student has completed 36 credit hours and before they have completed 45 credit hours. Once all requirements are met, the doctoral program director will forward the Application for Advancement to Candidacy form to the Dean of The Graduate College for review and approval.

Comprehensive Exam

Each doctoral student must pass a comprehensive oral examination that takes place in conjunction with the dissertation proposal defense. Committee members will ask the student to answer questions based on prior coursework, fundamental principles related to their project, and topics related to the student's independently researched seminar. The student is considered to have passed this exam with a majority vote of the committee.

This exam should take place commensurate with the dissertation proposal defense following the completion of all core requirements. It can only be done after identifying the dissertation committee, presenting an independently researched seminar, and completing all required courses and boot camps. If the comprehensive exam is not passed, the student will have the option of taking a second and final comprehensive exam within one long semester. Students will be dismissed from the program if they do not pass the comprehensive exam the second time. Any student who has not taken the comprehensive exam or has not passed the comprehensive exam by the time 45 semester credit hours have been accrued will be dismissed from the program.

Dissertation Proposal and Proposal Defense

Each PhD student must prepare a written dissertation proposal and defend it orally. This should be done commensurate with the comprehensive exam after the student has completed 36 semester credit hours. The same requirements are in place as per the comprehensive exam: the student must have completed all required courses and boot camps and presented their seminar. Any student who does not defend his/her dissertation proposal by the time 45 semester credit hours have been accrued will be dismissed from the program. If the proposal defense is not passed, the student will have the option of taking a second and final proposal defense in the following long semester. Students will be dismissed from the PhD program if they do not pass the proposal defense the second time. Students in good standing that are dismissed from the program will be encouraged to complete a degree in our master's program using a thesis or non-thesis option, depending on the status of their research.

The dissertation proposal must outline the substance and scope of the planned dissertation research and explain its merits. It has to include at least an introduction, methodology to be used, a survey of the relevant literature, and preliminary results that demonstrate the feasibility of the research project. The goal of the proposal is to establish that the student has a sufficient grasp of the fundamentals of the chosen dissertation topic to execute the research.

The proposal defense entails a public presentation of the student's dissertation proposal followed immediately by a closed defense of the proposal attended only by the student and their dissertation committee. The dissertation proposal must be approved by the majority of the members of the dissertation committee. The student's dissertation committee members must indicate their approvals on the doctoral Dissertation Proposal Form as well as on the Defense of Dissertation Proposal Form. These forms are available on The Graduate College's website.

A final copy of the dissertation proposal, accompanied by the signed approval forms, must be turned in to the doctoral program director, who will forward them to the dean of The Graduate College for review and final approval.

Candidacy and Dissertation

When all requirements for admission to candidacy have been met, the doctoral program director will forward the Application for Advancement to Candidacy to the Dean of The Graduate College for review and approval. This application form is available on The Graduate College's website.

A minimum GPA of 3.0 on all coursework undertaken in the doctoral program is required for admission to candidacy. Grades below a B on any graduate coursework cannot be applied toward the doctoral degree. Incomplete grades must have been cleared before approval for advancement to candidacy can be granted. No more than six semester credit hours of dissertation research can be taken before advancing to candidacy. No credit will be applied toward a student's doctoral degree for coursework completed more than five years before the date on which the student is admitted to candidacy. This time limit applies to course credit earned at Texas State as well as course credit transferred to Texas State from other institutions.

All doctoral students must complete a dissertation that consists of original research and demonstrates mature scholarship and critical judgment in addition to familiarity with tools and methods in the chosen

area. The dissertation project should result in at least one peer-reviewed publication. The dissertation project must adhere to the dissertation proposal and cover the topic approved by the student's dissertation committee.

After being admitted to candidacy, students must be continuously enrolled for dissertation hours each fall and spring semester until the defense of their dissertation. At least 36 semester credit hours of dissertation research must be taken after having advanced to candidacy. If a student is receiving supervision on a dissertation during the summer or if the student is graduating in the summer, the student must be enrolled in dissertation hours for the summer. All candidates for graduation must be enrolled in dissertation hours during the semester in which the degree is to be conferred, even if they have already satisfied the minimum dissertation hours.

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Once the dissertation has been completed, a final exam (referred to as the dissertation defense) on the dissertation must be conducted. The dissertation defense cannot be scheduled until all other academic and program requirements have been fulfilled. A complete draft of the dissertation must be given to the members of the dissertation committee at least two weeks before the defense. However, students are highly encouraged to provide drafts earlier so that the committee members can provide feedback, which the student, in consultation with the dissertation advisor, will address in later drafts to ensure that the dissertation is defendable, and each committee member is satisfied before the dissertation defense takes place.

The dissertation defense consists of two parts. The first part is a public presentation of their dissertation research. The second part of the defense immediately follows the public presentation. It is restricted to participation of the student's dissertation committee and entails an oral examination of the dissertation research. Approval of the dissertation requires positive votes from the student's dissertation advisor and from the majority of the remaining members of the dissertation committee. Notice of the defense presentation will be publicly posted at least two weeks in advance.

