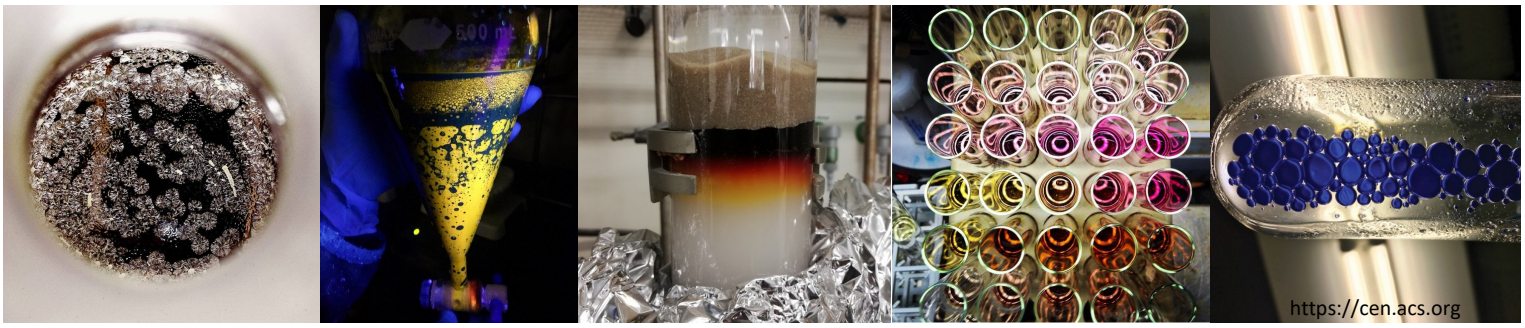
Department of Chemistry & Biochemistry



Graduate Student Handbook

California State University
SAN MARCOS

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WELCOME

Greetings entering graduate students, we are excited to have in our program!

This handbook is designed to inform you of our policies, procedures, and requirements and to help answer many questions as you move toward completing your degree. Although every effort has been made to keep this handbook current, policies and courses can change – please consult the University Catalog and Graduate Programs website for the most current and binding information. Your individual thesis advisor will be your primary contact and they will help you choose courses and design your research program. A lot of helpful information can also be found on the Office of Graduate Studies & Research website (http://www.csusm.edu/gsr). All forms can be found at: https://www.csusm.edu/chemistry/curriculum/chemms/current_students.html.

For specific program-related questions, feel free to contact me directly.

Welcome to the Department!

Robert Iafe, Ph.D.
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Associate Professor of Chemistry
Coordinator of Graduate Studies for Chemistry & Biochemistry

INTRODUCTION: MASTER OF SCIENCE IN CHEMISTRY

The graduate program in chemistry at California State University San Marcos (CSUSM) leads to a research-based Master of Science (MS) degree. The fields of biochemistry and chemistry aim to increase our molecular understanding of the organization of matter in natural and artificial systems and thereby provide solutions to problems of great importance to society. Our program provides students with both the freedom to explore diverse topics as well as a highly-structured "hands-on" research training environment where they can work one-on-one with faculty to systematically learn how to effectively and efficiently develop, plan, test, and present scientific hypotheses, investigations, and results. Another feature of our program is the Teaching Methods class, which is designed to give students the opportunity to discuss and implement pedagogical strategies employed in science education. Graduates with a MS in Chemistry will be prepared not only to continue study at the Ph.D. level, but also to successfully pursue careers in private industry or government affiliated labs and agencies, and to teach at the college level.

The graduate program in Chemistry fosters the integration of many disciplines. A wide range of faculty expertise and research interests enables the department to offer a curriculum that spans the fields of bio-analytical chemistry, biochemistry, bio-organic chemistry, inorganic organic chemistry, organic chemistry, physical chemistry, and chemical education. Students may develop a program of courses and research tailored to their individual interests within the areas of faculty expertise. In addition, students may choose a research supervisor outside of the Chemistry & Biochemistry Department to be on their committee, allowing them to pursue interdisciplinary studies, special field research, or industry projects. Seminar courses focus on the primary literature and are presented as a forum for open interchange and dissemination of scientific knowledge.

The Department maintains research laboratory space in both Science Hall 1 (~1800 sq feet) and Science Hall 2 (~1200 sq feet). The Department has a wide range of equipment used both in teaching and student research projects. Graduate students in this program will have access to: a Bruker Avance 400 MHz Nuclear Magnetic Resonance spectrometer, an Agilent 6410 Triple Quadropole LC/MS, an HP 5890/5972 GC/Mass Spectrometer, a Jasco Circular Dichroism Spectropolarimeter, three spectrofluorometers, a Varian SpectrAA 220 Scan Atomic Absorption Spectrometer, multiple UV/Vis spectrophotometers, Nicolet iS10 FT-IR spectrophotometer with Diamond ATR, multiple gas chromatographs, multiple HPLC systems, a confocal single molecule fluorescence microscope, a total internal reflection single molecular fluorescence microscope, and multiple anaerobic chambers. Excellent computer facilities also are available for computationally intensive research.

MENTORING

It is our belief that the quality of a student's graduate experience is, in large measure, a reflection of mentoring. Too often, especially in graduate programs that have large student–faculty ratios, students do not receive adequate faculty supervision. In our program, each student is carefully mentored throughout her/his training at CSUSM. No student will be without a thesis advisor (aka "thesis chair", "major advisor") at any time during their course of study, including leaves of absence from the program. Our aim is to include our graduate students in the every-day life of the department via teaching opportunities, participation in faculty research programs, and involvement in general departmental activities such as colloquium series, and social events.

Prior to acceptance into our program, students must be accepted by a thesis advisor whose research interests best match those of the student. This is facilitated when students make contact with faculty prior to applying to the program. However, should a student's research interests change (see list of faculty research interests herein) before they advance to candidacy, the student is free to switch to another thesis advisor.

Students should keep in contact with their thesis advisors as necessary, and at a minimum meet with them at the beginning of every semester. One of the first activities a new student should request is to meet with their assigned thesis advisor and fill out a Program of Study Form (**Appendix A**). This form will help the student plan which courses to take, how to make up for any course deficiencies, and how to transfer any outside graduate course credit.

OVERALL DEGREE PROGRAM

General Requirements

There are several specific requirements that must be met in order to earn the Master of Science in Chemistry degree. Students must complete these requirements in less than five years. While described in more detail below, in brief these requirements include:

I. **Coursework**: Our program requires a minimum of 30 semester units of study at the advanced level (courses numbered 500-698). Twenty-three (23) of these units are from required courses, and the remaining seven are elective. Coursework must be approved by the student's thesis committee and be recorded on a signed Program of Study Form (**Appendix A**).

II. **Research design and thesis proposal**: In order to be considered for advancement to candidacy, graduate students must have 1) obtained approval of their program of study, 2) developed a thesis proposal, and 3) successfully defended the proposal before their thesis committee. They must also meet any deficiencies if they were accepted conditionally. On approval of their thesis proposal, classified graduate students will be advanced to candidacy, and may then enroll in CHEM 698.

III. **Completion and defense of a written thesis**: The thesis must be based on original laboratory research, approved by the student's thesis committee, and defended in a public oral presentation to faculty and students.

IV. **Completion of at least one semester as a teaching assistant**: Because effective communication is important to success at the Master's level, the program in Chemistry requires that a graduate student, if possible, serve as a Teaching Assistant for one semester.

PROGRAM OF STUDY

Each graduate student must complete specific coursework that will lead to fulfillment of requirements for the Master of Science degree. This coursework is to be detailed on the Program of Study (POS) form (**Appendix A**) and approved by the student's thesis committee before the student advances to candidacy. The POS should be developed in consultation with the thesis advisor and the student's thesis committee, with a focus on gaining depth of knowledge in a particular sub-discipline of chemistry.

Thesis Committee Establishment

Each student must obtain the permission of a tenure-track Chemistry & Biochemistry faculty member to serve as their thesis advisor (typically the student's assigned thesis advisor when admitted to the program). Together the thesis advisor and student will select additional thesis committee members so that the thesis committee has at least 3 members. In addition to the thesis advisor, the thesis committee must consist of a second tenure track CSUSM faculty member from the Chemistry & Biochemistry Department, and the third member can be any person (CSUSM or outside of campus) who has a terminal degree (doctorate) and has expertise relevant to the research. Any additional members can be included as desired by the major advisor and student if that person has an advanced degree (Master's Degree or higher) and has pertinent background to the research topic. While more than three people can be on a thesis committee, know that extra members may mean extra scheduling difficulties for proposal and thesis defenses.

