



March 23, 2023

RE: Creation of an Additional Non-Thesis M.S. Degree Pathway in Chemistry Based on Candidacy

Dear Review Panels:

The Department of Chemistry and Biochemistry offers graduate programs leading to the Masters of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. The Department does not formally recruit students into the M.S. program; rather, all students are admitted into the Ph.D. program, whereupon a small fraction of matriculated students terminate their studies with the M.S. degree either by their own choice or as directed based on insufficient progress towards the Ph.D.

Currently, the only avenue available for graduate students to earn an M.S. degree is by completing sufficient research and writing and defending an M.S. thesis. The Department of Chemistry and Biochemistry is seeking to create an additional pathway, effective in AU23, for students to obtain an M.S. degree based on successful completion of the Ph.D. candidacy exam, without completing and defending an M.S. thesis. The department anticipates that offering such an option would (1) decrease the number of students exiting our Ph.D. program without a degree, and (2) decrease the average time it takes for students to receive M.S. degrees. Both are statistics that will help with recruitment of students to our program, and we anticipate that offering this M.S. degree option will help us to conserve valuable resources including time, space, federal grant funding, and departmental funds by expediting the exit of graduate students who will not complete the Ph.D.

The proposed M.S. degree based on candidacy was discussed extensively and approved unanimously by the Graduate Studies Committee (6-0), Chaired by the Vice Chair for Graduate Studies. Offering this degree program was also approved by a vote of the tenure-track faculty (27-5) in the Department of Chemistry and Biochemistry via an online vote.

The accompanying documents include a request for approval of a few minor revisions to our current thesis-based M.S. degree program to better reflect current practices in our program, our rationale for requesting a new non-thesis M.S. degree based on candidacy, a description of the requirements for the new degree pathway, and



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a clear delineation of the differences between the two M.S. pathways we are seeking to offer. We have also included Learning Objectives for each possible M.S. degree.

Sincerely,

Christine M. Thomas
Professor

To: College of Arts and Sciences Curriculum Committee

Re: Minor Revision to Chemistry M.S. Degree Program and Creation of an Additional Non-Thesis M.S. Degree Pathway Based on Candidacy

Date: March 23, 2023

The Department of Chemistry and Biochemistry offers graduate programs leading to the Masters of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. The Department does not formally recruit students into the M.S. program; rather, all students are admitted into the Ph.D. program, whereupon a small fraction of matriculated students terminate their studies with the M.S. degree either by their own choice or as directed based on insufficient progress towards the Ph.D.

Currently, the only avenue available for graduate students to earn an M.S. degree is by completing sufficient research and writing and defending an M.S. thesis. The Department of Chemistry and Biochemistry is seeking to create an additional pathway, effective in AU23, for students to obtain an M.S. degree based on successful completion of the Ph.D. candidacy exam, without completing and defending an M.S. thesis. We start by requesting approval of a few minor revisions to our current thesis-based M.S. degree program to better reflect current practices in our program, then provide our rationale for requesting a new non-thesis M.S. degree based on candidacy and describe the requirements for this new degree and clearly delineate the differences between the two M.S. pathways we are seeking to offer.

REVISIONS TO MOST RECENTLY APPROVED M.S. CURRICULUM

The Chemistry M.S. curriculum was most recently approved during semester conversion in 2011, and the previously approved semester conversion document is included as an Appendix (Appendix 1). We have carefully evaluated the approved thesis-based M.S. curriculum document to ensure that the program is still being administered as indicated in the approved document. For the most part, the approved thesis-based M.S. curriculum reflects our current practices, but there are a few minor revisions that we would like to request to better reflect how the program has evolved over the last decade. Requested changes are as follows:

- (1) On page 2 of the previous M.S. curriculum document, we stated that “The Department of Chemistry does not award a non-thesis M.S. degree.” Pending approval of the M.S. based on candidacy option described below, we request removal of this statement.
- (2) On page 2 of the previous M.S. curriculum document, we stated “Each student should enroll every semester (except summer term) for one hour of a divisional Seminar course (889X, where X = 1-6)...” We would like to modify this statement to explicitly define the course numbers and remove 8896, as this divisional seminar is no longer offered. Proposed new text is: “Each student should enroll every semester (except summer term) for one hour of a divisional seminar course (889X, where X = 1 (Analytical), 2(Biochemistry), 3(Inorganic), 4(Organic), 5(Physical))...”
- (3) On page 5 of the previous M.S. curriculum document, we indicate that the department administers placement exams to all graduate students prior to the start of their first semester in our program to evaluate their competence in undergraduate-level chemistry subject areas. Our department discontinued the practice of administering placement exams in 2020 as we found that the outcomes of these exams did not correlate well with student performance in graduate-level coursework or success in our program in general. Thus, we are requesting to remove the following paragraph:
“**Placement Exams** At the time students enroll in the Graduate School the department will administer a series of written examinations that are used to gauge competence at the undergraduate level in analytical, biological, inorganic, organic, and physical chemistry. The purpose of these examinations is to aid the student and faculty advisors in planning a suitable progression of coursework leading to the advanced degree. Students who are considered “not proficient” in an 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.”
- (4) On page 7 of the previous M.S. curriculum document, we indicate that a student may choose an advisor outside the Department of Chemistry and Biochemistry as long as they have a co-advisor on the Chemistry and Biochemistry faculty and have the approval of the Vice Chair for Graduate Studies. In practice, we have not permitted students to choose an advisor outside of the Department for at least 15 years, so we request to remove the following paragraph:
“A student may complete their M.S. research under the supervision of an advisor from outside the Department of Chemistry with a co-advisor on the Chemistry faculty. All such arrangements must be collaborative in nature with the Chemistry faculty member serving

as the Principal Investigator on the research project and are 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 an M.S. thesis in Chemistry.”

- (5) On page 7 of the previous M.S. curriculum document, we indicate that a student has one semester to find a new advisor if they choose to leave a research group or their research advisor resigns as their advisor. After this time, support (in the form of a graduate appointment) is withdrawn. Depending on when such a decision is made, this can result in ambiguity about how long support is maintained. For example, if a student decides to leave a group mid-semester, do they have until the middle of the following semester to find a new advisor? If so, it would require termination of an appointment in the middle of the semester, which is not possible with a GTA position. In addition, always giving students until the end of a semester to find a new advisor can result in last-minute decisions about whether a student will be appointed in the following semester, which presents financial difficulties to the student and logistical difficulties to the department (e.g. filling in a GTA position that is vacated at the last minute). Thus, we request to revise the timeline such that a student has 7 weeks to find a new advisor if their advisor resigns or if they choose to leave a research group. If a new advisor is not identified within 7 weeks, financial support will be withdrawn at the end of the current semester. We request to change the corresponding paragraphs as follows:

Previous language:

“If a student leaves a group, or the faculty advisor resigns his/her position as preceptor, the student will have up to one semester to find a new advisor. After this time, support will be withdrawn.”

Proposed revision:

“If a student leaves a group, or the faculty advisor resigns his/her position as advisor, the student will have seven weeks to find a new advisor. After this time, financial 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.”

- (6) On page 7 of the previous M.S. curriculum document, we stated that all students pursuing either an M.S. degree or Ph.D. degree are required to take a first-year oral examination in the summer of their first year of study. While it is true that the majority of students choosing not to continue in the Ph.D. program will make that decision after they have already taken the first-year oral exam required for the Ph.D. program, we do not think that this evaluation is necessary for M.S. students. The purpose of the first-year oral examination is to evaluate whether the student is ready to proceed with the further requirements of the Ph.D. program, but this information is not relevant if a student has already decided that they are going to pursue an M.S. as a terminal degree. Moreover, students in our new 1-year post-baccalaureate Chemistry Bridge Program have the option of transitioning into the thesis-based M.S. program and completing their M.S. degree within 1 year (total of 2 years if the year in the Bridge program is counted), and students in this situation should not be required to complete the first-year oral exam prior to writing and defending a master’s thesis. Thus, we request that, in rare cases where a student has already decided to pursue an M.S. rather than a Ph.D. prior to completing the first-year oral

examination, the first-year oral exam no longer be listed as a requirement for the M.S. degree. We request to revise the following paragraphs:

Previous language:

“First-Year Oral Examination All students pursuing either an M.S. degree or Ph.D. degree must take an oral examination in the summer of their first year of study. The focal point of this examination is a paper that is related to the student’s research topic and which is selected jointly by the student and their advisor. 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.

Repeat exams or extra chances at the cumulative exams will only be given in exceptional cases. The student must clearly state the grievance and proposed redress in a petition to the Graduate Studies Committee, who will act on the petition in consultation, and based on the recommendation, of the division(s) administering the exam.”

New language:

“First-Year Oral Examination The first-year oral exam that is typically required for students pursuing the Ph.D. degree is not required for the M.S. degree. Students have already chosen to follow an M.S. track may by the end of their first two semesters may elect not to take the first-year oral examination. However, once a student has decided not to complete the first-year oral examination, they are ineligible to remain in the Ph.D. program. Therefore, students are strongly encouraged to complete the first-year oral examination if there is any doubt about their intention to continue in the Ph.D. program.”

