

The Ohio State University  
Department of Chemistry and Biochemistry  
**Graduate Program Handbook**

*Summary of Procedures and  
Requirements  
for Graduate Degrees*

Chemistry Graduate Program  
Biochemistry M.S. Program

2019

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## 1. Preface

The requirements for advanced degrees at The Ohio State University are summarized in the *Graduate School Handbook*, which can be found on the Graduate School website at <http://gradsch.osu.edu/handbook>. All incoming students should become familiar with its contents and should use it for reference. The *Graduate School Handbook* rules apply to all students, and they address many areas that are not addressed in this document. All students are also bound by the Code of Student Conduct, which can be found at <https://trustees.osu.edu/bylaws-and-rules/code>.

This document summarizes specific requirements for graduate degrees in Chemistry and Biochemistry, as well as additional comments and instructions for students in our programs. In general, unless noted, the rules and policies in this document apply to students who enter in Autumn 2019 or later.

## 2. Administration and Contacts

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### 3. Programs of Study

The Department of Chemistry and Biochemistry oversees the Chemistry Graduate Program and the Biochemistry M.S. program.

The Chemistry Graduate Program confers both Ph.D. and M.S. degrees, but the program only admits students to the Ph.D. track. Students move the M.S. track typically to leave the program before completion of the Ph.D.

The Biochemistry M.S. program only admits current OSU students at this time, either on a transfer basis from another graduate program (such as the Ohio State Biochemistry Program) or from the Biochemistry B.S. degree or another related program. We anticipate that a combined B.S./M.S. in Biochemistry will be available starting Autumn 2020. The Biochemistry M.S. degree with emphasis in biotechnology is no longer offered.

The department also offers a one-year post-baccalaureate Chemistry Bridge Program as an American Chemical Society Bridge Site. The program admits students mostly from underrepresented groups for transition to the Ph.D. or M.S. program at the completion of the program. There is a separate procedures document for this program.

### 4. Admission

The Chemistry Graduate Program only admits one time per year for the Autumn semester.

Students must have a baccalaureate or professional degree (or equivalent foreign credential) from an accredited college or university, earned by the expected date of entry into your graduate program. Typically, this means a 4-year bachelor's degree or a 5-year combined BS/MS degree. A minimum of a 3.0 cumulative GPA (on a 4.0 scale) for the last degree earned is required.

In general, the program is looking for evidence of academic aptitude especially with strong grades in core chemistry classes and advanced classes in the intended area of study, evidence of successful research experience and aptitude, evidence of strong communication skills, and evidence of perseverance, motivation, goal-oriented behavior, and other non-cognitive factors that presage success in the graduate environment. Chemistry program applicants must have taken courses in general, organic, and physical chemistry--ideally a year of each--as well as at least one course in the divisional area of interest (e.g., biochemistry for students interested in biochemistry studies, inorganic chemistry for students interested in inorganic chemistry, etc.). Consequently, most successful applicants will be Chemistry or Biochemistry majors, but that is not required, with proper coursework.

The GRE General Test is not required, but is highly recommended. GRE scores are necessary to evaluate international students and can be used to support fellowship nominations for domestic students. A GRE Subject Test (such as in Chemistry) is not required, but a strong Chemistry GRE score is considered favorable.

The minimum total TOEFL score required in order to be eligible to apply is 79 on the Internet-based test and 550 on the paper-based test. Applicants who achieve a total score of 100 and a 22 or higher on the speaking section of the Internet-Based TOEFL will be most competitive. The minimum allowable score on the IELTS is a 7.0.

Students in the Chemistry Ph.D. program who did not speak English as a first language must demonstrate spoken English proficiency at the level required for a GTA appointment, as established by the English as a Second Language Program. This can be demonstrated with a TOEFL iBT speaking score of 28 or higher, IELTS score of 8.5 or higher, or an Oral Proficiency Assessment score of 4.0 or higher. Certification must be achieved by the end of the first year of study.

GRE and TOEFL or scores must be officially reported to OSU by ETS. If you are submitting scores for the IELTS, those scores must be reported to OSU directly by IELTS.

The Graduate Admissions Committee reviews and makes recommendations on each application for admission to the program. The Vice Chair for Graduate Studies has final approval on all offers of admission.

## **5. Financial Support and Appointments**

Most graduate students in the Ph.D. program receive financial support as Graduate Associates, either Graduate Teaching Associates (GTA) or Graduate Research Associates (GRA), or as Fellows during their tenure in the department. Graduate students supported by any of these appointments may not hold additional employment of any kind without express permission of the Vice Chair for Graduate Studies. Fellowship stipends may be supplemented up to the current GTA stipend; any stipends above that level must have prior approval by the Vice Chair for Graduate Studies.

The Graduate School sets minimum registration requirements of eligibility for GA and Fellowship appointments (see section 9.1 of the Graduate School Handbook). Students supported by GA should read section 9, Appendix E and Appendix F of the Graduate School Handbook.

A graduate student's activities in the department are typically a combination of study and work. In general, GA appointments are 50% effort, meaning they will typically require about 20 hours per week. In rare cases, GAs may be appointed for up to 75% effort. Graduate appointments are salaried (i.e., not hourly) positions paid on a fixed calendar set by the Graduate School. It is common and permissible for salaried positions to require orientation or training even if it does not fit within the normal window of work hours. In a salaried position, the employee is agreeing to do a particular job, but he or she is not compensated for the exact hours the work is carried out. There is no overtime. TAs are considered exempt under the Fair Labor Standards Act (FLSA) as educators, and the Labor Department has asserted that other relationships like RA and fellowship are principally training and that no employer-employee relationship exists. The department provides appointments so that students do not have to find other outside employment to afford graduate school, and we also are able to provide employment that is relevant to students' studies and builds students' resumes in the area of study. The department does everything possible for students to be able to complete TA duties in 16-18 hours per week while classes are in session, because we want students to be able to focus on studies as much as possible. Graduate appointments are continuous throughout the year (i.e., there is no "break" between them on the calendar).

Departmental policies regarding appointments include:

- (1) Students with a GPA below 3.00 lose their right to a department Graduate Research Associate appointment (dGRA), and may lose future support as a GTA. Students may be denied GA appointments by the Graduate School if their GPAs are below 3.00.
- (2) Students who qualify directly from the first year oral exam are required to advance to candidacy by the end of their second year. Students failing to advance to candidacy by this time must petition the Vice Chair for Graduate Studies for continuation of support regardless of the appointment type (GRA, GTA, or Fellowship appointment).
- (3) Students required to obtain an M.S. degree to qualify for candidacy are expected to advance to candidacy as soon as possible and certainly by the end of the third year. Students failing to advance to candidacy by this time must petition the Vice Chair for Graduate Studies for continuation of support regardless of the appointment type.
- (4) Students required to take a terminal M.S. degree are expected to defend their thesis by the end of their second year. Students failing to defend their M.S. thesis by this time must petition the Vice Chair for Graduate Studies for continuation of support regardless of the appointment type. In general, no further GTA will be granted after the end of the second year in this case.
- (5) The Ph.D. degree is a five-year program. Students who expect to enter their sixth year of graduate training must petition the Vice Chair for Graduate Studies to receive support during all or part of their sixth year, and must have the written approval of their advisor and advisory committee. These petitions must be included as part of the Post Candidacy Progress Report from an Advisory Committee meeting, and they must be received at least one month before the start of the Autumn semester (typically, by July 15). Approval of such petitions will require the demonstration of a reasonable prospect that the degree program can be completed within one year.
- (6) Department policies specify that students who have been enrolled for more than six years may not receive support as a GTA, GRA, or Fellow, from external, departmental, or other funding sources. Only in exceptional instances, which require demonstration of extenuating circumstances, will the Vice Chair for Graduate Studies consider a petition for support beyond six years. In general, no GTA will be granted after the sixth year.
- (7) Instructors evaluate their teaching assistants each term with ratings of Excellent (E), Satisfactory (S+, S, or S-), or Unsatisfactory (U). Evaluations are based primarily on overall performance as a GTA, but also include punctuality, attendance of staff meetings, and attitude toward students and staff. Students receiving an unsatisfactory (U) teaching evaluation will be suspended from their teaching appointment for one semester (excluding summer) and must petition the Vice Chair for Graduate Studies for subsequent reinstatement. No GTA support will be available during such a suspension. Petitions to be supported as a GTA can be made at the end of the semester (excluding summer) following the term during which the U rating was received. Any subsequent U or S- evaluations following reinstatement will lead to dismissal from the teaching program, and no further GTA support will be available. If a dGRA appointment is due at the end of the student's term in which he or she received the U, the department portion of the stipend will not be available. Two S- ratings are regarded as equivalent to one U rating.