A student must obtain the written consent of each member who will serve on the thesis committee (see: Thesis Committee Form, **Appendix B**). In some cases, a student will rely primarily on the thesis advisor for thesis development; in other cases, the committee members (*e.g.,* a research supervisor) will be consulted more substantively. It is the student's responsibility to keep all committee members informed of their progress and to ask the thesis advisor for guidance on the appropriate level of involvement for their thesis committee members.

Coursework

Your coursework will include at least 30 units of courses at the graduate level and all courses must be included on the Program of Study. Additional courses for the area of study may be required as determined by the thesis committee. Required courses are: two courses chosen from Computational Physical Chemistry (CHEM 501, 3 units), Advanced Organic Synthesis (CHEM 502, 3 units), or Advanced Inorganic Chemistry (CHEM 504, 3 units); Teaching Methods (CHEM 680, 1 unit); two seminars from Chemistry & Biochemistry Seminar (CHEM 690, 1 unit); two seminars from Research Colloquium (CHEM 691, 1 unit); Directed Studies (CHEM 697, 6 units); and Thesis Research (CHEM 698, 6 units). CHEM 697 is taken prior to defending the thesis proposal, and CHEM 698 is taken after the proposal is successfully defended and the student has advanced to candidacy. The remaining units (7-8) of graduate level coursework will be comprised of elective lecture/lab courses selected by the student and her/his committee (see list of potential department courses listed herein). The POS also may include additional courses needed to satisfy prerequisites for students admitted with conditional classified status (units not applicable to the

required 30). The formal POS must be submitted for approval to the student's thesis committee before the end of the second semester after admission to the program.

Typical Two-Year Full-Time Course of Study

Year 1, Fall Semester	Units
CHEM 504 Advanced Inorganic Chemistry	3
Elective Graduate Course	2-3
CHEM 690 Chemistry & Biochemistry Seminar	1
CHEM 697 Directed Studies	1-6
Develop Program of Study (POS)	
Establish Thesis Committee	
Year 1, Spring Semester	
CHEM 502 Advanced Organic Synthesis	3
Elective Graduate Course	2-3
CHEM 680 Teaching Methods*	1
CHEM 690 Chemistry & Biochemistry Seminar	1
CHEM 697 Directed Studies	1-6
Submit approved POS	
Defend thesis proposal and advance to candidacy	
Year 2, Fall Semester	
Elective Graduate Course	2-3
CHEM 691 Research Colloquium	1
CHEM 698 Thesis Research**	1-6
Year 2, Spring Semester	
Elective Graduate Course	2-3
CHEM 691 Research Colloquium	1
CHEM 698 Thesis Research	1-6
Defend and file thesis	
Additional Year(s)	
CHEM 699 Continuation of Thesis Research	1-6

*Teaching Methods (CHEM 680) can be taken at any time
**Students typically defend their thesis proposal by the end of the second semester. If deficiencies are not cleared for advancement, students will enroll in CHEM 697 until they advance to candidacy.

Typical Three-Year Part-Time Course of Study (6 units of less*)

Year 1, Fall Semester	Units
CHEM 504 Advanced Inorganic Chemistry	3
CHEM 690 Chemistry & Biochemistry Seminar	1
CHEM 697 Directed Studies	2
Year 1, Spring Semester	
CHEM 502 Advanced Organic Synthesis	3
CHEM 680 Teaching Methods**	1
CHEM 690 Chemistry & Biochemistry Seminar	1
CHEM 697 Directed Studies	1
Year 2, Fall Semester	
Elective Graduate Course	2-3
CHEM 697 Directed Studies	3-4
Year 2, Spring Semester	
Elective Graduate Course	2-3
CHEM 691 Research Colloquium	1
CHEM 698 Thesis Research***	2-3
Year 3, Fall Semester	
Elective Graduate Course	2-3
CHEM 691 Research Colloquium	1
CHEM 698 Thesis Research***	2-3
Year 3, Spring Semester	
Elective Graduate Course	2-3
CHEM 698 Thesis Research***	3-4
Additional Year(s)	
CHEM 699 Continuation of Thesis Research	1-6

*Students with 6 units pay part-time fees/tuition. For some financial aid purposes, 6 units allows students to be considered for full reimbursement. Note that some funding agencies consider 9 units to be full time instead of 6 units.
**Teaching Methods (CHEM 680) can be taken at any time
***Students typically defend their thesis proposal by the end of the second semester. If deficiencies are not cleared for advancement, students will enroll in CHEM 697 until they advance to candidacy.

Coursework Restrictions

Any course taken at CSUSM or other institutions at the 300-level or below may not be used in the Program of Study for the MS degree. With prior approval from the Graduate Coordinator, Master's students may count up to three (3) units of 400-level science majors (non-General Education) courses towards their 30-unit requirement. Up to six (6) units of graduate coursework from other Universities or from CSUSM taken prior to admittance in the MS program can be applied toward the degree. Students should not expect that such courses will transfer unless the student can show, to the satisfaction of the faculty in the Chemistry & Biochemistry Department, that this coursework is equivalent to CSUSM graduate course work. In no case will courses that were taken more than seven years prior to the filing of the thesis be counted toward graduation. Students may not elect credit/no credit for any course counted toward the degree that is also offered on a letter grade basis. Course prerequisites will be enforced, unless consent of instructor is granted.

Units from graduate-level courses that were successfully completed while a student was an undergraduate at CSUSM will not count toward the Master's degree unless a specific concurrent enrollment form was approved by Registration and Records during the student's final undergraduate semester.

ADVANCEMENT TO CANDIDACY

Advancement to candidacy is the process by which students become approved to carry out their research project with a successful thesis proposal defense. To be eligible for advancement, a graduate student must have attained classified status (*i.e.*, completed any deficiencies noted in their letter of acceptance to the program) and have constituted a thesis committee.

The Advancement Process

A student becomes advanced after:

1. they have successfully defended a research proposal orally before their thesis committee,
2. they have completed all deficiencies identified upon admission to the program, and
3. they have passed the graduate writing assessment requirement (GWAR).

The research proposal is a document which outlines the original research ideas and plans of the graduate student. While the actual format may vary depending on the thesis advisor's preferences, all proposals should include the information provided in the section "Required Proposal Components and Accompanying Guidelines" below. The student and thesis advisor will likely go through several drafts before the thesis advisor decides the proposal is ready to be sent to other committee members. **Early drafts (those that require extensive rewrites, grammatical errors, etc.) of the proposal should be exchanged only with the thesis advisor and should not be sent to committee members**. A wise graduate student will contact committee members early in the advancement process to determine the availability of the committee to meet. Find out when any of your members might be on sabbatical or out of state before trying to schedule a proposal date. **The finished proposal should be sent to the entire committee at least two weeks prior to the date for the proposal defense**. Do not give the proposal to your committee only days before your defense – while it might be the only subject on your mind, your committee likely has many other obligations and needs time to review the proposal. A committee member may refuse to attend your proposal defense (resulting in rescheduling) if they have not had enough time to review the proposal. Most proposal defenses include a brief presentation by the student to the committee, followed by a question and answer period. Afterwards, the student will be asked to leave the room while the committee decides if the student is ready to carry out the proposed research. A repeated defense may be necessary if the committee decides that the student is not ready to proceed. Upon approval of the proposal, the committee and thesis advisor will sign the advancement to candidacy form (**Appendix C**). The original of this form and the Program of Study form need to be given by the student to the Graduate Coordinator of the Chemistry & Biochemistry Department.

Required Proposal Components and Accompanying Guidelines

General Considerations:

1. All text much be double-spaced in 12-point Times New Roman or 11-point Arial font.
2. Margins should be one inch on all sides.

Title Page

1. Title should convey the specific nature of the proposed study.
2. Your name.
3. Thesis committee members.

Abstract *approx. length: 300 words*

1. Briefly convey the research to be conducted, including the rationale so that a general scientific audience can understand what you will be doing.
2. Include the hypothesis or objective of the study, an overview of methods, and a brief statement of the expected results and their significance.
3. Avoid acronyms, abbreviations, citations, and technical jargon specific to the field.
4. Write as one paragraph with no citations.

Specific Aims/Objectives *approx. length: 1 page*

1. Start with a brief narrative describing the long-term goals or objectives of the research project and the hypothesis to be tested (if there is one).
2. This is followed by a list of 2-3 specific aims describing how these hypothesizes will be tested or objectives met. Make sure they are attainable during the program time.
3. Summarize the expected outcomes (if the research proposed is hypothesis driven).