- (7) To the best of our knowledge, there were no learning outcomes provided for the thesis-based M.S. degree program in the previous M.S. curriculum document. At this time, we would like to add the following Learning Objectives thesis-based M.S. degree (also included as Appendix 2:

Learning Objectives (thesis-based M.S.)

Demonstrate a broad foundational knowledge of chemistry, particularly for a large subdiscipline such as biochemistry or analytical, inorganic, organic or physical chemistry.

- Students obtaining a Chemistry M.S. degree based on an M.S. thesis should have a broad working knowledge of the field at least comparable to the material taught in general chemistry and first undergraduate divisional classes (analytical, inorganic, organic, physical and biochemistry).
- Students should develop a deeper knowledge of their broader area of specialization (analytical, inorganic, organic, physical and biochemistry), equivalent to material in the divisional core graduate curriculum.
- This knowledge is evaluated through satisfactory performance in required classes.

Demonstrate expertise (in-depth knowledge) in a specific research area, including the motivations behind the research area and its broader impacts on the scientific field and/or society

- In the specific area of specialization, students should gain a deep knowledge of the field, equivalent to elective and special topics classes at the graduate level.
- Students should also be familiar with the current literature, both from their own lab and from other labs around the world working in the area.
- This specialized knowledge is evaluated in elective classes and at the final oral exams.

Evaluate scientific work critically, by applying, analyzing, synthesizing, and evaluating scientific knowledge

- Critical thinking is the mark of a mature scientist and will be developed through scientific inquiry (conducting research and writing an M.S. thesis dissertation).

Conduct meaningful scientific inquiry leading to new knowledge in the field, including devising hypotheses, developing research strategies, executing research, and interpreting results

- Demonstration of a solid grasp of the scientific method through conducting research in the laboratory and producing an M.S. thesis and, ideally, contributing to publications.
- Proper planning and execution of experiments includes a grasp of essential methods, including statistical analysis and laboratory or computational skills, to produce rigorous and reproducible results.

Communicate scientific concepts, methods, results, and conclusions effectively to experts and non-experts, including the society at large, in oral and written form

- Written communication skills are developed through writing the M.S. thesis dissertation.
- Oral communication skills are developed through presentations at research group meetings, performing GTA duties (not an explicit requirement, but most students will have this experience), and presenting thesis research at the M.S. oral exam.
- Presentations to broader audiences, such as at national or regional conferences, develop communication skills to those outside the student's immediate expertise.

Conduct and disseminate research professionally, responsibly, and safely, in accord with the ethical standards and best practices of the profession

- Students must participate in required training for laboratory safety (online and required CHEM 6781 class offered in first semester) and the responsible conduct of research (online and required CHEM 6782 class offered in second semester).
- Safety and ethics should be addressed in all scientific work, regularly at laboratory group meetings and with specialized training as needed throughout the student's career.
- Students should develop skills in applicable professional areas, such as pedagogy, teamwork, leadership, and business, through teaching, workshops, and interactions with alumni.

Timeline and methods for assessment:

- Student grades in core and elective classes as well as required Laboratory Ethics and Research Ethics classes will be evaluated each semester.
- The M.S. exam committee will evaluate foundational knowledge, in-depth knowledge, oral and written communication skills, and the contribution of the student's research to producing new knowledge in their field through evaluation of the M.S. thesis and oral defense. Unanimous approval of all committee members is required for successful degree completion.

RATIONALE FOR REQUESTING AN M.S. OPTION BASED ON CANDIDACY

We are requesting to create a second pathway towards completion of an M.S. degree to minimize the number of students that leave the Chemistry Ph.D. program without a degree in hand. This new pathway will allow students in the Chemistry Ph.D. program who have successfully completed candidacy to leave the graduate program with an M.S. degree without writing and defending an M.S. thesis. In such a case, the student would have already successfully completed a written and oral exam (in the form of candidacy) upon which their research accomplishments and knowledge were evaluated, such that an additional written and oral examination (in the form of a M.S. thesis and exam) would not be required.

Students choose to (or are asked to) leave the Ph.D. program for a variety of reasons. Sometimes this is a personal choice related to health concerns, changes in family obligations, changes in career aspirations, or loss of motivation to continue pursuing the Ph.D. In other cases, a student's advisor and advisory committee may decide that a student is no longer making sufficient progress towards the Ph.D. after passing their candidacy exam. In each of these scenarios, there may be cases where a student is unable or unwilling to continue in the program long enough to write and defend an M.S. thesis. At present, such a student would leave the Ph.D. program with no degree at all, despite completing all of their coursework requirements and demonstrating a mastery of their research area through successful completion of Ph.D. candidacy exam. Although this is not a common scenario, this is not a desirable outcome for the student or for the program and we would like to avoid such cases. A more common scenario is that a student who has passed candidacy and has decided (or been told by their advisor and/or advisory committee on the basis of lack of reasonable progress) that completing a Ph.D. is not for them will stay in the program for one or more additional semesters while they complete an M.S. thesis. This adds additional time-to-degree for the student and, depending on the student's career aspirations, may not be a valuable use of their time. Moreover, since they continue to receive financial support in the form of a GTA or GRA appointment until their M.S. thesis is completed, extending their time in the graduate program may also be considered an irresponsible use of financial resources.

In addition, many of the students working in laboratories in the Department of Chemistry and Biochemistry are from other graduate programs (e.g. Biophysics, Molecular, Cellular and Developmental Biology, Ohio State Biochemistry Program) that already offer the option to receive an M.S. degree based on successful completion of candidacy. Offering the same option to Chemistry Ph.D. students would help to eliminate confusion and/or equity issues that arise from students working side-by-side in the same research laboratories but being held to different standards and requirements for degree completion.

REQUIREMENTS FOR M.S. DEGREE BASED ON CANDIDACY

Coursework The student must have a minimum residence of two semesters at The Ohio State University with completion of at least 30 semester hours of graduate work. The student's course program should be decided in conjunction with the Advisor. A student pursuing the M.S. degree based on candidacy must complete a minimum of 12 hours of graded graduate coursework at the 5000-7000 level in Chemistry or Biochemistry and complete a minimum of 16 hours of CHEM 8998 or CHEM 8999.

The M.S. degree is a research degree; thus, most coursework should be taken during the first year. Courses that are indicated as electives may include those offered in areas related to the student's research topic (both inside and outside the Department of Chemistry and Biochemistry). Students may enroll in research as early as spring semester of their first year, and they must do so by the summer term of their first year in graduate school.

Students in good standing in the Graduate School will enroll in CHEM 8999 when they begin their degree research and during each subsequent term. Each student should enroll every semester (except summer term) for one hour of a divisional seminar course (889X, where X = 1 (Analytical), 2(Biochemistry), 3(Inorganic), 4(Organic), 5(Physical)), unless doing so violates the credit hour limits. This course requires regular attendance at departmental and/or divisional seminars.

Recommended Curriculum The following tables indicate the proposed recommended first-year curriculum for students pursuing the M.S. degree based on candidacy in the Department of Chemistry and Biochemistry. Students must complete at least 12 credit hours of coursework. Thus, first-year graduate students will begin introductory-level coursework (6000-level) in the first semester, moving to intermediate-level coursework (7000-level) in the second semester (Table 1). Please note that not all courses are offered in 7-week (1.5 credit hour) sessions; some courses are 14-week (3 credit hour) courses and will take the place of two 7-week session courses.

Table 1. Recommended Coursework for First-Year Graduate Students (Credit Hours)					
Year 1	AU S1	AU S2	SP S1	SP S2	SU
Course 1	Introductory Course (1.5) 6000-level	Introductory Course (1.5) 6000-level	Intermediate Course (1.5) 7000-level	Intermediate Course (1.5) 7000-level	Thesis Research (4) 8999
Course 2	Introductory Course (1.5) 6000-level	Introductory Course (1.5) 6000-level	Intermediate Course (1.5) 7000-level	Intermediate Course (1.5) 7000-level	
Course 3	Faculty Research (1) 6780	Lab Safety (1) 6781	Ethics (1) 6782		
Course 4	Seminar (1) 899X		Seminar (1) 899X		
Course 5	Research (7) 8998		Research (8) 8999 ^a		
Total Credit Hours	16		16		4

^a It is anticipated that students will only complete the candidacy exam if they are intending on continuing in the Ph.D. program at that point in time. Thus, we anticipate that all students who elect to leave the Ph.D. program with an M.S.

degree based on successful completion of the candidacy exam will have enrolled in thesis/dissertation research (8999) up until (and including) the semester in which they complete candidacy.

Students pursuing the M.S. degree in Chemistry based on candidacy will typically take only a seminar and research course after their first year of study. However, the recommended curriculum will vary based on whether the student is pre-candidacy (Table 2) or post-candidacy (Table 3). Students in the Chemistry Ph.D. program are required to complete candidacy during the second semester of their second year of study. Thus, all students who elect to exit the Chemistry Ph.D. program based on a successful candidacy exam will have completed at least 2 years of study and enrolled in a substantial number of credit hours of CHEM 8999 (thesis/dissertation research) despite the fact that they elect not to complete and defend an M.S. thesis.