- (8) Preceptors are required to grade the performance of students taking research credits under her or his supervision (e.g., CHEM 8999) each term with ratings of Satisfactory (S) or Unsatisfactory (U). Evaluations are based primarily on overall progress in research, but also include time spent in the lab, attendance at group meetings or other meetings set by the advisor, and handing in reports required by the advisor in a timely manner. Students receiving an unsatisfactory (U) grade will meet with the advisor and the Vice Chair for Graduate Studies to devise a plan to ensure future success. The VCGS may require a meeting of the Advisory Committee. In general, two U grades in research will result in withdrawal of support and dismissal from the program for lack of reasonable progress.

## 6. Advising

### a. Initial Advising

Students' official academic advisor at the time of entry to the program is the Vice Chair of Graduate Studies, and students are encouraged to meet with her or him as needed. Students will also be assigned a temporary advisor in the division of the student's major area of interest to advise on class choices and progress in finding a permanent advisor.

**Proficiency Exams.** At the initiation of studies, the department will administer written examinations that are used to gauge competence at the undergraduate level in analytical, biological, inorganic, organic, physical chemistry, and general chemistry. The purpose of these examinations is to aid the student and faculty advisors in planning a suitable progression of course work leading to the advanced degree. Students who are not proficient in a given area will be provided with advice on how to strengthen competency in that area. Such advice may include suggested course work and/or a course of independent study.

### b. Advisor Selection

Dissertation research is initiated when a student has selected a research advisor and has been admitted into a research group. The selection of an advisor is a major step in a student's program. The process involves attendance of faculty research presentations the first half of the Fall Semester, followed by a formal system of interviews during the second half of the semester. In addition, an informal process for the student to become acquainted with research groups is strongly encouraged; these activities can include attending group meetings, talking to students in the group, touring the lab, and gathering information on publication record, time-to-degree, and level and type of support typically available for group members. Students are required to enroll in a 7-week course designed to introduce them to the ongoing research in the department, CHEM 6780. During this class, each faculty member presents a short (~20 min) talk on their research. Students must meet minimum attendance requirements as specified in the syllabus in order to obtain a satisfactory grade in the course. These presentations are expected to help students identify at least four faculty members that he or she wishes to interview. Attending presentations from other disciplines will provide students with broader knowledge of ongoing research in the department and has been shown to result in students becoming interested in the research of faculty members they had not previously considered as an option for an advisor. After the end of the course, students will interview individual faculty whose research is of interest to them.

Students in the Biochemistry division are required to undertake three rotations in the first Autumn term on a specified schedule that is approximately 4 weeks per rotation. They must rotate with three different eligible members of the program, and they are not required to join the lab of any of the faculty with whom they do rotations. Students in other divisions are encouraged to do informal rotations on approximately the same schedule, but that is not required.

To initiate the interview procedure, the student will designate a minimum of four (4) faculty members that he or she wishes to interview. Students are encouraged to interview as many faculty as they feel may provide research programs of interest. Students may also have engaged in rotations the summer prior to start of graduate school or during the semester. These rotations may be considered an interview of a faculty member. The Vice Chair for Graduate Studies may assign additional faculty members, and will provide the student with an Interview Record Sheet. All faculty members on the Interview Record Sheet must sign the sheet after they have been interviewed. Students then submit a rank-ordered list of their top three choices for advisor to the Graduate Office by a date that is announced at the start of autumn semester, typically during the middle to the end of November. The Graduate Studies Office then provides the list of student advisor preferences to the division secretaries and all faculty. Following any formal faculty discussion that may be required by a division, the faculty member listed as the first choice must decide whether or not to serve as advisor to the student. The faculty member notifies the division secretary and Graduate Studies Office of his/her decision. If a faculty member decides not to serve as advisor, the faculty member who is the second choice makes a similar decision. This process is repeated until the student has an advisor. In the event a student is not accepted by one of their top three choices, the Vice Chair for Graduate Studies becomes active in helping the student find an advisor, in a manner left to the discretion of the Vice Chair. Once the list of advisor preferences has been distributed, it is a goal of the department to place students in research groups within a two-week period. The process of selecting an advisor must be completed by the end of the second semester in order to remain in good standing in the program and to qualify for a summer dGRA appointment.

A student must complete their Ph.D. research under the supervision of a member of the Graduate Faculty of the Chemistry Program (i.e., must have "P-status"). Collaborations with faculty outside the department are possible, however, the primary supervision or formal co-advising of the Ph.D. research by faculty outside the department is not permitted. Only regular faculty members of the Department of Chemistry and Biochemistry may serve as advisors for Chemistry PhD and MS students. Auxiliary faculty, Adjunct faculty, Emeritus faculty, Regional faculty, and those whose tenure-initiating unit is not the Department of Chemistry and Biochemistry may not serve as advisors to students in the Chemistry graduate program. Any other advising arrangement is subject to approval by the Vice Chair for Graduate Studies, who will request a description of the proposed research and consider whether it is suitable for a Ph.D. thesis in Chemistry and Biochemistry.

Students who wish to be co-advised by two eligible faculty members must formalize the agreement with a Memorandum of Understanding that is signed by the student, co-advisors, and Vice Chair. The agreement is available online. Co-advising relationships can be entered into at the time of the initial advisor matching, or later.

If a student leaves a group, or the faculty advisor resigns his/her position as preceptor, the student will have seven weeks to find a new advisor. After this time, support will be withdrawn (at the end of the term of enrollment) and the student will no longer be in good standing in the department.

### **c. Advisory Committee**

After selection of an advisor and in consultation with the student and their advisor, the Vice Chair for Graduate Studies will appoint an advisory committee for each student, typically in the summer at the end of the first year of study. The purpose of the advisory committee is to provide each student with support and guidance during their graduate career. Students should meet with their advisory committee each year following completion of the Candidacy Exam to discuss their progress in course work, examinations, and research. Students who do not hold an advisory committee meeting by the end of the fourth year of study will be found not be making reasonable progress and may be dismissed from the program. The student and advisor must provide the advisory committee and the Graduate Studies office with a short research progress summary in the form of a Post-Candidacy Progress Report. The advisory committee will provide written comments on the student's progress. In addition, students are free to meet with any committee member at any time during the year. The department hopes that this process will provide a mechanism for forging closer ties between students and faculty, both before and after graduation, and to provide additional guidance and support to students as they complete their research toward the Ph.D. degree.

The Advisory Committee must include the preceptor and two other members of the Chemistry graduate faculty, at least one of whom must be in the student's division. One member of the Advisory Committee may be from outside of the Chemistry program provided she or he is a member of the Graduate Faculty of some program at the University (i.e., has P-status in some program).

### **d. Activity Reports**

At the end of each academic year, all students must prepare an activity report that outlines their progress towards program requirements, presentations, publications, and other academic and professional activities. The template for the report is in the form of a CV that can be updated each year with a section of questions about program requirements. The report and an advising report must be provided to the Graduate Studies Office by September 30 of each year, with a copy also provided to the advisor. Activity reports are used for advising purposes, but also are used for award nominations and program assessment data.

## **7. Registration**

The Graduate School sets minimum requirements of eligibility for GA appointments to students who are in a degree program. Until passing the candidacy exam, students on GA appointments must register for at least eight (8) credit hours during fall and spring semester and four (4) during the summer session. After entering Ph.D. candidacy, the minimum number of credit hours per semester (including summer session) is three (3) to be considered a full-time student. Students who hold fellowships must register for twelve (12) credit hours during each fall and spring semester and six (6) during each summer session the appointment is held prior to entering Ph.D. candidacy. After candidacy, fellowship students must register for a minimum of three (3) credit hours each term. Each of these registration requirements qualifies the student to be considered a full-time student for purposes such as health insurance and visas for international students.

There are additional registration requirements imposed by the Graduate School. A student must be enrolled for at least three (3) credit hours during the term in which they graduate. A master's degree requires at least 30 graduate credit hours, and the Ph.D. requires at least 80 graduate credit hours (at least 50 beyond the

master's). Audited courses do not count toward these minima. In order to meet these minima, it is recommended to enroll in 16-18 credit hours in Autumn and Spring as a pre-candidacy student.

Students who transfer to OSU must meet specific residency requirements. Of the 50 post-masters credit hours required for the Ph.D., at least 24 must be taken at this university. Candidacy never transfers to a new program; transfer students to the Ph.D. program must take a candidacy exam in the Chemistry program. Qualification for candidacy will be determined by the Graduate Studies Committee. Students must have a 3.00 GPA or better to apply for the candidacy exam, which typically means they must take the exam no earlier than the term after they take their first graded courses. The Graduate School will accept petitions to waive this requirement for advanced students.