Background and Significance *approx. length: 6 pages*

Review the primary literature, summarizing the key information that is relevant to your proposed research.

1. Cover the state of existing knowledge, including literature citations and highlights of relevant data (may be published or unpublished from your lab). Avoid outdated research.
2. Provide the rationale for the proposed research.
3. Explain gaps that the project is intended to fill.
4. Include the potential contribution of this research to the scientific field (significance).

Study Design/Research Plan *approx. length: 6 pages*

The purpose is to describe how the research will be carried out. For each Aim of the project, describe the following:

1. Any preliminary data that relates to accomplishing that Aim.
2. The experimental procedures to be used, measurements to be made, analyses to be performed, and statistical tests to be applied.
3. Treatment groups versus controls where appropriate and details such as sample size, IACUC and IBR approvals as appropriate for the research proposed.
4. Often a figure is useful for describing what experimental and control groups will be tested and which analyses will be made.
5. Citations for published procedures, software, and statistical references.
6. Any potential difficulties or limitations and how they will be overcome.
7. Expected results or outcomes and alternative approaches that will be used if unexpected results are found.

Budget (*optional*) ***approx. length: 1 page***

1. Itemize major expenses
2. Specify the sources of funds to be used to cover these expenses and any fellowships/ scholarships you will be applying for.

Timeline

1. Include timeline for data collection, analysis, presentations, and meetings.
2. Be clear about timing for proposal and thesis defense.

References ***minimum 20 references***

Follow one consistent format for all references! Use the formal followed by a leading journal in your particular discipline in chemistry, *i.e.*, JACS format. Be consistent! Use of a reference manager such as Zotero is recommended for easy formatting.

Figures and Tables (*optional*)

1. Use figures, tables, or flowcharts where needed to illustrate complex ideas, designs and methods. This can help explain complicated experimental designs, intracellular pathways, geographical sampling locations, etc.
2. All figures and tables must include concise, explanatory legends or captions. Table captions are presented above the table, while figure legends are presented below the figure.
3. If you reproduce someone else's figure, you must include a citation in the legend indicating where this figure or schematic diagram came from. This citation needs to be included in your References section.
   Note: The MS thesis of former members of your lab should be cited like any other work, following the standard format for a dissertation.

Proposal Timing

The formal written thesis proposal is to be presented no later than the beginning of the second year of full-time study, or after 12 units of graduate coursework have been completed. Students are strongly advised to undertake the proposal defense as early as possible for the following reasons:

A. Students cannot enroll in CHEM 698 until they have advanced to candidacy; six units of CHEM 698 are required for the degree.
B. Students must be advanced to candidacy before they can apply to graduate.
C. The proposal should be defended before any major research toward the thesis begins. Part of the proposal defense process is to allow the committee to help the student design their project. If most or all of the research is done prior to the proposal defense, and major research design flaws are discovered, the committee can ask the student to redesign or repeat part or all of the research.
D. Students who do not attempt the proposal defense in a timely fashion may be dropped from the program.

Faculty are not expected to convene for a proposal defense during summer, university vacations, or the semester break in December/January. However, faculty may choose to attend defenses during breaks; the likelihood of this increases with the amount of notice given to the committee by the student.

THE THESIS

The thesis is the culminating experience for each student and is a substantial product of original empirical research carried out under the close supervision of a faculty thesis advisor and the thesis committee members. The format of the final thesis is to be determined by the faculty thesis advisor and the submitted thesis must comply with CSUSM Library standards (see the Graduate Studies website). The final thesis must be publicly presented and defended to the Thesis Committee, and the final submitted thesis must incorporate any recommended changes from the committee.

Guidelines for the required electronic thesis submission are on the library website at:
https://biblio.csusm.edu/content/e-thesis-project-and-dissertation-submission-guide.

Thesis Completion Process
Our program allows you to finish all of your course work in four semesters. However, progress toward the thesis varies a great deal among students. Although faculty do their best to provide the moral support and expertise you need to design, carry out, and write your thesis, the self-discipline and motivation you will need to complete your work must come from you. In the end, it is UP TO YOU to start your thesis, to keep it on track, and to bring it to final completion. Your progress is ultimately your responsibility.

You should start thinking about your thesis project very early on, even in your first semester. You are encouraged to schedule regular meetings with your thesis advisor to talk over ideas. Ask your advisor if they would be willing to set deadlines for you if you think it will help you to move ahead (but do not blame your advisor if you fail to meet the deadlines!). As a graduate student, you can no longer afford to think of summers and University holidays/breaks as "time off." Rather, those should be times in which you work especially hard on your research. We realize many of you work off campus, so setting practical goals for yourself can ensure constant progress on your thesis.

Theses always require more work than students expect. Typically, an idea must be refined and refined again over the course of several months. Multiple drafts of your written work with your thesis advisor will be necessary. Some frustration is inevitable, but it can be minimized by proper planning, realistic expectations, and a healthy attitude toward constructive criticism. One of the strengths of our graduate program is that we set high standards for our students. This means more effort and patience is required of you, but the result of your work will be a high-quality thesis of which you can be proud.

Only after you and your thesis advisor approve your thesis, is it time to send it to the rest of your committee. As with the proposal, it is not the job of the committee to help with early basic editing. Rather, they should receive what you and your advisor consider to be a finished product. You must give this final draft of your thesis to your committee at least two weeks prior to the defense date to allow them time to review it. If you wait until the last week of the semester to give your thesis to your committee and to schedule a defense date, do not be surprised if your committee is unavailable. The final step in your program is to orally and publicly defend your thesis and then incorporate any last changes requested by your committee before you submit your thesis to the library. *Faculty are not expected to convene for a thesis defense during summer, university*

vacations, or the semester break in December/January. However, faculty may choose to attend defenses during breaks; the likelihood of this increases with the amount of notice given to the committee by the student.

General Submission Dates for Spring graduation:

1. Apply for graduation by March 15.
2. Student must submit a draft of the thesis to the library for ADA compliance by 5pm on the Monday of Week 13. The draft will be returned within 2 weeks of submission.
3. Student must successfully defend their thesis with their committee in a public forum in time to submit the thesis.
4. Completed final drafts of the thesis and signatures of a successful defense must be submitted to the library by 5pm on the Thursday of Week 15 (last week of lecture).

If you only need a 1-week extension, please contact the graduate coordinate ASAP. A 1-week extension can only be made ***BEFORE*** the CSU-systemwide submission deadline.

If you cannot make the 1-week extension deadline, you may graduate in the summer, however the following criteria must be met:

1. Apply for graduation by March 15.
2. Student must submit a draft of the thesis to the library for ADA compliance by 5pm on the Monday of Week 13. The draft will be returned within 2 weeks of submission.
3. Student must successfully defend their thesis with their committee in a public forum before 5pm on the Thursday of Week 15 (last week of lecture); where the outcome is a pass but only the thesis is remaining to be completed.
4. Obtain graduate coordinator's approval to enroll in GRAD E699 (APPENDIX D) and submit form to registration and records. GRAD E699 is coded for Master's students who have completed all of their graduate coursework, including the for-credit supervised thesis/project coursework called for in the chemistry graduate program.
5. Complete thesis by summer ADA deadline.
6. Submit the final draft of thesis to the library by 5pm on Thursday of 10th week of summer session.

Guidelines for the required electronic thesis submission are on the library website at:
https://biblio.csusm.edu/content/e-thesis-project-and-dissertation-submission-guide.

TEACHING APPRENTICESHIP

Direct teaching experience is an optional educational exercise for our Master's students. The experience of designing syllabi and pre-lab lectures, of leading labs, and writing/grading assignments is invaluable for students whether or not they proceed into teaching careers. There are several options for fulfilling the teaching obligation. Most students teach a section of one of our lower-division major or non-major laboratories (*e.g.*, CHEM 150L, CHEM 201L), which are taught every semester. These well-structured courses have developed curricula to aid the student teacher. During the semester the student teaches they will sign up for CHEM 680 and they will receive a small salary. If a student has had extensive, relevant teaching experience, they may petition the graduate studies committee for waiver of the teaching requirement by first contacting the graduate coordinator. Discuss with your thesis advisor which semester would be best for you to teach and then contact the graduate coordinator to ask about teaching opportunities for that semester. You are expected to be available to teach every lab of your assigned class during your teaching semester.

ENROLLMENT AND REGISTRATION

Continuous Enrollment
Once accepted into the program, students must be continuously enrolled during each semester unless they apply for a leave of absence (see Leave of Absence below). Students need not enroll in courses during the summer, unless they expect to file their thesis during summer. You must be enrolled when you defend/file your thesis.

Leave of Absence
In accordance with CSUSM policy, a student may request a leave of absence for valid medical, planned educational, or professional reasons on a semester by semester basis. The form should be obtained from the Chemistry Graduate Coordinator or the graduate studies website. The Graduate Coordinator must fill in information and sign the form, then the student will bring the form to the Office of Registration and Records before the end of the add/drop period of enrollment. No more than two semesters (not including summer) will be excused through authorized leaves of absence. Authorized leaves of absence do not extend the time limit for degree completion. For example, if you enroll for three years, take two leaves of absence (miss year four) you will only have one year remaining to complete your degree. During a leave of absence, the student will not have access to most University resources or to faculty time.

Time Limit for Degree
A graduate student has five years to complete the course work and thesis. If the student does not complete the requirements within the five years, they will be dropped from the program. A student may petition the Dean of Graduate Studies and Research for special consideration to extend the time limit at one semester intervals. The student must meet with the Chemistry Graduate Coordinator who will complete the form to state the reasons for the extension and include a specific plan to complete the degree requirements. The Dean of Graduate Studies will decide if the extension will be granted.

Graduate Standing Continuation (Extended Learning E699)
The purpose of the Extended Learning E699 course is to allow students to be enrolled with the university (continuing the mandatory graduate standing status), without requiring specific products or faculty involvement (*i.e.*, course carries no units, is not graded, no instructor of record). This course is used during the final semester when a student has already finished writing their thesis and the committee has already reviewed the thesis but the student needs to complete final paperwork to submit the thesis to the library. Students who are still working closely with an advisor on their thesis research and/or writing should enroll in the graduate-level independent study course (CHEM 699), rather than the Extended Learning E699. The E699 course can only be taken once and can be used during a semester or during the summer. When authorized by the Graduate Coordinator of Chemistry, E699 provides access to certain university resources (*e.g.*, the library, e-mail/computing accounts) while the student works independently to finish their thesis filing. Registration for this enrollment status is offered through Extended Learning (follow the instructions on the GRAD E699 Enrollment Form, **Appendix D**).

GRADUATE WRITING ASSESSMENT REQUIREMENT

CSUSM requires that each student complete the Graduation Writing Assessment Requirement (GWAR) to assess writing proficiency by all graduate students. Students will not be advanced to candidacy unless they have met this requirement and students must pass the GWAR to remain enrolled in the MS program.

In the Department of Chemistry & Biochemistry, a student will have met the GWAR requirement if they scored ≥4.0 on the GRE writing exam. If the student scored less than 4.0, then the major paper assignment from Chem 690 will be evaluated. This document will be reviewed and scored by two people, the instructor of record of Chem 690 and the student's thesis advisor; if the instructor and advisor is the same person, another Chemistry & Biochemistry Department tenure-track faculty member will be selected (likely a member of the thesis committee). The proposal will be scored according to the rubric detailed below including scores (1 to 4 points) in each of four areas: Style and Format, Mechanics, Content and Organization, and Integration and Critical Analysis. The minimum acceptable combined score from all four sections is 10 points, with no scores of "1" on any section, resulting in a minimum average of 2.5 for all sections. If the student does not pass the GWAR with their Chem 690 paper evaluation, then they will meet with both reviewers to examine the weaknesses of the document and obtain suggestions for improvement. The student will revise and resubmit the document for re-evaluation. If the student does not pass the GWAR with their revised Chem 690 paper, then the student will be referred to the writing center where they will receive help with the document that has instructor/advisor comments. The student will then re-submit the paper to the original reviewers for a third evaluation. If the student is unable to pass the GWAR during the third evaluation of the document, then they will be considered to have failed the GWAR requirement and will be discontinued from the program. At any time during this process, the student may be referred to ALCI (American Language and Culture Institute) for further evaluation and instruction.

GWAR RUBRIC

I. Style and Format

4: In addition to meeting the requirement for a "3," the paper consistently models the language and conventions used in the scholarly/ professional literature appropriate to the student's discipline. The manuscript would meet the guidelines for submission for publication in a peer reviewed journal in the student's field of study.

3: While there may be minor errors, conventions for style and format are used consistently throughout the paper. Demonstrates thoroughness and competence in documenting sources; the reader would have little difficulty referring back to cited sources. Style and format contribute to the comprehensibility of the paper. Suitably models the discipline's overall scholarly style.

2: The style and format are broadly followed, but inconsistencies are apparent. There is selection of less suitable sources (non-peer reviewed literature, web information). Weak transitions and apparent logic gaps occur between topics being addressed. The style may be difficult to follow so as to detract from the comprehensibility of the manuscript.

1: While some discipline-specific conventions are followed, others are not. Paper lacks consistency of style and/or format. It may be unclear which references are direct quotes and which are paraphrased. Based on the information provided, the reader would have some difficulty referring back to cited sources. Significant revisions would contribute to the comprehensibility of the paper.

II. Mechanics

4: In addition to meeting the requirements for a "3," the paper is essentially error-free in terms of mechanics. Writing flows smoothly from one idea to another. Transitions effectively establish a sound scholarly argument and aid the reader in following the writer's logic.

3: While there may be minor errors, the paper follows normal conventions of spelling and grammar throughout. Errors do not significantly interfere with topic comprehensibility. Transitions and organizational structures, such as subheadings, are effectively used which help the reader move from one point to another.

2: Grammatical conventions are generally used, but inconsistency and/or errors in their use result in weak, but still apparent, connections between topics in the formulation of the argument. There is poor or improper use of headings and related features to keep the reader on track within the topic. Effective discipline-specific vocabulary is used.

1: Frequent errors in spelling, grammar (such as subject/verb agreements and tense), sentence structure, and/or other writing conventions make reading difficult and interfere with comprehensibility. There is some confusion in the proper use of discipline-specific terms. Writing does not flow smoothly from point to point; appropriate transitions are lacking.

III. Content and Organization

4: In addition to meeting the requirements for a "3," excels in the organization and representation of ideas related to the topic. Raises important issues or ideas which may not have been represented in the literature cited. Would serve as a good basis for further research on the topic.

3: Follows all requirements for the paper. Topic is carefully focused. Clearly outlines the major points related to the topic; ideas are logically arranged to present a sound scholarly argument. Paper is interesting and holds the reader's attention. Does a credible job summarizing related literature. General ideas are expanded upon in a logical manner thereby extending the significance of the work presented beyond a restatement of known ideas.

2: Ideas presented closely follow conventional concepts with little expansion and development of new directions. Certain logical connections or inclusion of specific topics related to the student’s area of study may be omitted. Ideas and concepts are generally satisfactorily presented although lapses in logic and organization are apparent. The reader is suitably introduced to the topic being presented such that the relationship to the student’s area of study is obvious.

1: The paper is logically and thematically coherent but is lacking in substantial ways. The content may be poorly focused or the scholarly argument weak or poorly conceived. Major ideas related to the content may be ignored or inadequately explored. Overall, the content and organization need significant revision to represent a critical analysis of the topic.

IV. Integration and Critical Analysis

4: In addition to meeting the requirement of a "3," the document presents the current state of knowledge for the topic being addressed utilizing a diversity of opinions. These various, and possibly conflicting, opinions are presented in a balanced manner and seamlessly woven together to illustrate a complete grasp of the literature across multiple research approaches utilizing appropriate national and international peer reviewed journals. Essential findings of multiple sources are accurately and concisely paraphrased, analyzed, and integrated. Original sources are clearly identified and correctly cited in both the body of the text and the reference section. Organizationally, smooth and effective transitions between topics lead the reader through an orderly discussion of the topic being addressed. The gaps in current knowledge are clearly identified and significant directions and approaches that fill these gaps are identified.

3: There are inconsistencies in the organization and logic of the presentation, but still clear analysis of the presented materials. While synthesis of all aspects of the topic may show varying degrees of development, the overall consistency, thoroughness, and analysis result in a well-crafted document.

2: Identification of key topics or uncertainties in the field may be incomplete. New concepts resulting from a synthetic presentation of ideas is poorly developed or lacking. Complex topics and related concepts are awkwardly presented and linkages among topics may be unclear.

1: Weakness is evident in the coverage of the field and analysis resulting in incorrect or poorly developed synthesis of results. Analysis is limited to categorizing and summarizing topics. The resulting manuscript degrades the comprehensibility of the document and the identification of knowledge gaps.

GRADES AND POLICIES

Academic Continuation
Graduate students must maintain an overall GPA of 3.0 and earn at least a C (2.0) in all courses, except those graded credit/no credit. Students who are admitted as conditionally classified because of GPA deficiencies may not earn less than a B (3.0) in the first three graduate courses taken at the 500 or 600 level at CSUSM (excluding CHEM 697). Any student whose overall GPA falls below 3.0 for two semesters, or who receives more than three grades of C (2.0) or lower, will be discontinued from the program.

Incomplete Grade
It is incumbent upon the student to initiate the request for an incomplete grade and to reach an agreement with the instructor regarding completion of the course work. A request for a grade of incomplete will be denied if the instructor believes it is inappropriate (see University Catalog). All incomplete grades must be completed within one year in accordance with CSUSM policy.

Repeating a Course
According to the CSUSM policy, "Graduate and post baccalaureate students may repeat up to two (2) courses in order to meet graduation requirements. Repeating a course does not expunge the earlier attempt from the student's record, but it may improve the student's grade point average (GPA). This policy is applicable only to non-thesis courses taken at CSU San Marcos." Additional details of this policy are available in the policy document "APC 307- 96" dated 2008.

Appeals
A graduate student who is aggrieved about a course evaluation, candidacy decision, or degree requirement should first discuss the matter with the relevant faculty member, then the thesis advisor, then the graduate coordinator, and then the department chair. If the matter cannot be informally resolved, then the student may file a formal grievance in accordance with CSUSM policy.

Ethics
Students are expected to understand and comply with all ethical standards that apply to scientists. Students must also abide by professional standards of conduct in the field of chemistry. Violations of ethical standards will be dealt with seriously and in accordance with CSUSM policy. The Chemistry & Biochemistry Department does not tolerate plagiarism or cheating in any form, and violations of our academic honesty policies may result in dismissal from the program.

GRADUATION AND COMMENCEMENT

To graduate in any given semester (fall, spring or summer), the thesis must be defended and filed with the library by deadlines posted for that semester. The dates change, but generally the last day to file will be early May, early August and early December for spring, summer and fall graduation, respectively. You will need to make an appointment contact the appropriate librarian and review materials posted on the library website to learn about requirements prior to the filing date.

You must apply to graduate with the University (**Appendix E**). If you do not graduate during the semester you applied, you will need to cancel the application and reapply for the appropriate semester. Make sure to meet with your thesis advisor early enough to ensure you have completed all of the coursework, teaching requirements, and thesis requirements before you apply to graduate.

Commencement, the major walking and hooding ceremony, currently only occurs in May. While there may be a small ceremony for Fall graduates, the May ceremony is the large, University-wide program. We strongly advise, and some thesis advisors may require, students to have actually filed their theses before walking. It is ultimately more satisfying to be done before, rather than participate in the graduation ceremony but not finish for months to years later!

University Resources

Library
The library is a major resource for graduate level study. The library now has 250,000 books and bound periodicals, 800 print journals, access to 11,000 electronic journals and 100 research databases. Electronic search, CD-ROM, interlibrary loan, and media services are available. For more information, call the CSUSM Library at (760) 750-4340.

Financial Aid
Several sources of financial aid are available to graduate students in addition to teaching assistantships. Students are responsible for identifying other sources of aid and may wish to consult with the University's Office of Financial Aid. For more information, please contact the CSUSM Financial Aid Office at (760) 750-4850.

Graduate Research Dissemination Fund
The Graduate Research Dissemination Fund provides financial assistance to help graduate students present their research completed at CSUSM. Appropriate activities include support for travel to a conference at which a student's paper or poster has been accepted, page charges for publication of a research paper, and other activities designed to help disseminate the results of student.

- Funds are distributed on a first-come, first-served basis, until funds for the current year run out.
- Students may only receive one award.
- Potential sources of other support will influence the size of the award.
- Group projects as well as individual projects may be funded.

Interested students may get the application form online or from the Office of Graduate Studies, CRA 5102. For further information, contact the Office of Graduate Studies and Research (x 4066).

Office for Training, Research & Education in the Sciences (OTRES) Program
The federal government has determined that Hispanic/Latinos, African Americans, Native Americans, and Pacific Islanders are severely underrepresented in the biomedical research workforce of the United States. The RISE Graduate Program provides support for living expenses of $15,000 for RISE Graduate Scholars (additional years of participation in the program include a modest increase in this award) and pays tuition and fees. The RISE Graduate Program will also provide some support for graduate students to defray research expenses in the laboratory where the students will conduct their research, and fund travel expenses to a national scientific research symposium. Details can be found at the OTRES website (www.csusm.edu/otres).

FINAL TIPS FOR A SUCCESSFUL DEGREE

- Meet regularly with your thesis advisor. Keep them informed of your progress, lack of progress, etc. Do not disappear for weeks on end!

- Design your Program of Study early and keep checking it. Make sure you will have the 30 required units by the time you want to file your thesis. It can be extremely frustrating to be done with the research and have to enroll in more coursework.

- Make sure you plan the best semester to do your optional teaching experience.

- If you came in "conditionally classified", rectify your requirements early. You cannot advance to candidacy until you are "classified".

- Be on campus as much as possible. Do not just come for classes, but instead spend time on campus; otherwise you are missing out on a lot of the graduate experience. Make friends with other grad students, discuss problems, hang out in lab to see how things run, etc.

- Keep your committee informed of your progress or any major changes. Do not let two years go by between your proposal and thesis defense without chatting with your committee. This is especially important if you are making changes to your research.

- If you feel like you are not making much progress, ask your advisor for deadlines to help give you more structure.

- When in doubt, ask.

- Work hard.

- Do not procrastinate.

- Have FUN and take ownership of your research!

THE CHEMISTRY & BIOCHEMISTRY FACULTY

Faculty Research Interests

Kang Du, Assistant Professor (Ph. D. Inorganic Chemistry, 2018; Northwestern University). Dr. Du joined the Department of Chemistry and Biochemistry at CSUSM in Fall 2022, after carrying out postdoctoral research in UPenn. His research interest includes toxic/valuable metal recovery, host-guest materials and inorganic molecules with fundamentally interesting physical properties. Previous research has focus on developing responsive MRI contrast agents, metal-organic capsules and magnetic nanoparticles for toxins.
Faculty website: https://faculty.csusm.edu/kdu/

Du, K.; Zemerov, S. D.; Hurtado Parra, S.; Kikkawa, J. M.; Dmochowski, I. J. Paramagnetic Organocobalt Capsule Revealing Xenon Host-Guest Chemistry. *Inorg. Chem.* **2020**, *59*, 13831–13844.

Du, K.; Thorarinsdottir, A. E.; Harris, T. D. Selective Binding and Quantitation of Calcium with a Cobalt-Based Magnetic Resonance Probe. *J. Am. Chem. Soc.* **2019**, *141*, 7163–7172.

Du, K.; Harris, T. D. A Cu^{II}_2 Paramagnetic Chemical Exchange Saturation Transfer Contrast Agent Enabled by Magnetic Exchange Coupling. *J. Am. Chem. Soc.* **2016**, *138*, 7804–7807.

Kambiz Hamadani, Associate Professor (Ph.D. Biochemistry and Molecular Biology, 2008; University of California Los Angeles). Dr. Hamadani joined the Chemistry and Biochemistry Dept. at CSUSM in Fall of 2013 after completing his post-doctoral training at UC Berkeley. His research interests include the study of co-translational protein folding and conformational dynamics, genetic code reprogramming using reconstituted in-vitro translation systems, directed evolution, single molecule fluorescence spectroscopy, and virtual and mixed-reality educational technology development
Faculty website: https://faculty.csusm.edu/hamadani

K. M. Hamadani, Y. Jiang, A. Ahmadinia, A. Hadaegh, J. Moraleja-Garcia, A. Mendez, A. Shaikh. "Framework for scalable content development in hands-on virtual and mixed reality science labs". *8th International Conference of the Immersive Learning Research Network (iLRN)*, **2022**. Vienna, Austria.

P. Soto, A. R. Carter, C. Deligkaris, D. Gül, **K. M. Hamadani**, J. Knight, D. Matulis, T. N. Ozturk, Y. Rivera-Colón, E. A. Yates. "Perspectives on How 1.5 Years of the COVID-19 Pandemic Have Impacted Biophysicists at Primarily Undergraduate Institutions". *The Biophysicist* **2022**.