Year 2-3	AU S1	AU S2	SP S1	SP S2	SU
Course 1	Seminar (1) 899X		Seminar (1) 899X		Research (4) 8999 ^a or 8998 ^b
Course 2	Research (7) 8999 ^a		Research (7) 8999 ^a		
Total Credit Hours	8		8		4

^a It is anticipated that students will only complete the candidacy exam if they are intending on continuing in the Ph.D. program at that point in time. Thus, we anticipate that all students who elect to leave the Ph.D. program with an M.S. degree based on successful completion of the candidacy exam will have enrolled in thesis/dissertation research (CHEM 8999) up until (and including) the semester in which they complete candidacy. ^b Once a student has elected not to complete a thesis and to obtain the M.S. degree based on candidacy, they will enroll in CHEM 8998 (non-thesis research) instead of CHEM 8999 for their final term.

Year 2-3	AU S1	AU S2	SP S1	SP S2	SU
Course 1	Seminar (1) 899X		Seminar (1) 899X		Research (3) 8999 ^a or 8898
Course 2	Research (2) 8999 ^a or 8898		Research (2) 8999 ^a or 8898		
Total Credit Hours	3		3		3

^a It is anticipated that students will only complete the candidacy exam if they are intending on continuing in the Ph.D. program at that point in time. Thus, we anticipate that all students who elect to leave the Ph.D. program with an M.S. degree based on successful completion of the candidacy exam will have enrolled in thesis/dissertation research (CHEM 8999) up until (and including) the semester in which they complete candidacy OR until it has been determined that they will exit the Ph.D. program. ^b Once a student has elected not to complete a thesis and to obtain the M.S. degree based on candidacy, they will enroll in CHEM 8998 (non-thesis research) instead of CHEM 8999 for their final term. ^c Student are not required to complete a third year of study if they have already decided to exit the program with a terminal M.S. degree based on candidacy.

Students terminating their studies with the M.S. degree based on candidacy would have sufficient credits after their first year of study to meet the 30 credit hour requirement for this degree. However, since the candidacy exam is not completed until the end of the second year of study they will have accumulated substantially more than the minimum number of credit hours required. Only students whose intention is to continue in the Ph.D. program should proceed with the candidacy exam, and the M.S. degree based on candidacy should only be considered as an exit strategy for

post-candidacy students. In other words, pre-candidacy students who elect to exit the Ph.D. program should complete the thesis-based M.S. degree and not consider completing the candidacy exam as a substitute for writing and defending an M.S. thesis.

While each division (sub-discipline) in the Department of Chemistry and Biochemistry has specific courses that are recommended, some of which proceed in a specific sequence, the Department does not consider that courses are formally “required” in the sense that a student cannot receive a graduate degree without successfully completing a given course. Students follow divisional guidelines and requirements for coursework, but exceptions are usually allowed and substitutions for introductory and intermediate courses are common. In the case of elective courses, some divisions have lists of approved electives, whereas other divisions allow the student considerable flexibility in choosing such courses. Ultimately, it is the student’s advisor and the Graduate Studies Committee who have final approval for a proposed curriculum.

Advisor Selection Students will be matched with a research advisor at the end of the fall semester of their first year of graduate study in the same manner as described for the Ph.D. and thesis-based M.S. degrees (see [Department of Chemistry and Biochemistry Graduate Program Handbook](#)).

Advisory Committee Each student will have an advisory committee appointed by the Vice Chair for Graduate Studies in consultation with the student and their advisor 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. The advisory committee must include the advisor and two other members of the graduate faculty. One member of the advisory committee may be from outside the Department of Chemistry and Biochemistry 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). The advisory committee members typically serve on the student’s candidacy committee.

Candidacy Examination Students will be required to complete the candidacy examination using the same timeline, format, and procedures as described for the Ph.D. program (see [Department of Chemistry and Biochemistry Graduate Program Handbook](#)).

Transition from Ph.D. program to Candidacy-Based M.S. Degree In many cases, students will elect to complete an M.S. degree on the basis of a successful candidacy exam on their own accord when they decide that they no longer wish to pursue the Ph.D. However, in other cases the advisor may decide, in consultation with the student’s advisory committee and/or the Graduate Studies Committee that the student is no longer making reasonable progress towards completion of the Ph.D. Such a conclusion will typically require a meeting of the student’s advisory committee and may be drawn as part of the post-candidacy progress report process. There is no specific timeline on which such decisions will be made by students, advisors, and committees. However, students who have elected to complete an M.S. degree based on candidacy or have been directed to do so by their advisor and/or advisory committee must complete an Application to Graduate as soon as possible (e.g. to graduate during the current semester or, if the deadline for application has already passed, to graduate during the subsequent semester). Students must enroll for at least 3 credit hours during the term in which they plan to graduate with an M.S. It is anticipated that these credit hours will consist of CHEM 899X seminar (during the AU and SP semesters) and 8998 (non-thesis

research). As students enrolled in 8998, students are expected to continue participating in research-related activities under the direction of their advisor.

Financial Support Most graduate students in the Department of Chemistry and Biochemistry receive financial support as Graduate Associates, either Teaching Associates (GTA) or Research Associates (GRA), or as Fellows during their tenure in the department. Students who have elected to complete an M.S. degree based on candidacy or have been directed to do so by their advisor and/or advisory committee must complete an Application to Graduate as soon as possible (e.g. to graduate during the current semester or, if the deadline for application has already passed, to graduate during the subsequent semester). Financial support in the form of a GTA/GRA appointment will not be provided for additional semesters once the decision to complete an M.S. based on candidacy has been made. Students must enroll for at least 3 credit hours during the term in which they plan to graduate with an M.S.

LEARNING OBJECTIVES AND ASSESSMENT PLAN FOR M.S. DEGREE BASED ON CANDIDACY

Learning objectives for the M.S. degree based on candidacy are provided below and as Appendix 3.

Chemistry Graduate Program

Learning Objectives (M.S. based on candidacy)

Demonstrate a broad foundational knowledge of chemistry, particularly for a large subdiscipline such as biochemistry or analytical, inorganic, organic or physical chemistry.

- Students obtaining an M.S. degree based on successful completion of the candidacy exam should have a broad working knowledge of the field at least comparable to the material taught in general chemistry and first undergraduate divisional classes (analytical, inorganic, organic, and biochemistry).
- Students should develop a deeper knowledge of their broader area of specialization (analytical, inorganic, organic, physical and biochemistry), equivalent to material in the divisional core graduate curriculum.
- This knowledge is evaluated through satisfactory performance in required classes and at the candidacy exam.

Demonstrate expertise (in-depth knowledge) in a specific research area, including the motivations behind the research area and its broader impacts on the scientific field and/or society as well as the current status of the area and what remains to be understood.

- In the specific area of specialization, students should gain a deep knowledge of the field, equivalent to elective and special topics classes at the graduate level.
- Students should also be familiar with the current literature, both from their own lab and from other labs around the world working in the area.
- This specialized knowledge is evaluated in elective classes and through both the written and oral portions of the candidacy exam.

Evaluate scientific work critically, by applying, analyzing, synthesizing, and evaluating scientific knowledge.

- Critical thinking and the use of higher order cognitive functions are marks of a mature scientist.
- These traits are developed through proposal writing (candidacy exercise) and scientific inquiry (conducting research).

Conduct meaningful scientific inquiry leading to new knowledge in the field, including devising hypotheses, developing research strategies, executing research, and interpreting results.

- Demonstration of a solid grasp of the scientific method occurs in proposal writing (candidacy exam), through research in the laboratory, and, ideally, through contributing to publications.

- Proper planning and execution of experiments includes a grasp of essential methods, including statistical analysis and laboratory or computational skills, to produce rigorous and reproducible results.

Communicate scientific concepts, methods, results, and conclusions effectively to experts and non-experts, including the society at large, in oral and written form.

- Written communication skills are developed through writing the candidacy proposal.
- Oral communication skills are developed through presentations at research group meetings, performing GTA duties (not explicitly a requirement, but most students will have this experience), and presenting their research results and proposed ideas at the candidacy exam.
- Presentations to broader audiences, such as at on-campus symposia or national or regional conferences, develop communication skills to those outside the student's immediate expertise.

Conduct and disseminate research professionally, responsibly, and safely, in accord with the ethical standards and best practices of the profession.

- Students must participate in required training for laboratory safety (online and required CHEM 6781 class offered in first semester) and the responsible conduct of research (online and required CHEM 6782 class offered in second semester).
- Safety and ethics should be addressed in all scientific work, regularly at laboratory group meetings and with specialized training as needed throughout the student's career.
- Students should develop skills in applicable professional areas, such as pedagogy, teamwork, leadership, and business, through teaching, workshops, and interactions with alumni.

Timeline and methods for assessment:

- Student grades in core and elective classes as well as required Laboratory Ethics and Research Ethics classes will be evaluated each semester.
- The candidacy exam committee will evaluate foundational knowledge, in-depth knowledge, familiarity with scientific literature, ability to develop hypotheses and design experiments, and oral and written communication skills through the oral and written portions of the candidacy exam. A detailed rubric for the candidacy exam will be provided to all committee members and completed at the end of the candidacy exam. The Candidacy Rubric is provided as Appendix 4. Unanimous agreement by all committee members that the candidacy exam has been completed satisfactorily is required for successful degree completion.