The Graduate School requires continuous enrollment of post-candidacy graduate students, meaning that the student must be enrolled for at least 3 credit hours each Autumn and Spring. Our department in general requires continuous enrollment throughout the entire time in the program, including pre-candidacy and summer terms, although occasionally exceptions may be made by petition if the student will not be in residence in Columbus for a term. Students must be enrolled in at least 1 credit hour of appropriate research, such as CHEM 8999 or CHEM 8998, any term they are conducting research in residence.

## **8. Chemistry Ph.D. Program**

### **a. Introduction**

The Graduate School requirements for the Ph.D. degree are stated in Section 7 of the *Graduate School Handbook*. The Chemistry Graduate Program has several additional requirements and procedures for Ph.D. students, as outlined below.

The Ph.D. is a research degree. Students are expected to develop a broad foundational knowledge of chemistry, in particular in their subdiscipline, as well as in-depth knowledge of the area of specialization. Students should be able to evaluate scientific work critically and conduct meaningful scientific inquiry leading to new knowledge in the field. Students must be able to communicate scientific results to experts and broader audiences, and conduct research professionally, responsibly, safely, and ethically. The learning objectives of the program are outlined in Appendix A.

### **b. Curriculum**

Students must satisfy the course requirements of one of the divisions of the department, or a designed multidisciplinary course of study, in addition to all program requirements. Students select a major area of study when they enter the program, but with the approval of the advisor (or the Vice Chair for Graduate Studies before a permanent advisor is assigned), they may later elect to complete the requirements of a different division, or an approved multidisciplinary track curriculum.

The purpose of coursework in the Ph.D. program is to prepare the student to take the candidacy examination and to undertake work on a significant original investigation in chemistry or biochemistry that culminates in a doctoral dissertation. Because the Ph.D. is a research degree, most course work is taken during the first year; usually only selected advanced subjects are taken in the second and subsequent years. Students who wish to

register for a course offered by another department must obtain permission from the advisor and the Vice Chair for Graduate Studies before registering for the course. Students who register for courses outside of the department without approval will be unenrolled from those courses and will be responsible for any resulting fees imposed by the University. In general, registration in courses for recreational or avocational purposes is not permitted.

Graduate courses in Chemistry and Biochemistry are numbered 6000 and higher. Courses that are 6000-level are foundational, 7000-level are intermediate, and 8000-level are advanced. Chemistry graduate courses are numbered xNxx, where N = 1 for analytical, 2 for biological, 3 for inorganic, 4 for organic, 5 for physical, 6 for theoretical, 7 for program requirements, 8 for seminars, and 9 for research. Most graduate classes are taught MWF for 55 minutes per class, for 7 weeks (a session) for 1.5 credit hours or for 14 weeks (a semester) for 3 credit hours.

All students must:

- Enroll in at least one (1) credit hour of CHEM 8999 Thesis/Dissertation Research under the name of their advisor each term they are in residence (including Summer terms). Students should enroll in CHEM 8998 under the name of the Vice Chair for Graduate Studies in their first term.
- Enroll in one of the CHEM 8891-8895 (1 credit hour) divisional seminar courses each Autumn and Spring term
- Complete CHEM 6780 Faculty Research Presentations, CHEM 6781 Laboratory Safety, and CHEM 6782 Ethics in Scientific Research in the first year of study
- Complete at least three (3) credit hours of graduate coursework outside of the major area of study (breadth requirement). These classes will typically come from the Chemistry or Biochemistry offerings from another major area, but they may include graduate coursework in another department with the permission of the advisor and Vice Chair for Graduate Studies. Typically, 6000+ courses in Chemistry or Biochemistry or 5000+ courses in another department would meet this requirement. Most students fulfill this requirement by enrolling in 3 credit hours of 6000-level Chemistry or Biochemistry classes outside the major area of study in the first semester.

**English as a Second Language.** Students whose native language is not English must demonstrate spoken and written English proficiency by the end of the first year (see also Section 5). Students may be waived out of these requirements by national origin or TOEFL or IELTS score, or may demonstrate proficiency by an examination or coursework of the English as a Second Language (ESL) Program, such as the ESL Composition Placement Test, Oral Proficiency Assessment (OPA), EDUTL 5040 Exit Exam, or Oral Proficiency Certification Assessment (OPCA). Students must take all courses recommended by the ESL Spoken English Program. Students must complete any required ESL composition coursework (EDUTL 5901 or 5902) by the end of the first year. We recommend taking in-person (rather than online) versions of these classes. If you must also take a spoken English class, we recommend delaying taking composition classes. The Graduate Studies Office can help you plan the timing of these courses and petition to take composition classes after the deadline, if required. Students who do not initially achieve full spoken English certification may achieve conditional certification that permits the student to be appointed as a GTA for lab courses only. Progress toward English certification, including adequate performance in ESL classes, achieving at least conditional certification by the end of Spring semester, and achieving full certification by the end of Summer term, is considered an essential element of reasonable progress; continued enrollment will be contingent upon this progress.

**Course Load.** A minimum of 80 graduate credit hours (or 50 credit hours beyond the master's degree) is required to graduate with a Ph.D. Pre-candidacy students must enroll in a minimum number of credit hours each term depending on the type of appointment. Graduate Associates (GAA, GRA, GTA) must enroll in at least 8 credit hours in Autumn and Spring and 4 credit hours in Summer. Fellows and Trainees must enroll in at least 12 credit hours in Autumn and Spring, and 6 credit hours Summer. All post-candidacy students must enroll in a minimum of 3 credit hours each term (including Summer). Summer students and post-candidacy students must obtain the permission of the advisor and Vice Chair for Graduate Studies to take more than the minimum number of credit hours. To ensure that students have reached 80 credit hours by the time of graduation, we recommend that students enroll in 16-18 credit hours during the Autumn and Spring of the first two years of study. Once coursework is completed, the balance of credit hours can be made up with CHEM 8998 or 8999.

Students should complete most coursework by the end of the first year, or the Autumn of the second year. Some Spring classes are offered only every other year, and so may require some minimal coursework in the Spring of the second year or later. To achieve this, students should enroll in all foundational (6000-level) classes in their major area of study in the first semester. Students should typically take 9 credit hours of lecture classes in the first semester (exclusive of Chem 6780, 6781, 889x, and 8998), which generally means they should enroll in 3 credit hours of classes outside of the major area of study. Students who are required to take spoken ESL courses (e.g., EDUTL 5030, 5040, 5045, 5050, 5055, 5060) may need to enroll in one fewer Chemistry lecture class, but should stay on schedule to complete the program coursework by the end of the second year. In the first Spring, students should enroll in all required advanced courses, and typically should enroll in 3-6 credit hours of lecture classes total (including electives). Some variation in these guidelines is noted below in the curricula for the major areas of study.

**Other Requirements.** In addition to the program course requirements noted above and the courses from the major area curricula below, students must also:

- Join a lab at the end of the first semester and begin research in the first Spring
- Take the first-year oral exam in the first Summer
- Advance to candidacy by the end of the second year, or the end of the third year if directed to complete a M.S. to qualify
- Hold annual committee meetings after advancing to candidacy
- Give a public research presentation by the end of the fourth year
- Write and defend a dissertation

Although the program does not have a publication requirement, publication of peer-reviewed research is strong evidence of a substantial contribution to the field and an essential component of the research enterprise. Publication expectations differ in different areas of chemistry. Students should discuss these expectations with their advisor and advisory committee. Similarly, presenting posters or oral presentations at venues outside the university, such as regional, national, and international conferences, develops essential skills and provides networking opportunities. Students should discuss conference presentation expectations with their advisors.

**Major Area Curricula.** Curricula are laid out for the traditional divisions of chemistry (analytical, inorganic, organic, and physical) and biochemistry. Deviations from the major requirements must be approved by the advisor and the division. Students should email the division secretary for permission with a brief justification, copying the advisor, and must forward the approval to the Graduate Program Coordinator to include in the student's file.

### Analytical Chemistry

18 credit hours of graded (A-E) graduate lecture classes are required, in addition to program requirements, seminar, and research (CHEM 6780, 6781, 6782, 8891, 8998/8999).

*Required classes:* CHEM 6110, 6120 (3 credit hours)

*Analytical electives:* 9 credit hours of CHEM 71xx classes

*Other electives:* 6 credit hours of graduate classes outside the Analytical division (6000+)

Elective courses outside the division may include, but are not limited to: Biochemistry 6761; Inorganic Chemistry 6320, 6330, 7320, 7360; Organic Chemistry 6440, 7440; Physical Chemistry 6520, 6530, 7520, 7540, 7550

In the first term, students should typically enroll in CHEM 6110, 6120, an available 71xx course, and three additional credit hours outside the division.

Other requirements:

- Students must complete 12-15 hours of lecture courses (graded A-E) during the Autumn and Spring semesters of the first year.
- A poster session will be held at the end of the Summer term in which the first year students will have the opportunity to report on their progress and to discuss their research with other students and faculty. All first year students must present a poster. A brief written description of the poster presentation shall be provided, in advance, to the Analytical division secretary.

### Biochemistry

15 credit hours of graded (A-E) graduate lecture classes are required, in addition to program requirements, seminar, and research (CHEM 6780, 6781, 6782, 8892, 8998/8999).

*Required classes:* BIOCHEM 6761, 6762, 6763 (6 credit hours)

*Biochemistry electives:* 6 credit hours of graduate classes should be in the area of Biochemistry or related disciplines. Classes outside the department may count toward this requirement with permission of the division.

*Other electives:* 3 credit hours of graduate classes must come from outside Biochemistry

Recommended Biochemistry electives include: BIOCHEM 6701 Molecular Biology, BIOCHEM 6765 Physical Biochemistry, BIOCHEM 7766 Nucleic Acids, BIOCHEM 7770 Protein Engineering, BIOCHEM 8900 Biomolecular NMR, BIOCHEM 8990 Advanced Topics, CHEM 7360 Bioinorganic Chemistry, MICRO 8050 RNA World.

In the first term, in addition to BIOCHEM 6761, students with molecular biophysics interests should take CHEM 6520 and 6530 (thermodynamics and kinetics); students with chemical biology interests should take either the physical organic (CHEM 6420 and 6430) or synthetic organic (CHEM 6410 and 6440) classes; and students with molecular biology interests should take BIOCHEM 6701.

Other requirements:

- First year students must participate in three laboratory rotations during the Autumn term with three different professors in the Department, on the schedule set by the Biochemistry division (approximately 4 weeks each). Students are not required to join the lab of a professor with whom they have done a rotation.

### Inorganic Chemistry

18 credit hours of graded (A-E) graduate lecture classes are required, in addition to program requirements, seminar, and research (CHEM 6780, 6781, 6782, 8893, 8998/8999).

*Required classes:* CHEM 6310, 6320, 6330, 6340 (6 credit hours)

*Inorganic electives:* 6 credit hours of Inorganic classes at the 7000-level or above (CHEM 7320, 7330, 7340, 7350, 7360, 7370, 8399)

*Other electives:* 6 additional graduate credit hours. 3 credit hours of graduate classes must come from outside the Inorganic division. 3 credit hours must be at the 7000-level or above. 7000+ level electives outside the Inorganic division must be approved by the advisor and division.

In the first Autumn, students should enroll in CHEM 6310, 6320, 6330 and 6340, and 3 credit hours of 6000-level classes outside the Inorganic division. Students with materials, photochemistry, or physical inorganic chemistry interests should take CHEM 6520 and 6530 (thermodynamics and kinetics); Organic electives (CHEM 6410, 6420, 6430, 6440) are recommended for students interested in synthetic inorganic or organometallic chemistry. In the first Spring, students should enroll in 9 credit hours of 7000+ classes.

### Organic Chemistry

15 credit hours of graded (A-E) graduate lecture classes are required, in addition to program requirements, seminar, and research (CHEM 6780, 6781, 6782, 8894, 8998/8999).

*Required classes:* CHEM 5420, 6410, 6420, 6430, 6440 (7.5 credit hours)

*Electives:* Either CHEM 7450 or 7460 is required (1.5 credit hours). 6 additional graduate credit hours, which may include CHEM 7470, CHEM 8499, or classes outside the Organic division, are required. 3 credit hours of graduate classes must come from outside the Organic division.

In the first term, students should enroll in CHEM 6410, 6420, 6430, and 6440, in addition to 3 credit hours outside the Organic division.

Other requirements:

- Organic division students are not required to carry out lab rotations, but are permitted to do so. Once a mutually agreeable rotation assignment is found, the rotation must be reported to the organic division secretary before beginning. The rotation period is a maximum of 4 weeks. All rotations must be within the department. Students are not required to join a lab in which they have done a rotation.

### Physical Chemistry

18 credit hours of graded (A-E) graduate lecture classes are required, in addition to program requirements, seminar, and research (CHEM 6780, 6781, 6782, 8895, 8998/8999).

*Required classes:* CHEM 6510, 6520, 6530, 6540, 7520, 7550 (12 credit hours)

*Physical electives:* Either CHEM 7530 or 7540 is required (3 credit hours)

Other electives: 3 credit hours of graduate classes must come from outside the Physical division

In the first term, students should typically enroll in 9 credit hours, including CHEM 6510, 6520, 6530, and 6540. Students with interests in theory who have not taken a class in linear algebra should enroll in MATH 5101 or another math class recommended by the temporary advisor.

Typical electives include: physical chemistry classes CHEM 6550, 7580, 7590, 8599, 8699; other chemistry classes CHEM 6110, 7330, 6340, 6420, 6440, 7140, 7150, 7160, 7350, 7380, 7440, 7460, 7470; physics classes PHYS 5300, 5400, 6804, 8804, 8820; math classes MATH 4512, 4551, 4552, 4568, 5101, 5102.

***Multi-Disciplinary Track (MDT).*** Some research problems of a multidisciplinary nature require a program of training in several fields that is not available from one of the divisional curricula. In those situations, the multidisciplinary track allows a student, working with a faculty member or team of faculty, to develop a suitable academic program. Our department encourages research in emerging disciplines, as well as traditional fields of chemistry. The purpose of the multidisciplinary track is to provide chemistry grad students with the freedom to design the best academic program for their graduate research and future career.

The current divisional course offerings are actually quite broad, and already have sufficient flexibility to accommodate most students engaged in multidisciplinary research. By their choice of electives or by taking a small number of additional courses, most students can acquire broad multidisciplinary training. However, when further flexibility is needed, the multidisciplinary track exists to fill that gap.

The Graduate Studies Committee will evaluate applications for the multidisciplinary program based on the information provided in the application and the student's academic record. Students cannot propose a curriculum that would be possible within one of the divisions, or with fewer required credits. Additional requirements for MDT curricula are noted in the application form, which is available online.

### **c. Qualifying Exam (First Year Oral Exam)**

All students pursuing a Ph.D. degree must take an oral examination to qualify for the candidacy exam. The First Year Oral Exams (FYOE) are conducted in the Summer term, typically in May or early June of the first year of study. The focal point of this examination is a paper selected jointly by the student and advisor that is related to the student's research topic. The purpose of this exam is to evaluate the student's progress within the context of an activity that is relevant to their research interests and to determine whether the student is ready to proceed with further requirements of the Ph.D. program. This is not a general exam, but it typically includes background questions related to the paper, especially as related to the first year coursework. The administration of the first-year oral examination is outlined below.

1. By April 1, the Secretary of each division notifies the Graduate Studies Office and announces to students:
  - (a) The date(s) on which the oral exams will be administered; and
  - (b) The members of the division's oral exam committee or committees.

The exam committee must be composed of three members of the graduate faculty of the Chemistry program (i.e., with P-status) appointed by the division. A single three-member committee is typical so that all students in a division will be evaluated by a common standard. However, it may not be practical for a single committee to examine all students in a given division, and multiple committees may be appointed. The student's advisor may serve on the committee, but the division may, at its discretion, choose to formulate alternate committees so that the advisor does not serve on a student's exam committee.

2. The Graduate Studies Office, in consultation with committee members and students, will schedule the individual exams. All exams must take place within the specified period unless the student has a valid excuse. Significant life events (e.g., wedding), documented medical excuses, or important scientific activities (e.g., presenting at a conference) may constitute valid excuses. Accommodations for valid excuses will be determined by the Vice Chair in consultation with the division and exam committee.
3. The basis of the exam will be a journal article that is related to the student's research topic and has been jointly selected by the student and advisor (i.e., it must be approved by the advisor). The article may or may not be one published with the advisor as a co-author. The article must be provided to the committee for approval at least two weeks prior to the exam, and it must be approved by the committee before proceeding to the exam. It is a good strategy to choose an article that covers substantial scientific issues and that is not overly difficult. An article that is, for example, a brief communication of measurements will give the examination committee little inspiration for exam questions. In that case, the line of questioning will be less predictable, which will put the student at a disadvantage.
4. The format of the exam will include a short presentation by the student of no more than 10 minutes, followed by approximately 50 min. of questions by the committee. The student may use slides or other figures during the 10 minute presentation, but should generally bring no more than five (5) such slides or figures. During the remainder of the exam, the student should use only the chalkboard or whiteboard. The presentation and paper will serve as the starting point for the subject of the questions. Students will be expected to discuss the content of the paper and respond to questions about broader concepts underlying the research described in the paper and work in the references therein.
5. The advisor, if not a member of the committee, may attend the exam as an observer. The advisor may not assist the student in any manner. In general, an attending advisor should not ask questions of the student, but may request permission from the committee to formulate a question.
6. After the exam, the student is excused. The exam committee, and the advisor if she or he is in attendance, will have a brief (5-10 minute) meeting to exchange impressions on the exam. This is very useful for getting an accurate view of the student's performance and preventing later misunderstandings.

Advisors are encouraged to attend the exam and this discussion.

7. Based on the student's overall performance on the oral exam and performance in first-year course work, the committee will determine whether each student is qualified to proceed directly to the candidacy exam, undergo further evaluation for qualification in the form of preparing and defending an M.S. thesis,

or proceed to a terminal M.S. degree (no qualification is possible). The exam outcomes will not be determined until all students in the division's cohort have completed the exam.

8. Within three business days of each division's last exam, the results of the exams must be communicated to the division secretaries and to the Graduate Studies Office. The Graduate Studies Office will communicate the results to the students.

In general, repeat examinations are not administered. Students may petition the decision of the divisional committee to the Graduate Studies Committee (via the Vice Chair), who will consider the proper redress for the stated grievance considering the advice of the advisor and divisional committee administering the exam.

Students who are directed to a terminal M.S. at the time of the oral exam are not eligible to petition to continue on to the Ph.D. even upon successful completion of the M.S. Students who are directed to the M.S. for further evaluation are usually, but not automatically, qualified for the candidacy exam upon a successful defense of the M.S. thesis. If it is clear at the time of the M.S. defense, even in the event of a successful M.S. exam, that there is no possibility of successful completion of the candidacy exam or Ph.D. dissertation, the M.S. committee may recommend to the GSC Chair that the student not be qualified for the candidacy exam. The final determination in such a case will be made by the GSC.

#### **d. Candidacy Examination**

**Timing.** The precise timing of the Candidacy Examination should be determined collectively by the advisor and the student using the following guidelines. Students who have qualified for candidacy from the First-Year Oral Examination must advance to candidacy no later than end of summer of the second year. Students directed to further evaluation by completion of an M.S. degree should initiate their Candidacy Examination during the semester immediately following the M.S. defense, and must advance to candidacy no later than the end of summer of the third year. It is strongly recommended that students develop their aims and get them approved by the end of Autumn of the second year, write the written portion (proposal) and get it approved by the end of Spring of the second year, and hold the oral exam no later than May of the second year. *To maintain reasonable progress, students must submit the written proposal to the committee for evaluation no later than March 15 of the year in which they must advance. Students will provide a copy to the Graduate Studies Office at the same time for tracking purposes.*

**Coursework.** To qualify for the candidacy exam, students must complete required courses as specified by each division; students are encouraged but not required to complete electives before taking the exam, unless the candidacy committee specifically requires those classes to be completed before the exam.

**Committee.** At the beginning of the second year, the Vice Chair will assign the Candidacy Committee with the preceptor as Chair, the other members of the Advisory Committee, and one additional member of the Chemistry graduate faculty. Of the three assigned members, two must be in the student's division, and one must be from outside the student's division. The advisor may suggest required members for the Candidacy Committee if the advisory committee does not meet the criteria, but the Vice Chair will make these assignments in part to divide the workload among the faculty. A member of the graduate faculty of the University from another graduate program may serve in place of one of the divisional members.

A university representative will sometimes be assigned by the Graduate School, as during a second candidacy exam.

The Chair of the Candidacy Committee (the advisor)—*not* the student—will arrange a time and location for the exam in consultation with his or her colleagues and the Vice Chair's office. The advisor may place a tentative date on the calendar for the exam, but the exam may not be scheduled firmly until the written proposal is approved. Exams must be held during announced University business hours, Monday through Friday. One member of the committee (including the advisor) may participate by videoconference without filing a petition, provided the conditions of Appendix B of the *Graduate School Handbook* are met.

**Procedures.** The Candidacy Examination includes both written and oral portions. The examination is a general exam, a comprehensive test administered by a committee of faculty based on the fundamentals and depth of knowledge of the broad area of chemistry in which the student is specializing. The student's progress in research will be evaluated by the examination committee, as well as the student's ability to formulate a sound, innovative, independent proposal within their area of research. Satisfactory performance in this examination or series of examinations admits the student to candidacy for the doctoral degree effective the subsequent semester.

The written portion of the Candidacy Examination for the Ph.D. takes the form of progress to date and proposed future work written by the candidate on the topic of their thesis research. At least one portion of the proposed work (one element or aim) must be original from the student. *To be clear, the entire proposal must be written by the student in her or his own words, but one aim of the proposal must be something conceived independently by the student that is not under active investigation in the student's lab or described in the advisor's papers or grant proposals.* It is common, although not required, for these proposals to contain three aims, with one aim describing work under current investigation, one aim describing further work that will be developed in the dissertation, and one aim independently conceived and formulated by the student. The purpose of this written exam is to examine the progress to date, the creative potential of the candidate, and their knowledge of the field and relevant literature surrounding their ongoing research and proposed work.

Before the student begins to write the proposal, the student must prepare an abstract or specific aims page of no more than one page that outlines the topic, aims and research strategy of the proposal, as well as the significance and innovation. The abstract/aims must be approved by all members of the committee for the student to proceed to the written exam. The committee should respond to the student within one week of receiving the abstract. The abstract topic may be approved even if there are issues in the actual text of the abstract that the committee would like to see addressed in the full proposal. The advisor should assure the committee of the independence of at least one of the aims of the proposal, and the rest of the committee must approve that it is sufficiently original and distinct from the advisor's research. As noted above, students must submit the written proposal to the committee for evaluation no later than March 15 of the year in which they must advance.

The written proposal should be no more than 10 pages with no less than half inch margins and a font size no less than Arial 11 or its equivalent. The 10 page limit includes any figures, but not the abstract/aims page or references cited. References should include full titles of articles, and pages should be numbered throughout. It is recommended that the proposal be formatted generally as an NIH or NSF research proposal. The candidacy committee may provide additional guidance on the exact format. The committee should respond with their judgement of the written proposal and any required issues to address within two weeks.

The approval of the written proposal is an exam exercise and should not simply consist of a series of suggested edits from different committee members. Each iteration of the proposal should be examined by all committee members and the results should be returned to the chair of the committee (the advisor). The chair can then give the collective judgement and comments to the student. In general the committee should respond with an overall judgement along the lines of Pass, Minor Edit, or Major Rewrite. It is not necessary for the written proposal to be flawless for the committee to approve it in order to move on to the oral exam; some issues may be left to address in the oral exam. However, all committee members must approve the proposal to move on to the oral exam. If it becomes clear after two revisions of the document that there is no possibility for a satisfactory overall performance on the candidacy exam, the student may be advised to waive taking the oral exam; however, the student may not be denied the opportunity to take the oral exam (see section 7.4 of the Graduate School Handbook). The advisor should consult with the GSC Chair before advising the student to waive the oral exam.

The written portion of the Candidacy Exam must be approved by the examination committee at least two weeks prior to the oral exam. A final draft of the student's written examination must be available to all members of the oral examination committee, including a possible university representative appointed by the Graduate School, at least two weeks prior to the examination. A copy of the approved proposal must be submitted to the Graduate Studies Office, and the Candidacy Examination committee must acknowledge approval of the proposal by signing a form that will be distributed electronically by the Graduate Studies Office. This must be completed before the Graduate Studies Office will approve the Application for Candidacy in [gradforms.osu.edu](http://gradforms.osu.edu).