If the dissertation defense is not approved, the student will have the option of taking a second and final dissertation defense once they have addressed issues as determined by the committee. Students who do not pass the dissertation defense the second time will be dismissed from the program.

Dissertation Committee

A student will select their dissertation advisor, who will serve as their dissertation committee chair, following laboratory rotations (CHEM 7201). The initial dissertation committee chair assignment, and its continuation, is subject to the approval of both parties. A dissertation committee chair can be changed with the approval of a student's assigned dissertation committee chair, a student's new dissertation committee chair, and the doctoral program director. If a dissertation committee chair withdraws mentorship, the student must secure a new dissertation committee chair within one long semester to stay on track in the program. Failure to do so will result in dismissal from the program.

The Dissertation Committee will be responsible for administering the Comprehensive Exam and the Dissertation Proposal Defense and will oversee the research and writing of the student's dissertation. The committee will consist of 4 members, including the student's dissertation committee chair who must be a regular graduate faculty member in the program, two other graduate faculty members from the chemistry and biochemistry department, and one graduate faculty from another department at Texas State University or an adjunct graduate faculty member (as defined by the Graduate College) from outside of the university. The student's dissertation advisor will chair the committee. The student, the dissertation committee chair, and the Dean of The Graduate College will approve the composition of the dissertation committee.

As per Graduate College policy, the Dissertation Committee Chair Assignment form and the Dissertation Committee Request form must be completed and approved by the Dean of The Graduate College to form the dissertation committee. Any changes to the dissertation committee must be submitted using the Dissertation Committee Chair/Committee Member Change Request form for approval of the dissertation committee chair, the doctoral program director, and the Dean of The Graduate College. Committee changes must be submitted no later than 60 days before the dissertation defense.

Dissertation Defense

Once the dissertation has been completed, a final exam (referred to as the dissertation defense) on the dissertation must be conducted. The dissertation defense cannot be scheduled until all other academic and program requirements have been fulfilled. A complete draft of the dissertation must be given to the members of the dissertation committee at least two weeks before the defense. However, students are highly encouraged to provide drafts earlier so that the committee members can provide feedback, which the student, in consultation with the dissertation advisor, will address in later drafts to ensure that the dissertation is defendable, and each committee member is satisfied before the dissertation defense takes place.

The dissertation defense consists of two parts. The first part is a public presentation of their dissertation research. The second part of the defense immediately follows the public presentation. It is restricted to participation of the student's dissertation committee and entails an oral examination of the dissertation research. Approval of the dissertation requires positive votes from the student's dissertation advisor and from the majority of the remaining members of the dissertation committee. Notice of the defense presentation will be publicly posted at least two weeks in advance.

If the dissertation defense is not approved, the student will have the option of taking a second and final dissertation defense once they have addressed issues as determined by the committee. Students who do not pass the dissertation defense the second time will be dismissed from the program.

The results of the dissertation defense must be recorded in the Dissertation Defense Report Form and submitted to The Graduate College before the Dean of The Graduate College can give final approval of the dissertation. This form can be downloaded from The Graduate College's website. The student must submit his/her dissertation to The Graduate

College for final approval. The guidelines for submission and approval of the dissertation can be obtained from The Graduate College.

Students must pass the dissertation defense by the time 99 semester credit hours have been accrued. The doctoral program will review each student annually to ascertain his/her progress towards the degree and will consult the student's dissertation advisor and dissertation committee on this matter as needed. Any student who does not pass the dissertation defense by the time 99 semester credit hours have been accrued will be dismissed from the program.

Doctoral level courses in Chemistry: CHEM (p. 4)

Courses Offered

Chemistry, (CHEM)

CHEM 7101. Doctoral Assistant Development.
This course is designed to prepare doctoral students employed as instructional assistants to perform effectively in diverse instructional settings. This course is seminar-based and covers topics related to teaching, research, and employment responsibilities. Completion of the course is required as a condition of employment for graduate assistants. This course does not earn graduate degree credit. Repeatable with different emphasis.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships

CHEM 7110. Advances in Molecular and Biophysical Chemistry.
This course is designed to provide students in the Integrated Molecular and Biophysical Chemistry PhD program a forum to discuss ongoing research progress and new discoveries through literature study. Students in the course will give informal 'work in progress' presentations and critically analyze recent publications in the field.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 7199. Dissertation.
This course consist of original research and writing in integrated molecular and biophysical chemistry to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CHEM 7200. Graduate Research.
This course is designed to provide doctoral students with an elective research option to allow them to collect preliminary data as they develop their dissertation proposal.
2 Credit Hours. 0 Lecture Contact Hours. 8 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CHEM 7201. Graduate Laboratory Rotations.
This course is designed to assist students in selecting a doctoral committee chair by having them work in several laboratories during their first semester in the program.
2 Credit Hours. 0 Lecture Contact Hours. 8 Lab Contact Hours.
Grade Mode: Credit/No Credit