DIFFERENCES BETWEEN THESIS-BASED M.S. DEGREE AND M.S. DEGREE BASED ON CANDIDACY

Since both the thesis-based M.S. degree and the M.S. degree based on successful completion of the candidacy exam are mechanisms by which a student who originally matriculated in the Chemistry Ph.D. program exits the program, many of the requirements of the two pathways (residency, coursework, advisor selection, financial support) are the same. The two routes are distinguished, however, by the following:

- (1) The M.S. degree based on candidacy requires successful completion of the Ph.D. candidacy exam (both oral and written components), while the thesis-based M.S. degree does not require completion of the candidacy exam.
- (2) The M.S. degree based on candidacy does not require a written M.S. thesis or an oral exam to defend the M.S. thesis, while an M.S. thesis and examination are required for the thesis-based M.S. degree.
- (3) While both degrees are research-based degrees and require a thorough and in-depth understanding of a particular research project (or projects), the learning goals of the two degree programs are somewhat different. The thesis-based M.S. degree requires a student to make progress on a research project and is granted based on completion of an independent research project. On the other hand, the M.S. degree based on candidacy requires a student to contribute intellectually to the future directions of a research project by writing a proposal for future studies in a particular research area as part of the candidacy examination process. While preliminary results are encouraged for the candidacy exercise, completion of a project is not a requirement for successful completion of the candidacy examination for the candidacy-based M.S. degree.

MASTER'S PROGRAM PROPOSAL – DEPARTMENT OF CHEMISTRY

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PROGRAM RATIONALE

The Department of Chemistry has traditionally offered thesis-based M.S. and Ph.D. degrees. In conversion to semesters, the fundamental basis for graduate degrees in Chemistry remains unchanged, although the coursework providing foundational knowledge has been re-designed and the content presentation has been re-envisioned.

Courses will continue to be offered in defined areas of specialization, except traditional sequences of intermediate and advanced courses have been re-designed to meet the needs of a modern program in chemical research. Courses are now offered from a topical perspective. These topical areas include foundational core course offerings in the disciplines of analytical, biological, inorganic, organic, and physical chemistry of general interest to beginning graduate students outside of a specific division. The majority of Introductory and Intermediate courses (6000-7000 level) were re-designed as seven-week session courses to further increase flexibility in student curricula by allowing a greater degree of diversity in course offerings and for flexibility in designing multidisciplinary tracks of study. Thus, the student under the new semester system will have a greater ability to take coursework that best suits their research interests, rather than a strictly proscribed curriculum based on divisions. It should be stressed that the overall content of the re-designed coursework is unchanged or modestly enhanced, and more modern topics that have been introduced as Individual Studies courses (693) or have been repeated offerings of advanced topics courses under quarters have been codified as new courses under semesters.

MASTER'S PROGRAM IN CHEMISTRY

Master's Degree The student must have a minimum residence of two semesters at The Ohio State University with completion of at least 30 semester hours of graduate work. The student's course program should be decided in conjunction with the Advisor. A student pursuing the M.S. degree must complete a minimum of 12 hours of coursework at the 5000-7000 level in Chemistry, and complete a minimum of 16 hours of 8999.

Students will carry out a research program that will culminate with the writing of a thesis. The research program should be initiated upon joining a research group. The Department of Chemistry does not award a non-thesis M.S. degree.

The M.S. candidate must pass an oral examination before a committee composed of at least two Chemistry Department faculty members, including the student's research advisor, following rules from the Graduate School Handbook.

The M.S. degree is a research degree, and thus all coursework is taken during the first year. Those courses indicated as electives may include those offered in other areas by the Division (both inside and outside the Chemistry Department) and, in some cases, additional courses in the major field. Students may enroll in research as early as spring semester of their first year, and they must do so by the summer term of their first year in graduate school.

Students in good standing in the graduate school will enroll for Research in Chemistry (CHEM 8999) when they begin their degree research, and during each subsequent term. Each student should enroll every semester (except summer term) for one hour of a divisional Seminar course (889X, where X = 1-6), unless doing so violates the credit hour limits. This course requires regular attendance at departmental and/or divisional seminars.

MASTER'S COURSEWORK UNDER SEMESTERS

Course Structure and Total Contact Hours Chemistry graduate courses under the semester system are either 7- or 14-weeks in length, for 1.5 or 3.0 credits, respectively. The autumn and spring semesters have been divided into two sessions each, designated as AU-1/AU-2 and SP-1/SP-2. The May term will be used primarily for specialized or laboratory courses, and the Department does not teach graduate courses during the summer term.

Recommended Curriculum The following tables indicate the proposed recommended first-year curriculum for students pursuing the M.S. degree in the Department of Chemistry. Students must complete 12 credit hours of coursework. Thus, first-year graduate students will begin introductory-level coursework (6000-level) in the first semester, moving to intermediate-level coursework (7000-level) in the second semester (Table 1). Please note that not all courses are 7-week sessions; some courses are 14-week semester courses, and will take the place of two 7-week session courses (dotted vertical line, Course 1, Table 1).

All instructional content from quarter-based courses will be represented in the semester courses listed at the end of this document (Page 11).

Year 1	AU-1	AU-2	SP-1	SP-2	SU
Course 1	Introductory Divisional Course (1.5) 6000-level	Introductory Divisional Course (1.5) 6000-level	Intermediate Divisional Course (1.5) 7000-level	Intermediate Divisional Course (1.5) 7000-level	Thesis Research (4) 8999
Course 2	Core Elective (1.5) 6N10*	Introductory Divisional Course (1.5) 6000-level	Intermediate Divisional Course (1.5) 7000-level	Intermediate Course (1.5) 7000-level	
Course 3	Faculty Research (1) 6780	Lab Safety (1) 6781	Ethics (1) 6782		
Course 4	Seminar (1) 889N*		Seminar (1) 889N*		
Course 5	Non-thesis Research (7) 8998		Thesis Research (8) 8999		
Total Credit Hours	16		16		4

*N = 1 (analytical), X = 2 (biological), X = 3 (inorganic), X = 4 (organic), X = 5 (physical), X = 6 (theoretical).

Students pursuing the M.S. degree in Chemistry will typically take only a seminar and research course after their first year of study.

Table 2. Recommended Coursework for Second- (and Third-) Year Students (Credit Hours)					
Year 2-3	AU-1	AU-2	SP-1	SP-2	SU
Course 1	Seminar (1) 889N*		Seminar (1) 889*		Thesis Research (4) 8999
Course 2	Thesis Research (7) 8999		Thesis Research (7) 8999		
Total Credit Hours	8		8		4
*N = 1 (analytical), X = 2 (biological), X = 3 (inorganic), X = 4 (organic), X = 5 (physical), X = 6 (theoretical).					

Students terminating their studies with the M.S. degree would have sufficient credits after their first year of study to meet the 30 credit hour requirement for this degree.

Curricular Requirements While each division (sub-discipline) in the Department of Chemistry has specific courses that are recommended, some of which proceed in a specific sequence, the Department does not consider that courses are formally “required” in the sense that a student cannot receive a graduate degree without successfully completing a given course. Students follow divisional guidelines and requirements for coursework, but exceptions are usually allowed and substitutions for introductory and intermediate courses are common. In the case of elective courses, some divisions have lists of approved electives, whereas other divisions allow the student considerable flexibility in choosing such courses. Ultimately, it is the student’s advisor and the Graduate Studies Committee who have final approval for a proposed curriculum.

REQUIREMENTS OF THE CHEMISTRY MASTER'S PROGRAM

The following information is taken from the document "Summary of Procedures and Requirements for Graduate Degrees (2010-2011)." No significant changes to this document are envisioned upon semester conversion.

Admission to the Master's Program in Chemistry The Department of Chemistry does not admit students directly into the M.S. degree program. Students may elect to terminate their studies with the M.S. degree after matriculation or may be directed by the faculty towards a terminal M.S. degree based on performance in the graduate program.

Duration of Master's Programs in Chemistry Typically, an M.S. student will spend two years in residence, but may spend no more than three years.

Placement Exams At the time students enroll in the Graduate School the department will administer a series of written examinations that are used to gauge competence at the undergraduate level in analytical, biological, inorganic, organic, and physical 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 considered "not proficient" in an 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.

Safety Seminar Program (CHEM 6781 – Laboratory Safety) Every graduate student is required to attend a complete series of Safety Seminars during their first year of study. The purpose of the series is to maintain high safety standards in the departmental teaching and research laboratories. The series of lectures, given weekly by the departmental safety coordinator, covers topics ranging from the handling of corrosive and toxic chemicals to fire fighting. Failure to attend any of these lectures will constitute an unsatisfactory performance as a Graduate Associate and may result in loss of departmental support during the summer of the first year. In addition to the Safety Seminars, each student must become familiar with the department's Chemical Hygiene Plan and the Standard Operating Procedures associated with their work.

Financial Support for Graduate Students Most graduate students receive financial support as Graduate Associates, either Teaching Associates (GTA) or 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. 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 must register for at least eight (8) credit hours during autumn and spring semesters and at least four (4) credit hours during the summer term. Students who hold fellowships or traineeships must register for twelve (12) credit hours during each term. Each of these registration requirements qualifies the student to be considered "full-time" for purposes such as visas, health insurance, etc.

There are further requirements imposed by the Graduate School. A Master's degree requires at least 30 graduate credit hours. Audited courses do not count toward these minima.

Departmental policies coincide with these guidelines for the most part:

- (1) Students with a GPA below 3.00 lose their right to a summer term Graduate Research Associate appointment from the department (dGRA), and may lose future support as a GA.
- (2) Students intending to take a terminal M.S. degree are expected to defend their thesis by the end of their third year. Students failing to defend their M.S. thesis by the end of their third year must petition the Vice Chair for Graduate Studies for continuation of support.
- (3) Every faculty member is required to evaluate their Graduate Teaching Assistants each term with ratings of Excellent (E), Satisfactory (S+, S, or S-), or Unsatisfactory (U). Evaluations are based on overall performance as a teaching associate, but also include punctuality, attendance of staff meetings, and attitude toward students. Students receiving an unsatisfactory (U) teaching evaluation will be suspended from their teaching appointment for one term and must petition the Vice Chair for Graduate Studies for subsequent reinstatement. No TA support will be available during such a suspension. Two S- ratings are regarded as equivalent to one U rating. Any subsequent U will lead to dismissal from the teaching program. No further TA support will be available. A further S- rating will result either in complete dismissal from the teaching program or a one-term suspension, as appropriate.

Faculty Research Presentations Students are required to attend a series of weekly Faculty Research Presentations during first session of the autumn semester (AU-1) of their first year in the program (CHEM 6780). The purpose of these presentations is to provide students with an overview of the types of research being conducted in various research groups, and to help students identify the faculty members that he/she wishes to interview. The point of attending presentations in the areas of interest to the student is obvious. The Department also hopes that attending presentations from other disciplines will provide students with points of reference, should they need help during the course of their graduate studies, for topics in which their advisor is not an expert.

Advisor Selection and Initiation of Research Thesis research is initiated when a student has selected a research adviser, 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 a formal system of interviews. To initiate the procedure, the student will obtain a "Selection of Research Advisor Form" from the Graduate Office and designate a minimum of four (4) faculty members that he/she wishes to interview. Students are encouraged to interview as many faculty as they feel may provide research programs of interest. The Vice Chair will assign additional faculty members for Graduate Studies in accordance with departmental and divisional guidelines, and 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 ("Choice of Preceptor" form) to the Graduate Office by the last day of final exams in autumn semester. The Graduate Studies Office provides the list of student advisor preferences to the division secretaries and faculty. Following any formal discussion between faculty 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 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 qualify for a summer term dGRA appointment.

A student may complete their M.S. research under the supervision of an advisor from outside the Department of Chemistry with a co-advisor on the Chemistry faculty. All such arrangements must be collaborative in nature with the Chemistry faculty member serving as the Principal Investigator on the research project, and are 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 an M.S. thesis in Chemistry.

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. 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 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 up to one semester to find a new advisor. After this time, support will be withdrawn.

First-Year Oral Examination All students pursuing either an M.S. degree or Ph.D. degree must take an oral examination in the summer of their first year of study. The focal point of this examination is a paper that is related to the student's research topic, and which is selected jointly by the student and their advisor. 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.

Repeat exams or extra chances at cumulative exams will only be given in exceptional cases. The student must clearly state the grievance and proposed redress in a petition to the

Graduate Studies Committee, who will act on the petition in consultation, and based on the recommendation, of the division(s) administering the exam.

Thesis The thesis resulting from the student's master's research must represent a significant contribution to knowledge in chemistry. A reading committee composed of the adviser and at least one graduate faculty member consider the merit of the thesis. The student's advisor selects this committee.

Final Oral Exam The M.S. candidate must pass an oral examination before a committee composed of at least two Chemistry Department faculty members, including the student's research advisor, following rules from the Graduate School Handbook.

MASTER'S PROGRAM UNDER QUARTERS

The following table outlines the suggested M.S. curriculum for graduate students under the current quarter system (Tables 4 and 5). All courses are three (3) credit hours. The specific recommendations or requirements vary slightly by area of specialization, with variation existing largely in the balance of major subject/elective courses.

Table 4. Recommended Coursework for First-Year Students (Credit Hours)				
Year 1	AU	WI	SP	SU
Course 1	Major Subject (3)	Major Subject (3)	Major Subject (3)	Thesis Research (7) 999
Course 2	Major Subject (3)	Major Subject (3)	Elective (3)	
Course 3	Colloquium (1) 885	Colloquium (1) 885	Colloquium (1) 885	
Course 4	Faculty Research (1) 693	Lab Safety (2) 685		
Course 5	Research (12) 999	Research (11) 999	Research (13) 999	
Total Credit Hours	20	20	20	7

Table 5. Recommended Coursework for Second- (and Third-Year) Students (Credit Hours)				
Year 2-3	AU	WI	SP	SU
Course 1	Colloquium (1) 885	Colloquium (1) 885	Colloquium (1) 885	Thesis Research (7) 999
Course 2	Research (8) 999	Research (8) 999	Research (8) 999	
Total Credit Hours	9	9	9	7

All instructional content from quarter-based courses will be represented in the semester courses listed at the end of this document (Page 11). The non-coursework requirements under the quarter system will remain unchanged under the semester system, and are detailed above.

TRANSITION PLAN

As indicated above, the vast majority of graduate students in the Department of Chemistry finish their basic coursework during their first year of study. Exceptions to this are largely due to some courses being offered in alternate years, and these alternate year courses will still be offered in the same order so as not to delay students. Thus, for the cohort of 55-60 students entering the graduate program in AU11 quarter, there will be a few (< 10%) who have not taken all their required coursework by the time semester conversion is implemented in the AU12 semester. The Vice Chair for Graduate Studies will manage individual advising of this remnant group of students, in concert with their research advisors. The greater flexibility of course offerings will also reduce any difficulties for the small fraction of students faced with transitioning from quarters to semesters after their first year of study.

SEMESTER COURSE LIST

Semester Course Number	Course Title	Semester Credit Hours	Quarter Course Basis	Quarter Credit Hours
5193	Individual Studies	1.0-10	693	0-15
5194	Group Studies	1.0-10	694	1.0-5.0
5420	Spectroscopy of Organic Compounds	1.5	632	3.0
5430	Carbohydrate Chemistry	1.5-3.0	635	3.0
5440	Introduction to Computational Chemistry	1.5-3.0	644	3.0
5520	Nanochemistry	3.0	611	3.0
6110	Survey of Instrumental Methods	1.5	new	
6120	Analytical Data Treatment	1.5	720	3.0
6210	Chemistry at the Interface of Biology	1.5	new	
6310	Fundamentals of Coordination Chemistry	1.5	new	
6320	Synthetic Principles in Inorganic Chemistry	1.5	753	3.0
6330	Group Theory and Bonding	1.5	851	3.0
6340	Physical Methods in Inorganic Chemistry	1.5	752	3.0
6410	Basic Organic Reaction Mechanisms	1.5	new	
6420	Stereochemistry and Conformational Analysis	1.5	730	3.0
6430	Introduction to Organic Synthesis	1.5	832/833	3.0/3.0
6440	Introduction to Physical Organic Chemistry	1.5	731/831	3.0/3.0
6510	Quantum Mechanics and Spectroscopy	1.5	new	
6520	Thermodynamics	1.5	775	3.0
6530	Kinetics	1.5	775	3.0
6540	Introduction to Electronic Structure	1.5	866	3.0
6550	Atmospheric Chemistry	1.5	641	3.0
6780	Faculty Research Presentations	1.0	new	
6781	Laboratory Safety	1.0	685	2.0
6782	Ethics in Scientific Research	1.0	new	
7120	Electrochemistry	3.0	821	3.0
7130	Fundamentals & Techniques of Separation Science	3.0	822	3.0
7140	Analytical Spectroscopy	3.0	823	3.0
7150	Mass Spectrometry	3.0	825	3.0
7160	Nuclear Magnetic Resonance	3.0	824	3.0
7170	Analytical Surface Science	1.5-3.0	new	
7320	Organometallic Chemistry	1.5	751	3.0
7330	Solid State Chemistry	1.5	754	3.0
7340	Diffraction Methods	1.5	new	
7350	Inorganic Photochemistry	1.5	995	3.0

7360	Bioinorganic Chemistry	1.5	752	3.0
7370	Nanochemistry	1.5	995	3.0
7380	Inorganic Materials	1.5	995	3.0
7390	Advanced Inorganic Laboratory	1.5	755	3.0
7430	Advanced Organic Synthesis	1.5	832/833	3.0/3.0
7440	Kinetics, Catalysis, and Transition State Theory	1.5	731/831	3.0/3.0
7450	Metals in Organic Synthesis	1.5	833	3.0
7460	Advanced Organic Reaction Mechanisms	1.5	731/831	3.0/3.0
7470	Computational Chemistry	1.5	944	3.0
7480	Advanced Organic Synthesis Laboratory	3.0	835/836	3.0-5.0
7520	Advanced Molecular Quantum Mechanics	3.0	862/863	3.0/3.0
7530	Spectra and Structure of Molecules	3.0	863/866	3.0/3.0
7540	Chemical Dynamics	3.0	876	3.0
7550	Statistical Thermodynamics	3.0	880	3.0
7560	Introduction to Astrochemistry	3.0	740	3.0
7570	Aerosol Science	1.5	new	
7580	Lasers, Optics, and Optical Instrumentation	1.5-3.0	997	3.0
7590	Molecular Simulation of Materials	3.0	996	3.0
8199	Advanced Topics in Analytical Chemistry	1.5-3.0	991	3.0
8299	Advanced Topics in Biochemistry	1.5-3.0	990	3.0
8399	Advanced Topics in Inorganic Chemistry	1.5-3.0	995	3.0
8499	Advanced Topics in Organic Chemistry	1.5-3.0	941/942/943	3.0
8599	Advanced Topics in Physical Chemistry	1.5-3.0	997	3.0
8699	Advanced Topics in Theoretical Chemistry	1.5-3.0	996	3.0
8891	Analytical Seminar	1.0	885	1.0
8892	Biochemistry Seminar	1.0	885	1.0
8893	Inorganic Seminar	1.0	885	1.0
8894	Organic Seminar	1.0	885	1.0
8895	Physical Seminar	1.0	885	1.0
8896	Theoretical Seminar	1.0	885	1.0
8899	Doctoral Seminar	1.0	new	
8998	Non-thesis Research	1.0-15	new	
8999	Thesis/Dissertation Research	1.0-15	999	1.0-15

Chemistry Graduate Program

Learning Objectives (thesis-based M.S.)

Demonstrate a broad foundational knowledge of chemistry, particularly for a large subdiscipline such as biochemistry or analytical, inorganic, organic or physical chemistry.

- Students obtaining a Chemistry M.S. degree based on an M.S. thesis should have a broad working knowledge of the field at least comparable to the material taught in general chemistry and first undergraduate divisional classes (analytical, inorganic, organic, physical and biochemistry).
- Students should develop a deeper knowledge of their broader area of specialization (analytical, inorganic, organic, physical and biochemistry), equivalent to material in the divisional core graduate curriculum.
- This knowledge is evaluated through satisfactory performance in required classes.

Demonstrate expertise (in-depth knowledge) in a specific research area, including the motivations behind the research area and its broader impacts on the scientific field and/or society

- In the specific area of specialization, students should gain a deep knowledge of the field, equivalent to elective and special topics classes at the graduate level.
- Students should also be familiar with the current literature, both from their own lab and from other labs around the world working in the area.
- This specialized knowledge is evaluated in elective classes and at the final oral exams.

Evaluate scientific work critically, by applying, analyzing, synthesizing, and evaluating scientific knowledge

- Critical thinking is the mark of a mature scientist and will be developed through scientific inquiry (conducting research and writing an M.S. thesis dissertation).

Conduct meaningful scientific inquiry leading to new knowledge in the field, including devising hypotheses, developing research strategies, executing research, and interpreting results

- Demonstration of a solid grasp of the scientific method through conducting research in the laboratory and producing an M.S. thesis and, ideally, contributing to publications.
- Proper planning and execution of experiments includes a grasp of essential methods, including statistical analysis and laboratory or computational skills, to produce rigorous and reproducible results.

Communicate scientific concepts, methods, results, and conclusions effectively to experts and non-experts, including the society at large, in oral and written form

- Written communication skills are developed through writing the M.S. thesis dissertation.

- Oral communication skills are developed through presentations at research group meetings, performing GTA duties (not an explicit requirement, but most students will have this experience), and presenting thesis research at the M.S. oral exam.
- Presentations to broader audiences, such as at national or regional conferences, develop communication skills to those outside the student's immediate expertise.

Conduct and disseminate research professionally, responsibly, and safely, in accord with the ethical standards and best practices of the profession

- Students must participate in required training for laboratory safety (online and required CHEM 6781 class offered in first semester) and the responsible conduct of research (online and required CHEM 6782 class offered in second semester).
- Safety and ethics should be addressed in all scientific work, regularly at laboratory group meetings and with specialized training as needed throughout the student's career.
- Students should develop skills in applicable professional areas, such as pedagogy, teamwork, leadership, and business, through teaching, workshops, and interactions with alumni.

Chemistry Graduate Program

Learning Objectives (M.S. based on candidacy)

Demonstrate a broad foundational knowledge of chemistry, particularly for a large subdiscipline such as biochemistry or analytical, inorganic, organic or physical chemistry.

- Students obtaining an M.S. degree based on successful completion of the candidacy exam should have a broad working knowledge of the field at least comparable to the material taught in general chemistry and first undergraduate divisional classes (analytical, inorganic, organic, and biochemistry).
- Students should develop a deeper knowledge of their broader area of specialization (analytical, inorganic, organic, physical and biochemistry), equivalent to material in the divisional core graduate curriculum.
- This knowledge is evaluated through satisfactory performance in required classes and at the candidacy exam.

Demonstrate expertise (in-depth knowledge) in a specific research area, including the motivations behind the research area and its broader impacts on the scientific field and/or society as well as the current status of the area and what remains to be understood.

- In the specific area of specialization, students should gain a deep knowledge of the field, equivalent to elective and special topics classes at the graduate level.
- Students should also be familiar with the current literature, both from their own lab and from other labs around the world working in the area.
- This specialized knowledge is evaluated in elective classes and through both the written and oral portions of the candidacy exam.

Evaluate scientific work critically, by applying, analyzing, synthesizing, and evaluating scientific knowledge.

- Critical thinking and the use of higher order cognitive functions are marks of a mature scientist.
- These traits are developed through proposal writing (candidacy exercise) and scientific inquiry (conducting research).

Conduct meaningful scientific inquiry leading to new knowledge in the field, including devising hypotheses, developing research strategies, executing research, and interpreting results.

- Demonstration of a solid grasp of the scientific method occurs in proposal writing (candidacy exam), through research in the laboratory, and, ideally, through contributing to publications.
- Proper planning and execution of experiments includes a grasp of essential methods, including statistical analysis and laboratory or computational skills, to produce rigorous and reproducible results.

Communicate scientific concepts, methods, results, and conclusions effectively to experts and non-experts, including the society at large, in oral and written form.

- Written communication skills are developed through writing the candidacy proposal.
- Oral communication skills are developed through presentations at research group meetings, performing GTA duties (not explicitly a requirement, but most students will have this experience), and presenting their research results and proposed ideas at the candidacy exam.
- Presentations to broader audiences, such as at on-campus symposia or national or regional conferences, develop communication skills to those outside the student's immediate expertise.

Conduct and disseminate research professionally, responsibly, and safely, in accord with the ethical standards and best practices of the profession.

- Students must participate in required training for laboratory safety (online and required CHEM 6781 class offered in first semester) and the responsible conduct of research (online and required CHEM 6782 class offered in second semester).
- Safety and ethics should be addressed in all scientific work, regularly at laboratory group meetings and with specialized training as needed throughout the student's career.
- Students should develop skills in applicable professional areas, such as pedagogy, teamwork, leadership, and business, through teaching, workshops, and interactions with alumni.

Chemistry Graduate Program Candidacy Rubric

This rubric has three purposes: (1) we will use aggregate statistics to evaluate how well the program is doing at achieving key learning outcomes; (2) it will help students understand the expectations for a satisfactory performance on the candidacy exercise; and (3) it will help faculty committees evaluate candidacy exams fairly and uniformly.

After the exam is complete and the student is asked to leave the room, all members of the committee should fill out the rubric. This can then be used to frame the discussion on the exam's outcome.

The rubric can be turned in on paper by handing it to the student, or electronically via the link provided before the exam. Copies of the filled out rubric will be provided to the student and advisor.

Student _____

Advisor _____

Date of Exam _____

Committee Member Name _____

Candidacy Scoresheet*

Performance	Exceeds expectations	Meets expectations	Below expectations	Cannot evaluate
Mastered <i>foundational knowledge</i> of chemistry and the large subdiscipline of the work				
Demonstrates <i>in-depth knowledge</i> of the area of the oral exam proposal and dissertation work				
Demonstrates a knowledge of, and ability to critically evaluate, the <i>scientific literature</i> in the area of the proposal and dissertation work				
Developed and articulated testable, <i>compelling hypotheses</i> related to the dissertation work				
Designed and provided justification for <i>appropriate experiments</i> to test hypotheses related to the dissertation work				
Independently developed a compelling hypothesis and appropriate experiments to address it in an area outside of the student's research (<i>independent aim</i>)				
Wrote a proposal that is <i>readable and persuasive</i>				
Displays <i>effective oral communication</i> skills and responds to questions effectively during the exam				

*Please mark one box per performance. "Cannot evaluate" means that you do not have enough information from the written and oral parts of the candidacy exercise to make a judgement.