S. Rosemond, **K. M. Hamadani**, J. H. D. Cate, S. Marqusee. Modulating long-range energetics via helix stabilization: a case study using T4 lysozyme. *Protein Sci.* **2018**, 27, 2084–2093.

K. M. Hamadani, J. Howe, M. Jensen, P. Wu, J. H. D. Cate, S. Marqusee. An in-vitro tag-and-modify protein sample generation method for single-molecule fluorescence resonance energy transfer. *J. Biol. Chem.* **2017**, 292, 15636–15648.

C. Riedel, R. Gabizon, C. A. M. Wilson, **K. M. Hamadani**, K. Tsekouras, S. Marqusee, S. Presse, C. Bustamante. The heat released during catalytic turnover enhances the diffusion of an enzyme". *Nature* **2014**, *517*, 227–230.

Robert G. Iafe, Associate Professor (Ph.D. Organic Chemistry, 2011; University of California Los Angeles). Dr. Iafe joined the Chemistry & Biochemistry faculty at CSUSM in Fall 2014, after completing an appointment as a Visiting Assistant Professor at the W. M. Keck Science Department at the Claremont Colleges. He is primarily interested in synthetic organic methodology, with a particular emphasis on organocatalysis, transition metal catalysis, and applications toward bioactive small molecule synthesis. Previous research projects have focused on macrocyclization strategies and computational investigations of pericyclic reactions.
Faculty website: https://faculty.csusm.edu/riafe

King, B. H.; Wang, M. L.; Jesse, K. A.; Kaur, G.; Tran, B.; Walser-Kuntz, R.; **Iafe, R. G.**; Wenzel, A. G. Silver-Catalyzed, N-Formylation of Amines Using Glycol Ethers. *J. Org. Chem.* **2020**, *85*, 13256–13263.

Oakley, J. V.; Stanley, T. J.; Jesse, K. A.; Melanese, A. K; Alvarez, A. A.; Prince, A. L.; Cain, S. E.; Wenzel, A. G.; **Iafe, R. G.** Gold-Catalyzed Friedel–Crafts-like Reaction of Benzylic Alcohols to Afford 1,1-Diarylalkanes. *Euro. J. Org. Chem*. **2019**, *42*, 7063–7066.

Karabiyikoglu, S.; **Iafe, R. G.**; Merlic, C. A. Ring-Closing Metathesis with Vicinal Dibromoalkenes as Protected Alkynes: A Synthetic Approach to Macrocyclic Enynes. *Organic Letters* **2015**, *17*, 5248–5251.

Paul G. Jasien, Professor Emeritus (Ph.D. Physical Chemistry, 1984; University of Illinois, Urbana-Champaign). Dr. Jasien joined the Chemistry & Biochemistry faculty at CSUSM in 1991, after positions at the National Bureau of Standards, Argonne National Laboratory, and Biosym Technologies. His research interests are in computational methods & quantum chemistry, as well as chemical education. Previous research projects have focused on intermolecular halogen bonding, complex reaction mechanisms, and student conceptual understanding.
Faculty website: https://faculty.csusm.edu/pjasien

P. G. Jasien, "A Note on Detailed Balance and Absolute Concentration Robustness in the Teaching of Chemical Kinetics," *The Chemical Educator* **24** (2019) 75–79.

A. P. Orlova and **P. G. Jasien**, "Halogen Bonding in Self-Assembling Systems: A Comparison of Intra- and Interchain Binding Energies," *Computational and Theoretical Chemistry* **1139** (2018) 63–69.

P. G. Jasien, "Student Understanding of a Simple Heating Curve: Scientific Interpretations and Consistency of Responses," *Journal of Education in Science, Health, and the Environment* **4** (2018) 172–182.

P. G. Jasien, "Helping Students Assess the Relative Importance of Different Intermolecular Interactions," *Journal of Chemical Education* **85** (2008) 1222–1225.

Sajith Jayasinghe, Professor (Ph.D. Biochemistry, 1999; University of Virginia). In a broad sense my research involves the use of biochemical and biophysical techniques to investigate the structure function of proteins. Presently my research focuses mainly on investigating the structure and function of proteins involved in the assembly bacterial curli. Curli is a class of cell surface filaments found in Escherichia and Salmonella spp. Curli, comprised mainly of the oligomerized protein subunit CsgA, is thought to facilitate bacterial surface colonization, long-term survival, and bacterial cell-cell association, and appear to play a vital role in host infection. Given its

apparent role in bacterial survival, inhibition of curli formation is thought to be a promising avenue for the development of novel agents that reduce bacterial viability and infection. However, our ability to exploit curli biogenesis in the development of novel therapeutic agents is limited due to scant mechanistic information available on curli assembly. The overall goal of the projects in my laboratory is to elucidate structural information on the proteins involved in curli assembly in an effort to determine the mechanism of curli biogenesis.
Faculty website: https://public.csusm.edu/jayasinghe

Jayasinghe, S. A.; Langen, R. Identifying structural features of fibrillar islet amyloid polypeptide using site-directed spin labeling. *Journal of Biological Chemistry* **2004***, 279*, 48420.
Jayasinghe, S. A.; Langen, R. Lipid Membranes Modulate the Structure of Islet Amyloid Polypeptide. *Biochemistry* **2005**, *44*, 12113.
Green, A.; Pham, N.; Osby, K.; Aram, A.; Claudius, R.; Patray, S.; **Jayasinghe, S. A.** Are the curli proteins CsgE and CsgF intrinsically disordered? *Intrinsically Disordered Proteins* **2016**, 4, e1130675

Jose A. Mendoza, Professor (Ph.D. Biochemistry, 1992; University of Texas Health Science Center at San Antonio). Dr. Mendoza joined the Chemistry & Biochemistry faculty at CSUSM in Fall 1994, after completing postdoctoral research appointments at the University of Utah and the University of Texas Health Science Center at San Antonio. He is interested in structure-function relationships of the "stress proteins", GroEL from *E. coli*, mammalian α-crystallin and Hsp60 from *H. pylori* and in the protective effects of heat-sensitive enzymes by GroEL and small organic molecules that accumulate during cellular stress called osmolytes
Faculty website: https://faculty.csusm.edu/mendoza

Mendoza, J.A.; Weinberger, K.K.; Swan, M.J. (2017) The Hsp60 protein of helicobacter pylori displays chaperone activity under acidic conditions. *Biochem. Biophys. Rep*. 9, 95–99.
Mendoza, J.A.; Correa, M.D.; Zardeneta, G. (2012) GTP binds to a-crystallin and causes a significant conformational change. *Int. J. Biol. Macromol*. 50, 895–898.
Melkani, G.C.; Sielaff, R.; Zardeneta, G.; **Mendoza, J.A.** (2012) Interaction of oxidized chaperonin GroEL with an unfolded protein at low temperatures. *Biosci. Rep*. 32, 299–303.

Wai Man Ng, Associate Professor (Ph.D. 1995; University of Arkansas). Extraction and detection of biomolecules, pharmaceuticals and natural products.

Astorino, T. A.; Martin, B. J.; Schachtsiek, L.; Wong, K; **Ng, K**. Minimal Effect of Acute Caffeine Ingestion on Intense Resistance Training Performance. *J. Strength. Cond. Res.* **2011**, 25, 1752.

Afra Panahi, Assistant Professor (Ph.D. Physical Chemistry, 2013; Michigan State University). Dr. Panahi joined the Chemistry & Biochemistry faculty at CSUSM in Fall 2017, after her postdoctoral positions in University of Michigan and Boston University. She is mainly interested in application of molecular dynamics simulations in studying membrane proteins along with developing computationally efficient techniques to model sgical membranes.

Bandara, A.; **Panahi, A.**; Pantelopulos, G. A.; Nagai T.; Straub, J. E.; "Exploring the Impact of Proteins on the Line Tension of a Phase-Separating Ternary Lipid Mixture" *J. Chem. Phys*. **2019**, 150, 204702

Morgado, I.; **Panahi, A.**; Burwash A.G.; Das, M.; Straub, J. E.; Gursky, O.; "Molecular Insights into Human Hereditary Apolipoprotein AI Amyloidosis Caused by the Glu34Lys Mutation." *Biochem.* **2018** 57, 5738

Panahi, A.; Bandara, A.; Pantelopulos, G. A.; Dominguez, L.; Straub, J. E. "Specific Binding of Cholesterol to C99 Domain of Amyloid Precursor Protein Depends Critically on Charge State of Protein." *J. Phys. Chem. Lett.* **2016**, *7*, 3535.