CHEM 7299. Dissertation.
This course consist of original research and writing in integrated molecular and biophysical chemistry to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CHEM 7300. Graduate Research.
This course is designed to provide doctoral students with an elective research option to allow them to collect preliminary data as they develop their dissertation proposal.
3 Credit Hours. 0 Lecture Contact Hours. 12 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CHEM 7305A. Physico-Chemical Properties and Metabolism of Xenobiotics.
This course is designed to introduce students to the concepts of physico-chemical properties of small molecules and how these impact the ability of these molecules to be used as probes in biological systems, focusing on the role that metabolic processes play in limiting or activating chemical probes and the role of chemical probes in investigating these processes. Students will explore experimental and computational methods for determining the relevant properties of compounds.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

CHEM 7311. Natural Products, Anti-Infective, and Anti-Cancer Agents.
This course is designed to introduce the natural products by discussing their important classes (secondary metabolites), classification, nomenclature, structure, biosynthesis, occurrence and structure elucidation. The study of their utilization in medicine as leads for the development of new antimicrobial and anticancer agents will constitute the main focus of the course. The students will learn how to utilize their knowledge of organic chemistry and biochemistry gained in undergraduate courses toward the application of advanced research active areas on chemistry-biology interface.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 7330. Environmental Chemistry.
An introduction to environmental chemistry, with an emphasis on aquatic resources. Basic principles of geochemistry and atmospheric chemistry, as they relate to pollutant impacts on aquatic ecosystems, also will be examined. Prerequisites: CHEM 2142 and CHEM 2342 and CHEM 3410 all with grades of "C" or better or instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 7342. Bioinorganic Chemistry.
This course is designed to provide a broad overview of metalloprotein active site design and reaction mechanisms catalyzed by metalloenzymes. Training sessions on the use of contemporary protein visualization tools will be provided and used throughout the course. Topics covered in the course include dioxygen transport and activating proteins, electron transfer proteins, dinitrogen (N2), and hydrogen (H2) activation, photosystem and oxygen evolution, zinc containing proteins, CO2 reduction, and modern advancements in the field of bioinorganic chemistry. Students can expect to develop strong foundational knowledge in metalloenzyme structure, function, and reaction mechanisms.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 7354. Eukaryotic Molecular Biology and Macromolecular Structure.
This course is designed to cover the specific topics of the regulation of gene expression in eukaryotes, including eukaryotic DNA replication, DNA repair, DNA recombination, DNA transcription, RNA processing, translation, post-translational protein modification. This course will also introduce the application of macromolecular structure determination in eukaryotic gene expression and its regulation. Students can expect to develop a strong foundation in eukaryotic molecular biology, a strong ability to discuss literatures and some grant writing ability.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 7361. Quantitative Methods in Biophysical Chemistry.
This course will integrate the physical, chemical, and biological aspects of fundamental biophysical methods, including spectroscopy, calorimetry, and hydrodynamics. Students will develop a quantitative skillset in multiple analytical methods that are used to characterize a variety of biological systems. This course will provide students with the physical and chemical foundation to quantitatively study biological macromolecules at multiple levels of complexity.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 7385. Metabolism and Metabolomics.
This course is designed to introduce students to the metabolism of macromolecules and the principles and practice of metabolomics. It will cover (1) biosynthesis and biodegradation of carbohydrates, lipids, amino acids, proteins, and nucleic acids; (2) metabolomics principles; (3) applications of metabolomics in the biomedical field. Discussions of literature in metabolomics studies will be emphasized.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 7391. Chemical Biology.
This course will introduce the emerging field of chemical biology and common tools that are used to analyze and manipulate biological processes with small molecules. Students will develop a strong foundation in the design and synthesis of chemical tools to interrogate biological systems and focus on implementing and interpreting assays with these tools, using examples from the current literature.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 7395. Fundamentals in Molecular and Biophysical Chemistry.
This course is designed to provide a functional overview of the physics, chemistry, and biology concepts that are central to the practice of molecular biophysical chemistry. Students will develop a broad scientific foundation to pursue interdisciplinary projects within the biophysical and biochemical sciences, as well as productively interface and collaborate with colleagues across sub-disciplines throughout their doctoral studies.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 7399. Dissertation.
This course consist of original research and writing in integrated molecular and biophysical chemistry to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CHEM 7599. Dissertation.
This course consist of original research and writing in integrated molecular and biophysical chemistry to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CHEM 7699. Dissertation.
This course consist of original research and writing in integrated molecular and biophysical chemistry to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
6 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

CHEM 7999. Dissertation.
This course consist of original research and writing in integrated molecular and biophysical chemistry to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit