# Master of Science (M.S.) Major in Biochemistry

## Major Program
The Master of Science (M.S.) degree with a major in Biochemistry is designed for students who have undergraduate degrees in Biology, Biochemistry, or Chemistry and wish to pursue advanced studies in Biochemistry.

## 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 webpage (http://mycatalog.txstate.edu/graduate/admission-documents/international) for additional requirements.

- completed online ApplyTexas application
- $40 nonrefundable application fee
- $50 nonrefundable international evaluation fee (if applicable)
- baccalaureate degree in chemistry, biochemistry, or a closely related field from a regionally accredited university
- official transcripts required from each four-year institution where course credit was granted
- minimum 3.0 GPA in your last 60 hours of undergraduate course work (plus any completed graduate courses)
- official GRE scores required with a preferred minimum of 300 (verbal and quantitative sections combined)
- statement of purpose discussing career goals and undergraduate experiences
- two letters of recommendation regarding the student’s academic potential and undergraduate research experience

### TOEFL or IELTS Scores
Non-native English speakers who do not qualify for an English proficiency waiver:

- official TOEFL iBT scores required with a 78 overall
- official IELTS (academic) scores required with a 6.5 overall and
  - minimum individual module scores of 6.0

This program does not offer admission if the scores above are not met.

## Degree Requirements
The Master of Science (M.S.) degree with a major in Biochemistry requires 30 semester credit hours including a thesis.

## Course Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 5110</td>
<td>Seminar in Chemistry (Taken three times)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 5381</td>
<td>Physical Biochemistry</td>
<td>3</td>
</tr>
</tbody>
</table>

### Electives
Choose 6 hours from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>CHEM 5310</td>
<td>Medicinal Chemistry</td>
</tr>
<tr>
<td>CHEM 5312</td>
<td>Organometallic Chemistry</td>
</tr>
<tr>
<td>CHEM 5313</td>
<td>Principles and Applications of Mass Spectrometry</td>
</tr>
<tr>
<td>CHEM 5320</td>
<td>Modern Molecular Modeling</td>
</tr>
<tr>
<td>CHEM 5321</td>
<td>Advanced Organic Chemistry</td>
</tr>
<tr>
<td>CHEM 5330</td>
<td>Physical Chemistry</td>
</tr>
<tr>
<td>CHEM 5333</td>
<td>Spectroscopy</td>
</tr>
<tr>
<td>CHEM 5341</td>
<td>Inorganic Chemistry</td>
</tr>
<tr>
<td>CHEM 5351</td>
<td>Introduction to Polymers and Polymer Synthesis</td>
</tr>
<tr>
<td>CHEM 5353</td>
<td>Polymer Processing and Characterization</td>
</tr>
<tr>
<td>CHEM 5355</td>
<td>Physical Chemistry of Polymers</td>
</tr>
<tr>
<td>CHEM 5365</td>
<td>Separation Methods in Chemical Analysis</td>
</tr>
<tr>
<td>CHEM 5382</td>
<td>Enzymology</td>
</tr>
<tr>
<td>CHEM 5383</td>
<td>Molecular Biology &amp; Molecular Genetics</td>
</tr>
<tr>
<td>CHEM 5385</td>
<td>MPMetabolism</td>
</tr>
<tr>
<td>CHEM 5390</td>
<td>Supramolecular Chemistry</td>
</tr>
<tr>
<td>BIO 5300</td>
<td>Neurobiology</td>
</tr>
<tr>
<td>BIO 5311</td>
<td>Cancer Biology</td>
</tr>
<tr>
<td>BIO 5480</td>
<td>Cytology and Micro-technique</td>
</tr>
<tr>
<td>BIO 7361C</td>
<td>Advanced Genomics and Bioinformatics</td>
</tr>
<tr>
<td>MSEC 7301</td>
<td>Practical Skills in Commercialization and</td>
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<tr>
<td></td>
<td>Entrepreneurship</td>
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<tr>
<td>MSEC 7302</td>
<td>Leadership Skills in Commercialization and</td>
</tr>
<tr>
<td></td>
<td>Entrepreneurship</td>
</tr>
<tr>
<td>MSEC 7325</td>
<td>Principles of Technical Project Management</td>
</tr>
<tr>
<td>MSEC 7340</td>
<td>Biomaterials and Biosensors</td>
</tr>
</tbody>
</table>

### Thesis

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 5399A</td>
<td>Thesis</td>
<td>3</td>
</tr>
</tbody>
</table>

Choose a minimum of 3 hours from the following:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>CHEM 5199B</td>
<td>Thesis</td>
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<td>Thesis</td>
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<td>Thesis</td>
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<td>CHEM 5999B</td>
<td>Thesis</td>
</tr>
</tbody>
</table>

Total Hours: 30

### Comprehensive Examination Requirements
All candidates for graduate degrees must pass one or more comprehensive examinations.

If a student elects to follow the thesis option for the degree, a committee to direct the written thesis will be established. The thesis must demonstrate the student’s capability for research and independent thought. Preparation of the thesis must be in conformity with
The Graduate College Guide to Preparing and Submitting a Thesis or Dissertation.


The student must submit an official Thesis Proposal Form ([http://www.gradcollege.txstate.edu/forms.html](http://www.gradcollege.txstate.edu/forms.html)) and proposal to his or her thesis committee. Thesis proposals vary by department and discipline. Please see your department for proposal guidelines and requirements. After signing the form and obtaining committee members’ signatures, the graduate advisor’s signature if required by the program and the department chair’s signature, the student must submit the Thesis Proposal Form with one copy of the proposal attached to the dean of The Graduate College for approval before proceeding with research on the thesis. If the thesis research involves human subjects, the student must obtain exemption or approval from the Texas State Institutional Review Board prior to submitting the proposal form to The Graduate College. The IRB approval letter should be included with the proposal form. If the thesis research involves vertebrate animals, the proposal form must include the Texas State IACUC approval code. It is recommended that the thesis proposal form be submitted to the dean of The Graduate College by the end of the student’s enrollment in 5399A. Failure to submit the thesis proposal in a timely fashion may result in delayed graduation.

**Thesis Committee**

The thesis committee must be composed of a minimum of three approved graduate faculty members.

**Thesis Enrollment and Credit**

The completion of a minimum of six hours of thesis enrollment is required. For a student's initial thesis course enrollment, the student will need to register for thesis course number 5399A. After that, the student will enroll in thesis B courses, in each subsequent semester until the thesis is defended with the department and approved by The Graduate College. Preliminary discussions regarding the selection of a topic and assignment to a research supervisor will not require enrollment for the thesis course.

Students must be enrolled in thesis credits if they are receiving supervision and/or are using university resources related to their thesis work. The number of thesis credit hours students enroll in must reflect the amount of work being done on the thesis that semester. It is the responsibility of the committee chair to ensure that students are making adequate progress toward their degree throughout the thesis process. Failure to register for the thesis course during a term in which supervision is received may result in postponement of graduation. After initial enrollment in 5399A, the student will continue to enroll in a thesis B course as long as it takes to complete the thesis. Thesis projects are by definition original and individualized projects. As such, depending on the topic, methodology, and other factors, some projects may take longer than others to complete. If the thesis requires work beyond the minimum number of thesis credits needed for the degree, the student may enroll in additional thesis credits at the committee chair’s discretion. In the rare case when a student has not previously enrolled in thesis and plans to work on and complete the thesis in one term, the student will enroll in both 5399A and 5399B.

The only grades assigned for thesis courses are PR (progress), CR (credit), W (withdrew), and F (failing). If acceptable progress is not being made in a thesis course, the instructor may issue a grade of F. If the student is making acceptable progress, a grade of PR is assigned until the thesis is completed. The minimum number of hours of thesis credit (“CR”) will be awarded only after the thesis has been both approved by The Graduate College and released to Alkek Library.

A student who has selected the thesis option must be registered for the thesis course during the term or Summer I (during the summer, the thesis course runs ten weeks for both sessions) in which the degree will be conferred.

**Thesis Deadlines and Approval Process**

Thesis deadlines are posted on The Graduate College ([http://www.gradcollege.txstate.edu](http://www.gradcollege.txstate.edu)) website under "Current Students." The completed thesis must be submitted to the chair of the thesis committee on or before the deadlines listed on The Graduate College website.

The following must be submitted to The Graduate College by the thesis deadline listed on The Graduate College website:

1. The Thesis Submission Approval Form bearing original (wet) and/or electronic signatures of the student and all committee members.
2. One (1) PDF of the thesis in final form, approved by all committee members, uploaded in the online Vireo submission system.

After the dean of The Graduate College approves the thesis, Alkek Library will harvest the document from the Vireo submission system for publishing in the Digital Collections database (according to the student’s embargo selection). **NOTE:** MFA Creative Writing theses will have a permanent embargo and will never be published to Digital Collections.

While original (wet) signatures are preferred, there may be situations as determined by the chair of the committee in which obtaining original signatures is inefficient or has the potential to delay the student’s progress. In those situations, the following methods of signing are acceptable:

- signing and faxing the form
- signing, scanning, and emailing the form
- notifying the department in an email from their university’s or institution’s email account that the committee chair can sign the form on their behalf
- electronically signing the form using the university’s licensed signature platform.

If this process results in more than one document with signatures, all documents need to be submitted to The Graduate College together.

No copies are required to be submitted to Alkek Library. However, the library will bind copies submitted that the student wants bound for personal use. Personal copies are not required to be printed on archival quality paper. The student will take the personal copies to Alkek Library and pay the binding fee for personal copies.

Master’s level courses in Chemistry and Biochemistry: CHEM
Courses Offered
Chemistry (CHEM)

CHEM 5110. Seminar in Chemistry.
A course designed to acquaint the graduate student with current research areas in chemistry. May be repeated twice for total of 3 semester hour credit.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5195. Professional Development of Graduate Assistants.
This course is designed to develop and enhance graduate assistants’ laboratory instruction abilities. Topics covered in the course include effective lecture techniques, laboratory safety, theory and practical knowledge on laboratory experiments and laboratory section management. This course does not earn graduate credit.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships

CHEM 5199B. Thesis.
This course represents a student’s continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

CHEM 5285. Laboratory Development Practice.
This course develops the laboratory instructional abilities of post-baccalaureate students seeking either 8-12 Chemistry or 8-12 Physical Science Teaching Certification. Topics include both traditional laboratory techniques and guided inquiry techniques, safety, laboratory management, pedagogical theory and practical knowledge of laboratory experiments.
2 Credit Hours. 1 Lecture Contact Hour. 2 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

CHEM 5295. Professional Development of Graduate Assistants.
This course is designed to develop and enhance graduate assistants’ laboratory instruction abilities. Topics covered in the course include effective lecture techniques, laboratory safety, theory and practical knowledge on laboratory experiments and laboratory section management. This course does not earn graduate credit.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Graduate Assistantship|Exclude from Graduate GPA
Grade Mode: Leveling/Assistantships

CHEM 5299B. Thesis.
This course represents a student’s continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

CHEM 5310. Medicinal Chemistry.
This course surveys modern approaches to drug discovery and mechanisms of drug action with the focus on molecular structures of drugs. Examples of drug discovery for the chemotherapy of cancer, microbial and cardiovascular diseases will be examined.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5312. Organometallic Chemistry.
This course will survey the structure, bonding, and reactivity of organometallic complexes. Homogeneous catalysis of the transition metals as well as the main group elements along with specialized “seminal research papers” in the field of organometallic chemistry will also be presented.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

This course is designed for graduate chemistry and biochemistry majors. Sections of the course are devoted to the theory and practice of mass spectrometry. Application to chemistry, biochemistry, biology and materials science will be explored.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5320. Modern Molecular Modeling.
The application of computational techniques to molecular modeling. Topics covered include quantum mechanical modeling, force field based molecular modeling, energy minimization, molecular dynamics, vibrational spectra, solution of crystalline structures, diffraction patterns, molecular blends, phase equilibria, crystal morphology, physical property prediction, and mesoscale modeling. Prerequisites: CHEM 3340 with a grade of “D” or better or consent of instructor.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

Study of the relation of the following topics to structure and reactions of organic compounds: bonding, stereochemistry, acid-base concepts, physical organic chemistry, reactive species, and mechanisms.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5330. Physical Chemistry.
Fundamentals of physical chemistry are surveyed, emphasizing application in the other chemical sub-disciplines. Topics include classical thermodynamics, kinetics, atomic structure, and molecular spectroscopy.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5333. Spectroscopy.
Study of various spectrometric techniques in qualitative and structural analysis of chemical substances. Students who have completed CHEM 4333 or its equivalent may not take this course for master's credit.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
CHEM 5341. Inorganic Chemistry.
This course will review essential concepts in inorganic chemistry including atomic structure, bonding theory, acid-base chemistry, solid state structures, and coordination chemistry. Analytical techniques for characterizing inorganic structures will be discussed along with current topics in the field. This course does not earn graduate degree credit.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from Graduate GPA|Leveling
Grade Mode: Leveling/Assistantships