Panahi, A.; Brooks III, C. L. "Membrane Environment Modulates the pKa Values of Transmembrane Helices." *J. Phys. Chem. B* **2015**, *119*, 4601.

Panahi, A.; Feig, M. "Dynamic Heterogeneous Dielectric Generalized Born (DHDGB): An Implicit Membrane Model with a Dynamically Varying Bilayer Thickness." *J. Chem. Theory Comput.* **2012**, *9*, 1709.

Jacqueline Trischman, Professor, CSTEM Dean (Ph.D. Marine Natural Products Chemistry/Oceanography, 1993; Scripps Institution of Oceanography, UC San Diego). Dr. Trischman joined the faculty in 1995 after teaching at both the undergraduate and graduate levels at Tulane University and UC San Diego. Dr. Trischman's research interests include isolation and structure elucidation of marine and indigenous plant natural products, chemical ecology of marine microorganisms with a focus on *Mycobacterium marinum*, a close genetic relative of *M. tuberculosis*, and instrumental analysis in chemical education.

Trischman, J. A.; Oeffner, R. E.; deLuna, M.; Kazaoka, M. (2004) Competitive induction and enhancement of indole and a diketopiperazine in marine bacteria. *Marine Biotechnology,* 6, 3.

Trischman, J. A.; Moore, B. S.; Seng, D.; Kho, D.; Jensen, P. R.; Fenical, W. (1999) Salinamides, Antiinflammatory Depsipeptides from a Marine Streptomycete. Journal of Organic Chemistry. 64, 1145–1150.

CHEMISTRY & BIOCHEMISTRY COURSES

Note: courses may change, and additional courses may be offered each semester. Please consult the online catalogue and schedule of classes.

Courses open to Advanced Undergraduate or Graduate Students

CHEM 501 Computational Physical Chemistry (3 units)
Introduces students to computational methods as applied to some of the major theoretical ideas of Physical Chemistry. The concepts to be covered will include examples from: Classical Chemical Thermodynamics, Statistical Thermodynamics, Chemical Kinetics, Quantum Chemistry, and/or Molecular Modeling. The course is designed to build on previous knowledge of Physical Chemistry gained at the undergraduate level. *Prerequisite: CHEM 401 and CHEM 402 or classified graduate standing*.

CHEM 502 Advanced Organic Synthesis (3 units)
Builds on the total synthesis concepts introduced in the undergraduate organic sequence. Reactions of organic compounds will be studied from the perspective of conformational analysis, mechanism, reactive intermediates, and synthetic methods. *Prerequisite: CHEM 202L or classified graduate standing.*

CHEM 504 Advanced Inorganic Chemistry (3 units)
Surveys the elements and compounds of both the main group and transition series, with an emphasis on rationalizing patterns of structure, stability and reactivity across the periodic table. Introduces applications to catalysis, geochemistry and biochemistry *Prerequisite: CHEM 404 or classified graduate standing.*

CHEM 511 HPLC Methods (2 units)
Introduces the theories for different separations and detection modes of High Performance Liquid Chromatography (HPLC). Includes HPLC method development, parameter optimization and the applications of HPLC techniques for the separation of pharmaceuticals and biological samples. *Prerequisite: CHEM 416 or classified graduate standing.*

CHEM 514 Electrochemical Methods (3 units)
Introduces modern electrochemical methods from a theoretical and practical perspective. Fundamentals of the electrode/solution interface, interfacial electron transfer and mass transport. Provides application to a variety of modern electrochemical techniques is demonstrated. *Prerequisite: CHEM 404 and CHEM 416 or classified graduate standing.*

CHEM 521 Organometallics (2 units)
Introduces the chemistry of carbon to transition-metal bonds beginning with rules governing structure and stability; effects of metal and ancillary ligand environment; general mechanistic steps; NMR and IR spectroscopy; fluxional processes. Followed by applications in homogeneous catalysis and stoichiometric organic synthesis. *Prerequisite: CHEM 202L and CHEM 404 or classified graduate standing.*

CHEM 531 Biosynthesis of Natural Products (2 units)
Introduces the main building blocks and basic synthetic mechanisms employed in the biosynthesis of natural products. Areas of metabolism fed by the acetate, shikimate, mevalonate and deoxyxylulose phosphate pathways will be studied while investigating modern drug candidates that these pathways have produced. *Prerequisite: CHEM 202L and either CHEM 341 or CHEM 352, or classified graduate standing.*

CHEM 532 Medicinal Chemistry (2 units)
Introduces design and development of drug candidates to cure diseases based on the modulation of current drug targets, including proteins, nucleic acids, and other receptor-based functionalities. Focuses on structure-activity relationships, pharmacokinetics, and pharmacodynamics. *Prerequisite: CHEM 202L and CHEM 341 or CHEM 352 or classified graduate standing.*

CHEM 533 Polymer Chemistry (2 units)
Introduces the basics of polymer synthesis. Traditional polymerization techniques, such as free-radical, anionic chain, and step-growth polymerization, as well as newer methods of polymer synthesis will be discussed. Preparation of advanced block, star and brush copolymers, semi-conducting and biodegradable polymers, and the fundamentals of structure and physical properties of polymers, and methods of characterization will also be covered. *Prerequisite: CHEM 202L or classified graduate standing.*

CHEM 534 Advanced Spectroscopic Methods (2 units)
Introduces advanced spectroscopic techniques used to elucidate the structures of organic molecules of various molecular weights. Emphasizes problem solving, starting with the application of fundamental concepts and techniques, and building toward state-of-the-art methods used by the modern organic and bioorganic chemist. *Prerequisite: CHEM 416 or classified graduate standing.*

CHEM 550 Protein Structure & Function (dual listed with CHEM 450, 3 Units)
Fundamentals of protein structure including structural motifs, domains, and folding, methods of protein structure determination, and structural bioinformatics. In-depth consideration of the structure-function relationship in representative proteins involved in important biological functions such as transport, enzyme catalysis, protein-nucleic acid interactions, signal transduction, immunity, and membrane channels and receptors. *May not be taken for credit by students who have received credit for CHEM 450. Prerequisite: CHEM 341 or CHEM 351 or classified graduate standing.*

CHEM 551 Biophysical Chemistry (dual listed with CHEM 451, 3 Units)
Application of the principles of physical chemistry to the study of dynamic biomolecular systems and processes. Review of thermodynamics, chemical kinetics, transport processes, chemical equilibria, and physical equilibria. Use of optical spectroscopy, magnetic resonance spectroscopy, and mass spectrometry. Focuses on biomolecular structure and dynamics; protein folding; protein engineering; membrane protein biophysics; and translation. *May not be taken for credit by students who have received credit for CHEM 451. Prerequisite: CHEM 341 or CHEM 351 and CHEM 401 or classified graduate standing.*

CHEM 552 Single Molecule Spectroscopy (2 units)
Introduces the development and application of single molecule (SM) detection to problems in biology and biochemistry. Topics covered include early pioneers of the field; the principles of instrument design; methods/approaches for sample preparation and probe attachment; single molecule fluorescence spectroscopy/microscopy; super-resolution imaging techniques; force spectroscopy/microscopy; hardware/software considerations for data acquisition and analysis; and a literature survey of current research applications. *Prerequisite: CHEM 341 or CHEM 351 and CHEM 401 or classified graduate standing.*

CHEM 553 Membrane Protein Biophysics (2 units)
Introduces the principles that govern the structure and function of membrane proteins. Different classes of membrane proteins will be discussed using examples that play important roles in human health and disease. *Prerequisite: CHEM 341 or CHEM 351 or classified graduate standing.*

CHEM 555 Enzymology (dual listed with CHEM 455, 3 Units)
Focuses on enzyme kinetics, the mechanisms of enzyme catalysis, and enzymatic regulation. Includes a review of basic enzymatic concepts, enzyme kinetics of single substrate reactions, enzyme inhibition and multi-substrate enzyme systems, mechanisms of enzyme catalysis, active site studies, the description of specific well-characterized enzymes, and mechanisms of enzyme regulation. *May not be taken for credit by students who have received credit for CHEM 455. Prerequisite: CHEM 341 or CHEM 351 or classified graduate standing.*

CHEM 556 Synthetic Biochemistry (2 units)
Compares and contrasts cell-based and cell-free approaches to making and engineering commodity small molecules and genetically-encoded biopolymers using naturally-existing or biologically-inspired enzymes. Both templated and non-templated synthetic systems will be explored. Includes biofuels production, drug discovery, protein engineering, and structural biophysics. *Prerequisite: CHEM 401 (or equivalent) and either CHEM 341 or CHEM 351 (or equivalent) or classified graduate standing.*