After the written portion is approved, the student must initiate an Application for Candidacy form electronically at [gradforms.osu.edu](http://gradforms.osu.edu), which must be signed electronically by the advisor and the GSC Chair. All signatures must be completed at least two weeks prior to the examination date. *This two week period before the exam is required by the Graduate School and may not be appealed.*

The oral portion of the Ph.D. Candidacy Examination consists of questions related to ongoing research, defense of proposed work, and general questions that may be related to the written portion of the Candidacy Examination or, if unrelated, on subjects in which the candidate is expected to be proficient (related to the research topic or larger area of chemistry, for example). The oral exam lasts approximately two hours, and it must entirely consist of questions by the committee. Typically, the first hour will focus more on the proposal itself, and the second hour will include more general questions. By rule of the Graduate School, the exam cannot begin with an uninterrupted presentation by the student, but the committee will typically ask the student to describe the proposal as part of the exam. The student may bring a copy of the proposal and up to five slides or figures in any format (electronic or printed), but should expect to be asked questions and answer at the chalkboard or whiteboard throughout the exam.

The written and oral portions of the candidacy exam constitute a single exam and are considered together. The candidate will be evaluated on his or her performance on the general questions, academic ability, research progress and understanding of the research problem, and the defense of the research proposal including the ability to meaningfully formulate problems and hypotheses and devise suitable tests for those problems.

The student is considered to have passed the candidacy exam only when the committee members unanimously affirm that the performance was satisfactory. In the event of an unsatisfactory exam, the candidacy committee may specify the nature of the second exam. Typically, it will still have both written and

oral portions, although if there were no issues with the written exam, the original written proposal may be accepted as the written portion for the second exam. A second oral exam is required, unless the committee believes there is no possible path to a satisfactory second exam, which must be indicated on the Report on Candidacy on [gradforms.osu.edu](http://gradforms.osu.edu). This option would normally be applied only in exceptional circumstances and in consultation with the GSC Chair. The second exam must be administered by the same committee, and the Graduate School will also assign a Graduate Faculty Representative who will vote as a normal member of the candidacy committee. A student who fails the candidacy exam twice is not permitted to be a candidate in any doctoral program at the University, but may transfer to a Master's program (including the Chemistry M.S. track) with the support of the GSC chair and the approval of the program.

**Rubric.** Beginning January 1, 2019, a rubric will be used to evaluate all candidacy exams. The main purpose of the rubric is to collect aggregate assessment data for the program, but the rubric is also a useful tool to help the committee discuss and evaluate the exam uniformly and fairly. It is also a useful tool for students to understand candidacy expectations more clearly (Appendix B). The rubric was developed based on the learning objectives for the program (Appendix A).

In practice, students and committees will receive an email with links to the rubric PDF and an electronic form before the exam. The rubric will be submitted by all participating faculty and will be shared with the student. There is no mandatory relationship between how the form is filled out and how the faculty member votes.

#### **e. Candidacy**

Students formally advance to candidacy in the term following a successful exam. The registration requirement for post-candidacy students is reduced to 3 credit hours per term. In general, students must enroll in at least one credit hour of research (CHEM 8999) each term and 1 credit hour of seminar (CHEM 889x) each Autumn and Spring. The Candidacy period is limited to five years. One additional term of extension is permitted by petition to the Graduate School, but will only be approved with the approval of the Vice Chair on the advice of the advisor and advisory committee. After that time, a second candidacy exam is required for activation of a two-year supplemental candidacy term. Applications for such extensions will only be approved with exceptional circumstances.

**Oral Research Presentation Requirement.** Students must present a public research seminar by the end of the fourth year of study, typically 20 minutes or more in length. Most students meet this requirement by giving a research-in-progress presentation in one of the department's seminar series in the year after advancing to candidacy. Students may also meet this requirement by giving an oral presentation at a conference or other public forum. The presentation must be in a formal setting and publicly announced, and it must cover the student's original research (i.e., not be a literature presentation). Public research presentations in a graduate program, training grant or center seminar or symposium meet this requirement, but group or joint group meetings do not.

**Post-Candidacy Advisory Committee Meetings.** Students who have advanced to candidacy must hold an annual post-candidacy advisory committee meeting. These meetings are a best practice in graduate education, they give students a broader network of support for research and professional development, and they help resolve problems that arise between students and advisors.

The students and advisor must complete a Post-Candidacy Progress Report (PCPR) and provide it to the committee prior to the meeting. The committee should comment directly on the form during the meeting and

sign the form. The completed form must be returned to the Graduate Studies Office by the deadline. If the student is petitioning for continued financial support after the fifth year of study, the advisor and committee must assess that petition and the prospects for completion of the dissertation within a year.

The committee meeting is not an exam and it is not a seminar. It is a tool for both the student and advisor to get feedback and input. It should include a short presentation of progress and goals, with ample time for discussion. These meetings typically take one hour, but it is recommended that they are scheduled for 90 minutes in case closed discussion with the committee is required after the meeting. The committee meeting should include a discussion of career goals and necessary or useful professional development. Students are highly encouraged to complete an Individual Development Plan and provide it to the committee with the PCPR. The myIDP site from Science Careers or the ChemIDP site from the American Chemical Society are useful tools for completing and IDP.

Students who reach the end of the fourth year of study who have not yet held an advisory committee meeting will be found not to be making reasonable progress, and will receive a short term of probation to come into compliance before being dismissed from the program. The Vice Chair will set a deadline earlier than the end of the summer term (typically around July 15) for committee meetings that must include a request for funding beyond the fifth year. The entire committee should meet together with the student for the initial meeting in the third or fourth year (although participation by videoconference is acceptable). The student may opt to meet with the committee members in smaller groups or individually in the fifth year, but if there are issues with progress or other serious matters, a meeting with the full committee is recommended and may be required by the Vice Chair.

A student must initiate an Application to Graduate form at [gradforms.osu.edu](http://gradforms.osu.edu) for the Graduate School no later than the third Friday of the semester or the third Friday of summer session for commencement) at the end of the term in which graduation is expected.

#### **f. Dissertation**

The dissertation committee is composed of the advisor and at least two other members of the advisory committee, although with permission of the Vice Chair other members of the graduate faculty of the program may be substituted if required (such as if an advisory committee member will be away during the time of the defense). The document must conform to the document preparation guidelines of the Graduate School. In general, the dissertation committee should be provided a complete document at least 1-2 weeks before approval is required. Draft approval is provided by approval of the Application for Final Oral Exam by the committee. Approval of the application certifies that the dissertation is of sufficient merit to warrant holding the exam, which means it need not be ready to file but must be more than draft. An approvable document must be of a standard comparable to an article that could be submitted to a journal for publication. It also must be complete, meaning that it must have all chapters, front matter including abstract, and references, and be substantially in the correct format.

#### **g. Final Oral Exam**

On approval of the dissertation by the advisor and the rest of the reading committee, a final oral examination, based largely on the dissertation work, will be held in accord with the Graduate School guidelines. The examination committee will consist of the members of the dissertation reading committee, and a graduate faculty member assigned by the Graduate School from a department other than Chemistry and Biochemistry.

The final oral exam must be held at least 2 weeks after the approval of the Application for Final Oral exam. *Hence, the dissertation must go to the reading committee at least 3-4 weeks before the intended exam date.*

Final oral exams should be approximately two hours in length, but the first hour can consist of a public presentation. There must be at least a one-hour closed period available for the committee to ask questions, although it is not required that the entire time is used by the committee. The program coordinator will ask each student/advisor if the final exam presentation is to be public. If so, an announcement will go out to the department the Friday before the week of the exam. Public exam presentations are strongly encouraged.

After the final oral exam is complete, the reading committee must provide Final Approval of the dissertation. The dissertation must also be filed electronically through OhioLINK. The Graduate School posts two deadlines each term. Students must pass the oral exam, obtain final approval, and upload the dissertation by the regular deadline to participate in commencement and have the degree conferred in the same term. If any of those things occur after the regular deadlines by before the end-of-semester deadline, the degree will be conferred the next term, but the student is no longer eligible to enroll or hold a graduate appointment and does not need to pay tuition in the term of conferral.

## **9. Chemistry M.S. Program**

### **a. Introduction**

The Department of Chemistry and Biochemistry does not admit students directly to the Chemistry M.S. program, but students may transfer to the program from the Chemistry Ph.D. program. This would typically be done if a student wished to end their studies before completing the Ph.D., or on the way to the Ph.D. to qualify for candidacy if directed to do so by the first year oral exam committee, or to exit the program if required to do so by the first year oral exam committee.

Students working toward an M.S. degree will not receive financial support from the department (GRA, GTA, GAA) after completion of two years in the program. The Department of Chemistry and Biochemistry does not award non-thesis M.S. degrees and does not award M.S. degrees on the basis of satisfactorily completing the doctoral candidacy examination.