CHEM 5351. Introduction to Polymers and Polymer Synthesis.
This course is designed to develop the student's general understanding of polymer history and importance as well as terminology, structure, and synthesis. The overall scope of the course will be to develop the student's general knowledge of polymer synthesis and structure. Students who have completed CHEM 4351 or its equivalent may not take this course for master's credit.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5353. Polymer Processing and Characterization.
This course is designed to explore the areas of polymer processing and characterization. Students will be introduced to extrusion, injection molding, film formation, thermoforming, thermal-optical measurements, classical mechanical testing, and methods for determination of polymer molecular weight. Prerequisites: CHEM 5351 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5355. Physical Chemistry of Polymers.
A study of the physical chemistry of polymers. Subjects covered include thermodynamics, kinetic polymerization, phase relationships, molecular geometry, spectroscopy of polymers, polymer physics and mechanical behavior, polymer blends, rheology, and polymer composites.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5365. Separation Methods in Chemical Analysis.
The principles of gas chromatography, capillary electrophoresis, and mass spectrometry are discussed with a balance among theory, practice, and application.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5370. Problems in Chemistry.
Open to graduate students on an individual basis by arrangement with the faculty member concerned. May be repeated once with different emphasis for additional credit.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5375. Biochemistry.
A course devoted to a study of the chemistry of carbohydrates, lipids, proteins, enzymes, and nucleic acids. A study of enzyme kinetics and thermodynamics of coupled reactions is included.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5381. Physical Biochemistry.
An introduction to the physical techniques of biochemistry with emphasis on the interpretation of experimental data obtained from electrophoresis, chromatography, immunological methods, ultracentrifugation, spectroscopy and emerging techniques.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5382. Enzymology.
A study of the chemical and physical properties of enzymes. Topics will include structure-function relationships, elucidation of chemical and kinetic mechanisms, and the role of enzymes in metabolism.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5383. Molecular Biology & Molecular Genetics.
This course addresses the basic genetic mechanisms of bacteria and eukaryotes and introduces some examples of the biochemical and genetic techniques employed to study cells, tissues, and organisms.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5384. Current Topics in Biochemistry and Molecular Biology.
Course provides students with advanced knowledge in the areas of biochemistry and molecular biology. Topics include signal transduction and the molecular biology of cancer, as well as emerging topics in Genomics, Proteomics, and other new developments in biochemistry. May be repeated once for credit. Prerequisites: CHEM 5381.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Standard Letter

CHEM 5385. Metabolism.
A study of biodegradation and biosynthesis of carbohydrates, lipids, amino acids, proteins, and nucleic acids. Students who have completed CHEM 4385 or its equivalent may not take this course for master’s credit.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5386. Proteins.
This course will cover advanced biochemistry topics related to proteins. Topics will include protein structure, structure-function relationships, and current methodologies for examining proteins in addition to current findings in primary literature. Prerequisite: CHEM 5375 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5387. Nucleic Acids Chemistry.
This course will cover advanced biochemistry topics related to nucleic acids. Topics will include nucleic acid structures and properties, catalytic nucleic acids, protein-nucleic acid interactions, higher order complexes of protein-nucleic acids, and current methodologies for examining nucleic acids in addition to current findings in primary literature. Prerequisite: CHEM 5383 with a grade of "C" or better or equivalent.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter
CHEM 5390. Supramolecular Chemistry.
This course is designed to be a survey of the nature of non-covalent interactions between host and guest species. Emphasis will be focused on the rational design of hosts, thermodynamic and kinetic parameters involved in binding and the applications of various binding/recognition phenomena.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5395. Fundamentals of Research.
Course is designed to acquaint the beginning graduate student with materials and methods of chemical research.
3 Credit Hours. 2 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter

CHEM 5399A. Thesis.
This course represents a student’s initial thesis enrollment. No thesis credit is awarded until student has completed the thesis in CHEM 5399B.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

CHEM 5399B. Thesis.
This course represents a student’s continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

CHEM 5599B. Thesis.
This course represents a student’s continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding.
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit

CHEM 5999B. Thesis.
This course represents a student’s continuing thesis enrollment. The student continues to enroll in this course until the thesis is submitted for binding. Graded on a credit (CR), progress (PR), no-credit (F) basis.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Credit/No Credit