CHEM 590 Special Topics in Chemistry (1-2 units)
Surveys a topic from the chemical or biochemical literature. *Students should check the Class Schedule for listing of actual topics. Prerequisite: Classified Graduate Standing or consent of instructor.*

Courses Open Only to Graduate Students

CHEM 680 Teaching Methods (1 unit)
Introduces graduate students to the procedural information and practical skills needed to be an effective teaching assistant. *Enrollment restricted to students with Graduate standing. May be repeated once.*

CHEM 690 Chemistry & Biochemistry Seminar (1 unit)
Provides students with a variety of conceptual tools to help them be successful in integrating the various demands and many activities that comprise their graduate experience, e.g. studying, learning, mentoring and being mentored, choosing a research advisor, starting their research work,

critically reading the scientific literature, and presenting scientific research. *May be repeated with new content for a maximum of two (2) units toward the Master's degree. Credit/No credit grading only. Enrollment restricted to students with Graduate standing.*

CHEM 691 Research Colloquium (1 unit)
Provides students with opportunities to give a seminar each semester on a selected journal topic or their own research as well as an opportunity to engage with invited speakers in various chemical fields. *May be repeated with new content for a maximum of two (2) units toward the Master's degree. Credit/No credit grading only. Enrollment restricted to students with graduate standing.*

CHEM 696 Project Research (1-6 units)
Work on project research for graduate students who are conducting research at, or in collaboration with, a company. *Enrollment restricted to students with graduate standing. No more than twelve (12) units of credit may be applied to the major. Enrollment restricted to student who have obtained consent of instructor.*

CHEM 697 Directed Studies (1-6 units)
Designed to teach techniques in the research laboratory and developing preliminary data prior to advancement to candidacy. *Enrollment restricted to students with graduate standing. No more than six (6) units of credit may be applied to the major. Enrollment restricted to student who have obtained consent of instructor.*

CHEM 698 Thesis Research (1-6 units)
Design, implementation, and analysis of formal research project in chemistry & biochemistry. *Enrollment restricted to students with Graduate standing. Prerequisite: Advancement to candidacy. No more than six (6) units of credit may be applied to the major. Enrollment restricted to students who have obtained consent of instructor.*

CHEM 699 Continuation of Thesis Research (1-6 units)
Designed to allow students to remain matriculated, and to use the facilities and resources of the University, while they complete their thesis writing or finish lab work after exhausting all CHEM 698 units. Students should be actively writing the thesis while taking CHEM 699. May be repeated as needed but must be completed no later than 5 years after entry into the program. Units may not be applied to the required units for the Master's Degree. *Enrollment requirement: prior registration in CHEM 698 with an assigned grade of Satisfactory Progress (SP). Units may not be applied to the required units for the Master's Degree.*

APPENDIX A

Program of Study – Master of Science in Chemistry

Name:_____ Date:_____

Course Deficiencies: If none, check here: ___

Course Number/Name	Units	Semester(s) Taken	Grade

Required Courses

Course Number/Name	Units	Semester(s) Taken	Grade
Core Course: CHEM _____	3		
Core Course: CHEM _____	3		
CHEM 680 Teaching Methods	1		
CHEM 690 Chemistry & Biochemistry Seminar	2		
CHEM 691 Research Colloquium	2		
CHEM 697 Directed Studies	6		
CHEM 698 Thesis Research	6		

Elective Courses

Course Number/Name	Units	Semester(s) Taken	Grade

Total Units (30 required): _____ Total Units at 500 level: _____
Required coursework: _____ Total Units at 600 level (17 required): _____
Elective coursework: _____

_____	_____	_____
Thesis Chair (print name)	Thesis Chair (signature)	Date
_____	_____	_____
Thesis Committee Member (print name)	Thesis Committee Member (signature)	Date
_____	_____	_____
Thesis Committee Member (print name)	Thesis Committee Member (signature)	Date
_____	_____	_____
Thesis Committee Member (print name)	Thesis Committee Member (signature)	Date

APPENDIX B

Department of Chemistry & Biochemistry
Thesis Committee Membership Record

(Graduate Student Name) (Date)

(Proposed Thesis Topic of Title)

I agree to serve as the member of the thesis committee for the above-mentioned graduate student.

(Committee Member Name)	(Committee Member Signature)	(Date)	☐ Check if Research Supervisor
(Committee Member Name)	(Committee Member Signature)	(Date)	
(Committee Member Name)	(Committee Member Signature)	(Date)	

I agree to serve as the chair of the thesis committee for the above-mentioned graduate student, and I approve the two faculty members who have signed above as committee members.

(Thesis Advisor Name)	(Thesis Advisor Signature)	(Date)
(Former Thesis Advisor Name)	(Former Thesis Advisor Signature)	(Date)

The Graduate Studies Committee approves the thesis committee for the above-mentioned graduate student.

(Graduate Coordinator Name)	(Graduate Coordinator Signature)	(Date)

When completed, this form will be placed in the student's folder in the Department of Chemistry & Biochemistry. Copies may be sent to the student, other committee members, and the former advisor if applicable. If there are changed in committee composition, the student should complete a new form.

APPENDIX C

Master's Degree
Advancement to Candidacy Form
CHEMISTRY

Student Name _____ ID Number _____

Email _____ Phone Number _____

CANDIDACY REQUIREMENTS

A graduate student who has been met any conditions set upon their admission to the program is normally advanced to candidacy by his/her faculty advisor after the student has:

1. Be a student in good standing with a GPA of 3.0,
2. Have completed all core coursework as defined by the program option,
3. Have obtained a chair and at least two (2) committee members for thesis committee,
4. Have developed a program of study approved by the student's thesis committee, and
5. Orally presented an approved proposal for thesis research to the thesis committee that has been approved by the graduate studies committee.

A formal thesis proposal must be orally presented to the committee no later than the beginning of the second year of full-time study or after twelve (12) units of graduate coursework have been completed.

REQUIRED SIGNATURES

Graduate Coordinator:	***Print***	***Sign***	***Date***
Thesis or Project Chair:	***Print***	***Sign***	***Date***
Committee Members:	***Print***	***Sign***	***Date***
	Print	***Sign***	***Date***
	Print	***Sign***	***Date***

GRAD E699 Enrollment Form

GRAD E699 -- Graduate Standing Continuation. Provides continuation of graduate standing for students finalizing culminating activities (thesis, project, or comprehensive exam).

GRAD E699 carries zero credit units, has no instructor of record, and is "graded" CR automatically upon completion of the term. It is designed to confer enrollment status for the purpose of the continuous enrollment policy. The course may not be repeated.

GRAD E699 Criteria for Enrollment: GRAD E699 is designed for Master's students who have completed all of their graduate coursework, including the for-credit supervised thesis/project coursework called for in their respective graduate programs. Students who are still working closely with an advisor should enroll in their respective department's graduate-level independent study course, rather than GRAD E699.

Directions for Enrolling in GRAD E699

1. Obtain approval from the graduate program coordinator.
2. After obtaining graduate program approval and coordinator signature, submit this completed form to Registration and Records.
3. Course payment and add/drop deadline policies apply.

Student name:		
Program:		Year:
Campus ID:		☐ Summer
Email:		☐ Fall
Telephone:		☐ Spring
Student Signature:		Date:
Graduate Program Coordinator Name:		
Signature:		Date:

APPENDIX E

Graduate and Commencement

Information:

The online link to apply to graduate is: http://www.csusm.edu/enroll/graduation/index.html

How to apply for graduation

- Applications for graduation are now completed online through your student center. Graduation Application Information.
- Your graduation application must be submitted to Cougar Central by the deadline listed below. The hours of operation of Cougar Central are listed on their website.
- Contact your department or program advisor for any special requirements for the graduation application process
- If you apply for graduation but then do not finish that term, you will need to submit two forms: (1) a Graduation Cancellation Form, and (2) a new graduation application. The Graduation Cancellation Form can be obtained from Cougar Central.

When to apply for graduation

Master's degree candidates should file for graduation in accordance with the following schedule:

- For graduation at the end of the Fall Semester: **November 15**
- For graduation at the end of the Spring Semester: **March 15**
- For graduation at the end of the Summer Term: **March 15**

Note: If the above dates should fall on a weekend or holiday, the deadline will be at the close of business on the previous working day.

Commencement information

Information about Commencement can be found on the Commencement website.