### **b. Curriculum**

The student must have a minimum residence of two semesters at The Ohio State University with completion of at least 30 hours of graduate work. The student's course program should be decided in conjunction with the advisor. Chem 6780, Chem 6781, and Chem 6782 are required. Students must enroll in a divisional seminar (Chem 889x) each Autumn and Spring and in at least one credit hour of Chem 6999 or 8999 each term they are conducting research. In addition, students must complete at least 12 credit hours of graduate coursework (6000-level or above) in Chemistry or Biochemistry, or related areas with approval of the advisor and Vice Chair for Graduate Studies. Credits for lab rotations do not count toward the 12 credit hours.

### **c. Thesis**

The M.S. in Chemistry is a thesis-based program. Students must conduct original research under the guidance of a member of the graduate faculty of the Chemistry program, and write and defend a thesis based on this research that adds to the knowledge in some area of chemistry or biochemistry.

#### **d. Master's Exam**

The candidate must pass an oral examination before a committee composed of at least two faculty members from Chemistry program, including the student's research advisor. Should the graduate record of the candidate be satisfactory to the examining committee, the scope of the examination will be confined to the candidate's field of specialization. The electronic approval of the report on the final exam and the report on the final document in gradforms, as well as electronic submission of the approved thesis to OhioLink, must be completed by the deadline published by the Graduate School for the semester or summer term of graduation.

The Graduate School does not specify the exact format of the master's exam, but they are generally about one hour including about 20 minutes of presentation and 40 minutes of questions from the committee. It is not customary to have a public presentation with the master's exam, but it is allowed if limited to 30 minutes and if it is followed by a closed period for questions of about an hour. Exams should not exceed 2 hours total in either format.

## **10. Biochemistry M.S. Program**

### **a. Introduction**

The Biochemistry M.S. is a research (thesis) based program. The program is designed to train students with a suitable bachelor's degree for a career in biochemistry. Coursework includes a core curriculum with an emphasis on biochemistry courses, and electives for further specialization.

The department also offers a combined B.S./M.S. in Biochemistry. The curriculum for this accelerated combined degree is designed to allow for the completion of both the B.S. and M.S. degrees in Biochemistry in five years. (Completion of the two separate degrees independently would typically take at least six years.) Students in the combined B.S./M.S. degree program will usually begin taking graduate level courses in the third year of the program. Students will conduct independent research under the supervision of a faculty member and use the findings for fulfilling the thesis requirement of a Master's degree. Either option will offer career enhancement opportunities well beyond what is possible with the regular B.S. degree.

The Biochemistry M.S. program only admits current OSU students at this time, either on a transfer basis from another graduate program (such as the Ohio State Biochemistry Program) or from the Biochemistry B.S. degree or another related program. The combined B.S./M.S. program is under review for semester conversion and it not admitting students at this time. The Biochemistry M.S. degree with emphasis in biotechnology is no longer offered.

Normally, a M.S. (Thesis Option) student will spend two years in residence. The B.S./M.S. program typically requires 5 total years.

### **b. Advising and Financial Support**

Students must complete their M.S. research under the supervision of a faculty member in the Department of Chemistry and Biochemistry. In general, the advisor should be among those indicated to be part of the Biochemistry division, but other advisors in the department are possible with approval of the Graduate Studies Committee. Research may be done in collaboration with faculty outside the department, but the direct supervision of the M.S. research of Biochemistry graduate students by faculty outside the department is not permitted. Any other advising arrangement is subject to approval by the Vice Chair for Graduate Studies.

The Biochemistry M.S. program and B.S./M.S. program are completely self-supported; no financial support is offered or guaranteed by the department. Students who transfer to the M.S. program from another OSU graduate program may be supported as a GA using the resources of the advisor and with the permission of the Vice Chair for Graduate Studies.

After selection of an advisor and in consultation with the student and their advisor, the Vice Chair for Graduate Studies will appoint an advisory committee for each student typically composed of the research advisor and one additional faculty member in the department. The purpose of the advisory committee is to provide each student with support and guidance during his or her graduate career. Students should meet with their advisory committee during the autumn semester of each year to discuss their progress in course work, examinations, and research. In addition, students are free to meet with any committee member at any time during the year. The department hopes that this process will provide a mechanism for forging closer ties between students and faculty, both before and after graduation.

If a student leaves a group, or the faculty advisor resigns his/her position as preceptor, the student will have until the end of that term to find a new advisor. If less than two weeks remain in the term including final examination week, then the student will have until the fifth week of the following term to find a new advisor. After this time, the student will no longer be in good standing in the department and support will be withdrawn (at the end of the term of enrollment) if the student was supported as a GA.

### **c. Curriculum**

The student must have a minimum residence of two semesters at The Ohio State University with completion of at least 30 credit hours of graduate work. The student's course program should be decided in conjunction with the advisor. Course work must be at the 6000-9000 level, and the courses in related fields must be acceptable to the Vice Chair for Graduate Studies, the student's advisor, and the Biochemistry division.

Students must take (a) 9 credit hours of core classes including Biochem 6701, 6761, 6762, 6763. (b) At least 6 hours of biochemistry electives from the department's listings (at the 6000 level or above). Related courses from other divisions (6000 level or above) or other departments (5000 level or above) may count as an elective with the permission of the Biochemistry division. (c) 1 hour of seminar (Biochemistry Division Student Seminar, Chem 8892) per academic semester. (d) Chemistry 6781 and 6782 are required, although these can be waived for transfer students who took equivalent safety and ethics courses in another department.

Recommended electives include: Biochemistry 6765, 7770, 7766, 8900, 8990

Other possible electives include:

Chemistry 6100-6599, 7100-7599, 8199-8699

Biomedical Informatics 5730

Microbiology/Cancer Biology and Genetics 7010

Microbiology 6020, 8050  
Molecular Genetics 5060, 5735

Students must enroll in at least 1 credit hour of research (Biochemistry 6999, Chemistry 8999, or equivalent) in each term of study, including summer term. At least 10 credit hours of research are required for the M.S.

The curriculum for the combined B.S/M.S. is currently under review.

#### **d. Thesis**

The thesis resulting from the student's graduate research must represent a significant contribution to knowledge in biochemistry. The importance of the research should be sufficient to warrant the acceptance for publication of a paper in one of the respected journals of biochemistry or a related scientific area, although acceptance of such a publication is not required for graduation. A reading committee composed of the advisor and at least one other graduate faculty member will consider the merit of the thesis in detail. The student's advisor selects the other committee member who is a member of the graduate faculty from the department.

#### **e. Masters Exam**

On approval of the thesis draft by the committee, a final oral examination, based largely on the thesis work, will be held in accord with the Graduate School guidelines. The examination committee will consist of the members of the thesis reading committee. A unanimous vote of the committee members is required for a satisfactory decision.

## **11. Academic and Professional Standards**

The department has high expectations for academic excellence. All students must maintain a B average in graduate coursework and make reasonable progress towards the degree. The department also puts the utmost value on safe, ethical, and professional conduct of research, using the best practices in the field. All researchers participate in online training from the office of Environmental Health & Safety, and Chemistry graduate students take both Research Safety and Ethics courses in the first year of the program. All researchers participate in online training on the responsible conduct of research from the Office of Research Compliance. The department's safety culture requires everyone's participation, and is accomplished through a partnership that involves EHS, our own safety staff, a Safety Committee of faculty and staff, the Joint Safety Team involving students and staff, and a network of laboratory safety officers. Lab coats and eye protection are required in the labs at all times

#### **a. Academic Standards**

A graduate student is expected to maintain a point-hour ratio of B (3.00) or better in all graduate-credit courses. If a student's cumulative point hour ratio (CPHR) falls below the 3.00 requirement after 9 credit hours, they are placed into a remediation plan for one term by the Graduate School in consultation with the Graduate Studies Committee. If the CPHR does not improve above 3.00 after one term, the student is automatically placed on one term of probation by the Graduate School. *Students on probation may be denied GA appointments by the Graduate School.* The student is expected to raise the CPHR above 3.00 the next term,

but continued enrollment is permitted on a term-by-term basis, as determined by the Vice Chair for Graduate Studies and the Graduate School. If the CPHR continues to deteriorate during remediation or probation, the Graduate School will issue a Special Warning and may dismiss the student. For additional information, please see section 5.3 of the Graduate School Handbook.

For students to remain in good standing, they must make reasonable progress in the program. This includes completion of courses, on-time completion of milestones (first year oral exam, MS if required, candidacy, oral presentation, advisory committee meetings), adequate research progress, and adherence to academic and professional standards. This includes adherence to safety requirements and accepted standards of research conduct. Students who do not make reasonable progress are warned in writing with a specific plan to come back into compliance. Students who do not achieve this remediation in the time allotted may be denied further funding by the department and may be denied further enrollment. See section 5.4 of the Graduate School Handbook for additional information.