Performance	Exceeds	Meets	Below
Mastered foundational knowledge of chemistry and the large subdiscipline of the work	<ul style="list-style-type: none"> • Student is an authority in their large subdiscipline and has a broad knowledge of chemistry • There are no major gaps in knowledge • Level of knowledge is at or near what is expected for a senior graduate student 	<ul style="list-style-type: none"> • Student demonstrates understand of most fundamental concepts • Level of knowledge is clearly above a typical undergraduate but below that of a senior grad student 	<ul style="list-style-type: none"> • Student does not demonstrate understands of many key fundamental concepts • Level of knowledge is at or below a typical undergraduate student
Demonstrates in-depth knowledge of the area of the oral exam proposal and dissertation work	<ul style="list-style-type: none"> • Student is an authority in the area of the proposal and dissertation • Student demonstrates a command of key fundamental concepts as well as a detailed knowledge of the research area 	<ul style="list-style-type: none"> • Student is aware of and understands research in her own lab, but lacks knowledge about the broader area • Student understands fundamentals in the field but lacks detailed knowledge 	<ul style="list-style-type: none"> • Student is not even familiar with research in her own lab • Student lacks fundamental knowledge about the field • Advisor corrects the students several times about key facts related to the work
Demonstrates a knowledge of, and ability to critically evaluate, the scientific literature in the area of the proposal and dissertation work	<ul style="list-style-type: none"> • Student stays abreast of the literature and is aware of recent developments • Student is able to critical evaluate publications in a manner that approaches peer review 	<ul style="list-style-type: none"> • Student is familiar with key papers, but lacks knowledge of important details • Student is able to explain but not critique experiments in key papers 	<ul style="list-style-type: none"> • Student lacks familiarity with key papers in the field • Student is not able to explain experiments related to the work
Developed and articulated testable, compelling hypotheses related to the dissertation work	<ul style="list-style-type: none"> • The hypothesis is sound, testable, and addresses a key gap in the field • The hypothesis is based on evidence of literature or preliminary data • The hypothesis is a compelling as those in competitive NIH/NSF proposals 	<ul style="list-style-type: none"> • The hypothesis is reasonable and addresses an important question, but is not compelling enough for an NIH/NSF proposal • The question is a relatively minor extension of existing knowledge 	<ul style="list-style-type: none"> • The hypothesis is too simple and not based on a critical evaluation of the literature • The hypothesis could be proved or disproved from information already in the literature
Designed and provided justification for appropriate experiments to test hypotheses related to the dissertation work	<ul style="list-style-type: none"> • The experimental design addresses the question, and is creative and innovative • The line of investigation is highly compelling and will advance the field regardless of the outcome 	<ul style="list-style-type: none"> • The experimental design is reasonable, but lacks innovation or imagination • Student has provided some information on pitfalls and alternative approaches and has made a sound argument for the selected approaches 	<ul style="list-style-type: none"> • There are major flaws with the experimental design, or relies entirely on the most obvious approaches • The student is unable to articulate potential problems or alternative approaches, or cannot argue for the selected approaches

Performance	Exceeds	Meets	Below
<p>Independently developed a compelling hypothesis and appropriate experiments to address the hypothesis in an area outside of the student's research (independent aim)</p>	<ul style="list-style-type: none"> • An aspect of the proposal is creative and clearly outside of the student's and advisor's area of work • The question is compelling and the experiments will address it 	<ul style="list-style-type: none"> • The most independent parts of the proposal hew closely to the lab work and lack imagination • The question raised is not that compelling or the experiments proposed may not address them thoroughly 	<ul style="list-style-type: none"> • It is difficult to discern any aspect that is independent of the student's or advisor's work • The question raised is not interesting or the experiments proposed are wholly inadequate
<p>Wrote a proposal that is readable and persuasive</p>	<ul style="list-style-type: none"> • The written proposal is of the quality typical for a fundable fellowship proposal or peer reviewed publication • Text has been clearly edited, figures are understandable and well labeled, and citations are complete 	<ul style="list-style-type: none"> • The written proposal is of the quality typical for a submitted but not funded proposal • The text has some typos, illustrations have minor imperfections, or citations have errors 	<ul style="list-style-type: none"> • The written proposal is clearly below what is acceptable for a fellowship proposal submission • The text has grammar errors, typos, poor organization, problematic figures, or lacks citation information
<p>Displays effective oral communication skills and responds to questions effectively during the exam</p>	<ul style="list-style-type: none"> • The explanation of the proposal is clear, concise and well thought out • Student listens to questions and responds appropriately and correctly to most of them • The student is able to work through challenging questions logically and in a way that demonstrated deep understanding 	<ul style="list-style-type: none"> • The student describes the proposal accurately and it is possible to follow, but lacks clarity or precision • The student can answer basic questions, but cannot respond to more advanced or complex questions • The student has difficulty working through challenging or thought-provoking questions 	<ul style="list-style-type: none"> • The explanation of the proposal is difficult to understand • The student does not respond to questions directly • The student is unable to answer even many basic questions

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

2022

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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 2022 or later.

2. Administration and Contacts

2022-2023 Chemistry Program Graduate Studies Committee

Christine Thomas, Chair
Jon Parquette, Organic Division
Abraham Badu-Tawiah, Analytical Division
John Herbert, Physical Division
Yiyong Wu, Inorganic Division
Marcos Sotomayor, Biochemistry Division

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Admissions 614 292-5577
Graduate Program Coordinator 614 292-8917
Vice Chair, Graduate Studies 614 292-8688

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.

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 as long as proper coursework has been taken.

The GRE (general or subject tests) is not required.

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.

TOEFL 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 autumn, spring, or summer terms).

Departmental policies regarding appointments include:

- (1) Students with a GPA below 3.00 are considered in poor academic standing and may be denied GA appointments by the Graduate School.
- (2) Students who qualify directly from the first-year oral exam are required to advance to candidacy by the end of the spring term 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). A petition for an extension to the candidacy deadline will generally be accepted in the following circumstances: switching research advisors/groups prior to candidacy, an approved leave of absence from the graduate program, and birth or adoption of a child while in the graduate program.
- (3) Students required to obtain an M.S. degree as a result of their first-year oral exam are expected to complete and defend their thesis by the end of the spring term of their second year. Students failing to defend their thesis 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). A petition for an extension to the M.S. degree deadline will generally be accepted in the following circumstances: switching research advisors/groups prior to obtaining the M.S. degree, an approved leave of absence from the graduate program, and birth or adoption of a child while in the graduate program.
- (4) Students required to obtain an M.S. degree as a result of their first-year oral exam are expected to advance to candidacy as soon as possible and certainly by the end of the spring term of their 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. A petition for an extension to the candidacy deadline will generally be accepted in the following circumstances: switching research advisors/groups prior to candidacy, an approved leave of absence from the graduate program, and birth or adoption of a child while in the graduate program.
- (5) Students required to obtain a terminal M.S. degree are expected to defend their thesis by the end of the spring term 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 appointment will be granted after the end of the second year in this case.
- (6) 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 in the form of a Post Candidacy Progress Report from an Advisory Committee meeting. In order to qualify for a GA appointment beyond the fifth year of study, Post Candidacy Progress Reports 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. A petition for an extension of support beyond year five will generally be accepted in the following circumstances: switching research advisors/groups, an approved leave of absence from the graduate program, and birth or adoption of a child while in the graduate program.
- (7) 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. Examples of extenuating circumstances that may be considered exceptions include switching research advisors/groups, an approved leave of absence from the graduate program, and birth or adoption of a child while in the graduate program. No GTA appointment will be granted after the sixth year.

- (8) 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.
- (9) Faculty advisors 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.

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 to obtain a satisfactory grade in the course. These presentations are expected to help students identify at least four faculty members that they wish 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 remove faculty members from the students lists of suggested faculty (e.g. if a faculty member is not accepting new students) or assign additional faculty members in related research areas, 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 Ph.D. and M.S. 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 advisor, the student will have seven weeks to find a new advisor. After this time, financial 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. Each year, beginning in their fourth year of study, 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. Each member of the advisory committee will provide written comments on the student's progress. Either the student or the advisor can request an advisory committee meeting if they feel that this would be a beneficial exercise, or the student can request to meet individually with their advisory committee members to discuss their post-candidacy progress. Although the annual progress reports are typically due in the summer, 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 advisor and two other members of the Chemistry graduate faculty. 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 the end of the summer term 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; students who transfer 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, particularly 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 coursework 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. Graduate classes are either taught 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 their chosen division. 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 their division 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 Spring semester of their first year, students should enroll in all required advanced courses, and typically should enroll in 3-9 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 Spring semester of the second year or the end of the Spring semester of the third year if directed to first complete an M.S. to qualify
- Complete annual activity reports
- Complete annual post-candidacy progress reports at the end of the fourth year and beyond
- 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 in the Analytical division

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, a 71xx course (if offered), 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: 4.5 credit hours of Inorganic classes at the 7000-level or above (CHEM 7310, 7320, 7330, 7340, 7350, 7360, 7370, 8399).

Other electives: 7.5 additional graduate credit hours. A minimum of 3 credit hours of graduate classes must come from outside the Inorganic division. A minimum of 3 credit hours must be at the 7000-level or above. 7000+ level electives outside the Inorganic division should be discussed with the advisor.

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, 6530, or 6540 (thermodynamics, kinetics, or electronic structure); 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.

Note: Owing to their interdisciplinary nature, CHEM 7580 and CHEM 6550 can be counted as “out of division” electives to fulfill the breadth requirement.

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 Graduate Studies Committee will evaluate applications for the multidisciplinary track 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 upon request from the Graduate Studies office.

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 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). Choosing an article published with the advisor as a co-author is discouraged. 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, is encouraged to 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.
7. Based on the student's overall performance on the oral exam and performance in first-year coursework, the committee will determine whether each student is qualified to proceed directly to the candidacy exam, or undergo further evaluation for qualification in the form of preparing and defending an M.S. thesis. 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 the M.S. for further evaluation are required to complete and defend an M.S. thesis by the end of the spring semester of their second year. The M.S. committee for such students will be comprised of three faculty members. On the basis of the M.S. defense, the committee will decide whether the student is qualified to proceed to the candidacy exam. If the committee decides that successful completion of the candidacy exam is unlikely, the M.S. committee can determine that the M.S. is a terminal degree. In such a case, further enrollment and GRA/GTA appointment will not be possible. A student may petition the decision of the M.S. exam 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 M.S. committee.

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 spring 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 spring of the third year.

Students must submit their aims to their candidacy committee before Thanksgiving of the year in which they must advance, with the intention of having them approved by the end of the autumn semester. The written proposal must be submitted to the committee for evaluation no later than March 15 of the year in which they must advance. The candidacy exam must be held by the last official date of the spring semester in which students must advance (second year, or third year if students were directed to complete a M.S. first).

Exceptions to these deadlines will be considered upon request to the Vice Chair and will generally be granted in cases where a student has switched research advisors/groups prior to candidacy, has taken an approved leave of absence from the graduate program, or has had or adopted a child since starting the graduate program. Requests for deadline extensions should be made at least 2 weeks prior to the stated deadline.

Students should provide a copy of their aims and a copy of their proposal to the Graduate Studies Office at the same time they are submitted to their committee for tracking purposes by cc'ing the Graduate Program coordinator on correspondences with the candidacy committee.

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 advisor as Chair, the other members of the Advisory Committee, and one additional member of the Chemistry graduate faculty to achieve a total of four committee members. The Vice Chair will assign the fourth committee member with the intention of dividing the workload among the faculty.

A university representative will sometimes be assigned by the Graduate School, particularly 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. Unless otherwise stated, 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 and/or biochemistry 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. To get a better idea of the criteria used by the committee in their evaluations of performance, students should consult the [Candidacy Rubric](#).

Written Portion. The written portion of the Candidacy Examination toward a Ph.D. takes the form of a *Research Proposal*, similar to what would be submitted to a U.S. federal funding agency (NSF, NIH, DOE, etc.) to request financial support for a research project. Before the student begins to write the full proposal, the student must prepare a "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 one-page limit is inclusive of figures/schemes that are deemed necessary to convey the ideas (relevant literature references can be listed on a separate page). 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 aims page. The aims may be approved even if there are issues in the actual text of the specific aims 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. In some departmental divisions, it is common to express one or more Aims as a scientific hypothesis along with the description of the Approach how the hypothesis can be confirmed (or rejected). It is the responsibility of the student to clarify this with the advisor and committee during the preparation of the Specific Aims page.

A successful candidacy proposal will demonstrate the student's scientific vision, familiarity with the research topic and literature, and the student's logical and critical thinking, such as the ability to develop and write down a clear plan as to how the research questions can be successfully addressed along with expected outcomes. A "Background" section should summarize the status of the specific research field along with the relevant literature and motivate the questions to be addressed as well as their broader impact on the field ("Why is this research important? How does it significantly advance the field?"). The research objectives are then formulated in multiple different "Aims". It is common, although not required, that the proposal contains three Aims, with one Aim describing research in progress by the student along with its planned completion, one Aim describing novel, future work that will be conducted as part of the dissertation, and one Aim that is independently conceived and formulated by the student, which does not necessarily become part of the thesis work. The Aims should be thematically linked, but still sufficiently complementary so that their successful completions do not depend on each other. Each Aim has its own goal(s) followed by a detailed description of the "Approach" or "Strategy" chosen to achieve the goal(s), such as sample preparation and other experimental details, measurements, theory, computer simulations, data analysis, new methods development, etc. It can also include a short section about "Potential Pitfalls" and proposed remedies.

Research progress made to date by the student can be part of some but not all Aims and can be included in a "Preliminary Results" section in the corresponding Aim(s). *The entire proposal must be written by the student in her or his own words, and one Aim must be conceived independently by the student and describe a research goal that is not pursued in the student's lab or described in the advisor's papers or grant proposals.* Advisors are permitted to assist with editing the proposal with respect to grammar and writing style and may provide suggestions about how the proposal is framed and where more detail or content is needed. The advisor should, however, limit their input on the scientific content of the proposal and the proposed ideas in general, particularly with respect to the independent aim. As noted above, students are strongly encouraged to 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. Students are encouraged, but not required to use the template found here ([Candidacy Proposal Template](#)) as a starting point when preparing their written 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 both the student and the chair of the committee (the advisor). The chair can then discuss the collective judgement and comments to the student. In general, the committee should respond with an overall judgement along the lines of Approve, 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 Graduate Studies Committee 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.

After the written portion is approved, the student must initiate an Application for Candidacy form electronically at 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. Students are highly encouraged to hold practice oral exams with other students both inside and outside their research groups prior to their candidacy exam. However, advisors are *not* permitted to attend or participate in these practice exams.

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. This option would normally be applied only in exceptional circumstances and in consultation with the Graduate Studies Committee 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 Graduate Studies Chair and the approval of the program.

Rubric. A [Candidacy Rubric](#) is 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. The rubric was developed based on the [Learning Outcomes](#) for the program.

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 by the Graduate School. 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. Students may either meet this requirement by giving a research-in-progress presentation as part of the department's divisional seminar series or 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 Progress Reports. Students in their fourth year and beyond and their advisors must complete an annual Post-Candidacy Progress Report (PCPR) and provide it to their committees. A committee meeting may be held at the advisor or student's request, or the student may meet with one or more of their committee members individually. The committee members should provide their comments directly on the form. 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 completed form must be returned to the Graduate Studies Office by the announced deadline, at which point it will be routed to the committee members for electronic signature.

When completing the PCPR, 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 completed a PCPR 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 students requesting funding beyond their fifth year. Committee meetings are not required at any point, 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.

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

A student must initiate an Application to Graduate form at gradforms.osu.edu for the Graduate School at the beginning of the term in which they plan to graduate. Generally, these forms are due the third Friday of the semester or the third Friday of summer session.

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 but 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 is required to do so on the way to the Ph.D. to qualify for candidacy if directed 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.

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. Students completing a M.S. for evaluative purposes as directed by the first year oral exam committee, must have a committee comprised of at least two faculty members from the 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. 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 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.

Normally, a M.S. (Thesis Option) student will spend two years in residence.

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.

No financial support is offered or guaranteed by the department for students in the Biochemistry M.S. program. 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 advisor, 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.

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. Master's 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. 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) or Title IX (titleix.osu.edu) websites.

12. Vacation, Leave, and Work Policies

a. Vacation

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.

b. Medical and Parental Leave

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.

Medical leave. 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). 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 six weeks 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. If a student is supported on a GTA appointment at the time that the leave is requested, the graduate studies office will work with TA coordinators to ensure that substitute TAs are available to cover the student's TA duties while they are on leave (at the expense of the department). If a student is supported on a GRA appointment at the time that the leave is requested, their advisor is responsible for continuing to cover the costs associated with stipend, fee authorization and benefits. It is the responsibility of the advisor to ensure that paying a student while on such a leave is in compliance with the rules and regulations of the external funding agency. Leaves of absence of longer than six weeks may be granted for personal reasons or for personal or family illness, but absence of this length will be unpaid (no stipend or benefits associated with the appointment).

Parental leave. 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 the birth or adoption of a child, up to the last day of the appointment. "Paid leave" here means maintenance of 100% of stipend, fee authorization and other benefits associated with the appointment. If a student is supported on a GRA appointment at the time of their parental leave, their advisor is responsible for continuing to cover the costs associated with stipend, fee authorization and benefits. It is the responsibility of the advisor to ensure that paying a student while on parental leave is in compliance with the rules and regulations of the external funding agency. If a student is supported on a GTA appointment at the time of their parental leave, the department will work with the student to ensure that as much flexibility as possible is provided with respect to their TA responsibilities. There are two possible options that the student may choose from depending on their particular circumstances: Option 1: The student may opt to take 6 consecutive weeks of parental leave in which they are not expected to perform any GTA duties. The graduate studies office will work with TA coordinators to ensure that substitute TAs are available to cover the student's TA duties while they are on leave (at the expense of the department). Where possible, the student should give the graduate studies office and TA coordinators as much advanced notice as possible to make these arrangements. While it is understood that the start date of this 6-week absence may be difficult to accurately predict, the student should inform the graduate studies office that they will be requesting parental leave at least 2 months in advance. Option 2: The

student may opt to distribute their 6 weeks of parental leave throughout a semester, such that they are effectively performing a reduced (50%) GTA load throughout the entire semester. In this case, the student must request a parental leave from the graduate studies office at least 2 months prior to the start of a semester so that these arrangements can be taken into consideration while scheduling the student's GTA duties.

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

c. Other Workplace 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.

d. Grievances

Discussion with the Vice Chair for Graduate Studies and/or Graduate Studies Committee 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.