Typically, an MS can be completed in two years and the PhD program is designed to be completed within 5 years. Students who enter having had strong undergraduate preparation generally complete the majority of the required courses during their first year. It is required that the candidacy exam be completed by the end of the second year, and efficient and productive researchers may complete their PhD sooner than the 5-year time limit.

## **b. Safety**

All students must take the Lab Standard and Building Emergency Action Plan training online from Environmental Health & Safety (although available through BuckeyeLearn) before doing in research in a department lab. Additional training may be required by the Graduate Studies Office, the Undergraduate Studies Office as part of GTA duties, or advisors, specific to research in their laboratories. Students must also adhere to departmental and university safety requirements, including wearing suitable eye protection and a lab coat at all times in the laboratory. Each student must become familiar with the department's Chemical Hygiene Plan and the Standard Operating Procedures associated with their work.

Every graduate student is required to complete the Safety Seminar (CHEM 6781) course during the second half of Autumn Semester of the first year. Failure to attend any of the lectures associated with this course will result in a grade of Unsatisfactory and will constitute an unsatisfactory performance as a Graduate Associate, which may result in loss of departmental support in future terms.

Adherence to laboratory, departmental, and university safety practices is considered an element of reasonable progress in the program. Failure to comply may result in Unsatisfactory grades in research (Chemistry 8999) and dismissal from the program.

## **c. Ethics and Responsible Conduct of Research**

Students must be familiar with standards for ethical scientific and academic conduct set by the University and accepted broadly both nationally and internationally.

Every graduate student is required to complete the Ethics in Scientific Research course (CHEM 6782) during the Spring Semester of the first year. Failure to attend any of the lectures associated with this course will result

in a grade of Unsatisfactory and will constitute an unsatisfactory performance as a Graduate Associate, which may result in loss of departmental support in future terms.

The Code of Student Conduct should be reviewed by all students (especially rule 3335-23-04 Prohibited Conduct). Academic misconduct allegations are adjudicated by the Committee on Academic Misconduct. Materials for all program requirements are expected to be the student's own work and in the student's own words, with proper attribution of borrowed ideas. Plagiarism is the representation of another's words or ideas as one's own, and it is prohibited by the Code. Plagiarism includes unacknowledged word-for-word use or close paraphrasing of another person's work, or unacknowledged use of another person's ideas.

Research misconduct means fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results. The University Policy and Procedures Concerning Research Misconduct is available at the Office for Research Compliance website and should be reviewed by all students. Research misconduct allegations are adjudicated by the Office of Research Compliance at the direction of the Vice President for Research.

Sanctions for academic misconduct in graduate classes or program requirements (such as candidacy or the dissertation), or for research misconduct, are likely to entail dismissal from the program and University, but in some cases may involve failing grades, probation, or other measures.

The Graduate Student Code of Research and Scholarly Conduct (Appendix C of the Graduate School Handbook) states:

Graduate students and Graduate Faculty aspire to professional behavior that is consistent with the highest ethical and moral standards. The Graduate School at The Ohio State University expects that graduate students will demonstrate responsibility and integrity in pursuing their creative and scholarly interests. The academic enterprise is dependent upon such behavior. Graduate students are responsible for learning about appropriate standards for ethical research and scholarly conduct and for following all university policies related to ethical research and scholarly conduct.

When graduate students join the Ohio State community, they become members of disciplinary, scholarly, and professional communities that extend beyond the university. Graduate students are expected to learn, respect, and abide by the professional codes of ethics and responsibilities that are commonly accepted in their field of study or area of research. These codes include but are not limited to the following: a responsibility to contribute an original body of work to one's chosen discipline and the recognition that one's work is based on the work of others which must be respected and properly acknowledged. Graduate students also have the responsibility to treat university faculty, staff, and other students respectfully and professionally.

Graduate Faculty, advisors, and graduate programs should actively encourage their students to participate as members of their chosen disciplinary, scholarly, and professional communities. Graduate students should be encouraged to seek and share knowledge wherever and whenever possible. Academic advisors and other faculty members should educate graduate students through example and discussion, addressing such issues as academic honesty, research, publication, recruitment, and hiring practices, and applicable fellowship and graduate associateship responsibilities. Disciplinary codes of ethics and norms should be discussed among graduate students and faculty. Such communication is a means of setting high standards of behavior in graduate study and beyond.

#### **d. Harassment-free Workplace**

The University policy on sexual misconduct states:

Members of the university community have the right to be free from all forms of sexual misconduct which impede the realization of the university's mission of distinction in education, scholarship, and service. All members of the university community are expected to conduct themselves in a manner that maintains an environment free from sexual misconduct.

Sexual misconduct violates the dignity of individuals and will not be tolerated. The university community seeks to eliminate sexual misconduct through education and by encouraging everyone to report concerns or complaints, including third parties when the respondent is a member of the university community. The university is committed to stopping sexual misconduct, preventing its recurrence, eliminating any hostile environment, and remedying its discriminatory effects.

All university employees have an obligation to report sexual assaults. Many OSU employees in human resources and supervisory positions (including faculty members) have an obligation to report sexual misconduct in any form. The university strongly discourages romantic and/or sexual relationships between faculty and graduate students in the same department. Relationships between supervisors and employees or between students and others in a supervisory, teaching, evaluation, or advising position are prohibited. The full policy on sexual misconduct can be found on the Human Resources ([hr.osu.edu](http://hr.osu.edu)) or Title IX ([titleix.osu.edu](http://titleix.osu.edu)) websites.

## **12. Vacation, Leave, and Work Policies**

### **a. Vacation and Leave**

Graduate students do not get extended breaks between terms as undergraduates do; graduate student appointments are continuous over the calendar year. GAs and Fellows do not accrue vacation or sick leave. Graduate students may take holidays, vacations and leaves within the rules set by the University, Graduate School, department, and advisor. In general, students should not plan to take vacations during classes in the Autumn and Spring semesters during classes, or during May, to facilitate attendance in course work, seminars, exams, and symposia.

First year students must be in town from the first day of orientation (typically 10 days before Autumn classes begin) to the last day grades are due in Autumn (around Dec. 15), and from the first day of classes in the Spring semester to the end of the first week of June. In general, students should not take more than a total of three weeks (15 working days) of vacation in the first year, with the permission of the advisor at the time and TA supervisor, as appropriate.

After the first year, vacation policies are at the discretion of the advisor and the appointing unit, so long as they do not conflict with Graduate School, program or curricular requirements. As point of reference, full time Ohio State professional staff members generally get 10 paid holidays and accrue 12 days of vacation per year. The Graduate School suggests 10 days (2 weeks) of vacation per year for GAs and Fellows.

Family and medical leave policies are governed by the Graduate School and the Human Resources policies of the appointing unit. It is important to understand that even GA-appointed students are not eligible for the protections for workers under the Family and Medical Leave Act (FMLA), because GA appointments are 50% effort and do not exceed 1,250 hours per year. Moreover, Ohio State faculty and staff leave policies do not apply to students.

GAs with at least a 50% FTE appointment, who have completed at least two consecutive semesters of GA appointment and are in good academic standing, are eligible for up to 6 weeks of paid leave for birth mothers and up to 3 weeks of paid leave for fathers and adoptive parents, up to the last day of the appointment. Similarly qualified GAs are eligible for up to six week of paid leave (up to the end of the appointment) for serious health conditions or to care for a family member with a serious health condition. "Paid leave" here means maintenance of 100% of stipend, fee authorization and other benefits associated with the appointment. Short term absences (usually 1-3 days but possibly up to 2 weeks as warranted) are generally available to GAs, fellows and trainees for personal illness or in the event of the death of an immediate family member with the permission of the advisor and other relevant immediate supervisors (such as a TA coordinator).

See section 11.2 and Appendix F of the Graduate School Handbook for additional information.

#### **b. Other Work Policies**

Graduate students supported as GAs or Fellows may not hold additional or outside employment without the express permission of the Vice Chair for Graduate Studies. Additional employment is generally not permitted. Even if the Vice Chair grants permission, such employment is at the discretion of the advisor and subject to the policies of the appointing unit and source of funds.

#### **c. Grievances**

Discussion with the Vice Chair for Graduate Studies usually leads to resolution of a grievance. If discussion with the Vice Chair proves unsatisfactory, the Graduate School has established grievance procedures for issues related to examinations and GA appointments (Appendix D of the Graduate School Handbook). Grievances not related to examinations or GA appointments that cannot be resolved through discussion with the Vice Chair may need to be referred to the Graduate School or Human Resources for further review.