

**THE VANDERBILT**  
**Ph.D. PROGRAM**  
**IN**  
**CHEMISTRY**

**August 2019**

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# THE VANDERBILT Ph.D. PROGRAM IN CHEMISTRY

## I. INTRODUCTION

The following procedures, rules, and regulations apply to all students who begin graduate work in the Fall of 2017 and contain revisions that apply to currently enrolled graduate students. All students should also be aware of and comply with University requirements as outlined in "The Bulletin of Vanderbilt University, The Graduate School" and in the "Student Handbook," which are available at the following University websites <http://www.vanderbilt.edu/catalogs/grad/Grad01.html> & [http://www.vanderbilt.edu/student\\_handbook/](http://www.vanderbilt.edu/student_handbook/). University policies and procedures relating to misconduct in research by faculty and students are also specified in the "Faculty Manual" which is available in electronic form at (<https://www.vanderbilt.edu/faculty-manual/>). Graduate students are responsible for being fully informed about the Vanderbilt Honor Code and about the policies and expectations of the Graduate Honor Council (see appropriate sections in the "Student Handbook" and (<https://studentorg.vanderbilt.edu/gsc/honor-council/>). Students should also be aware of any additional rules or conditions specified in their award letters or other correspondence.

The program of study outlined below is designed to emphasize the importance of research and advanced critical thinking in graduate study with an overall objective of enabling each student to carry out and defend an independent, successful research project at the Ph.D. level. To accomplish this objective, students must (1) advance their broad understanding of chemical knowledge, (2) master the subject material relevant to their field of study, (3) complete a successful Ph.D. research dissertation, and, (4) advance their communication skills particularly in regard to effective communication of chemical knowledge and the defense of proposed research. Close interaction between graduate students and their Research Directors is critically important in designing and completing an appropriate program of study and a successful research project. Coursework and research programs undertaken by students will be individually tailored for students in consultation initially with a faculty advising committee and subsequently with their Research Director. The student's Research Director, faculty committees, and the

Director of Graduate Studies (**DGS**) will regularly monitor student progress in all areas of graduate study, particularly research performance.

A year-by-year outline of a typical graduate career is given below (Part II) with requirement deadlines specified only for students who would begin their graduate study in the Fall Semester. Topics underlined are described in more detail in Part III. Students are encouraged to complete their Ph.D. program of study as soon as possible. It should always be remembered that successful research progress is the central aim of the chemistry Ph.D. program.

## II. OUTLINE OF A TYPICAL Ph.D. PROGRAM OF STUDY\*

### First Year

1. Participate in orientation and TA training activities.
2. Enroll in Chem 6901 (Introduction to Research) and complete three research group rotations by the end of the fall semester.
3. Enroll in the Chem 6900 (Professional Development) course offered in fall and spring semesters.
4. After completing the research rotations, submit the names of three potential dissertation research directors.
5. Complete at least five academic quality-point courses of the Course Program in addition to Chem 6900 and Chem 6901 by the end of the first year
6. Join a Research Group by January and begin Research as soon as possible.
7. Attend the Departmental and Graduate Student Seminar series.

### Second Year

1. Continue Research at an accelerated pace.
2. Complete Course Program.
3. Select members of student Academic and Research Monitoring (ARM) Committee in consultation with your Research Directors and complete the Preliminary Examination requirement by *31 October*.
4. Attend the Departmental and Graduate Student Seminar series

### Third Year

1. Continue Research as a major effort.
2. Present a public seminar based on your research project as part of the Graduate Student Seminar series. Attend the Departmental and Graduate Student Seminar series.
3. Select additional members of student Ph.D. Committee in consultation with Research Director and complete the Ph.D. Qualifying Examination requirement by *15 March*.

### Fourth and Subsequent Years Until Completion of the Degree Requirements

1. Attend the Departmental and Graduate Student Seminar series
2. Present and defend an Independent Research Proposal coupled with an ARM Committee Review at least six months prior to the Final Defense.
3. Write a Dissertation and complete a public Final Defense of the dissertation before the student's Ph.D. Committee (final year).

\* Program is based on student admission in Fall Semester (with an academic year beginning at the start of Fall Semester); underlined terms are discussed further in Part III. To minimize scheduling conflicts, students may be requested to conform to staggered deadlines for date-specific requirements.

### III. DETAILED REQUIREMENTS

The following terms are discussed in more detail on the following pages:

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## A. Orientation

All incoming students are expected to participate in orientation. A major part of orientation is Teaching Assistant (TA) training. This training will familiarize the TA with the undergraduate General Chemistry or Organic Chemistry laboratory course, thereby greatly enhancing their ability to overseeing these teaching assignments. Students must complete TA training in order to be eligible for a teaching assistantship. Other orientation activities include safety training, training in responsible conduct in research (RCR), course advising and registration, and events to help choose research rotations.

Incoming students are encouraged to review the four traditional areas of chemistry (analytical, inorganic, organic, and physical chemistry) in preparation for graduate coursework. Listed below are examples of chemistry textbooks recommended for your review. More recent editions of these or comparable textbooks are likely available. The choice of courses to be taken is made in consultation with the Faculty Advisor (Section B). Time during orientation will be scheduled for course advising.

Analytical: "*Principles of Instrumental Analysis*," by Skoog, Holler, and Nieman (5<sup>th</sup> Ed., Brooks/Cole, 1998).

Inorganic: "*Inorganic Chemistry: Principles of Structure and Reactivity*," by Huheey, Keiter, and Keiter (4th Ed., Addison-Wesley, 1997), "*Inorganic Chemistry*" by Atkins and Shriver (3rd Ed., Freeman, 2001), "*Inorganic Chemistry*" by Miessler and Tarr (3rd ed., Prentice Hall, 2003), and "*Concise Inorganic Chemistry*" by Lee (5th Ed., Chapman and Hall, 1996).

Organic: "*Introduction to Organic Chemistry*" by Streitwieser, Heathcock, and Kosower (4th Ed., Prentice Hall, 1992), or "*Organic Chemistry*" by Solomons (6th Ed., Wiley, 1996), or "*Organic Chemistry*" by McMurry (4th Ed., Brooks/Cole, 1996), or "*Organic Chemistry*" by Loudon (3rd Ed., Benjamin/Cummings, 1995).

Physical: "*Physical Chemistry*" by Alberty and Silbey (2nd Ed., Wiley, 1997), Chapters 1-7, 9-11, 13-14, 16-20, or "*Physical Chemistry*," by Atkins (5th Ed., Freeman, 1994) Chapters 1-14, 16-17, 20, 24-27, or "*Physical Chemistry*" by Levine (5th Ed., McGraw-Hill, 2002).

## B. Faculty Advisor

For those students who do not yet have a Research Director, the DGS with input from a faculty advising committee will serve to advise these students based on the research interests and academic background of the student. Otherwise, the student's Research Director serves as the Faculty Advisor.

### C. Research Rotations & Research Director

Joining a research group is an important part of a graduate student's career. Selection of a Research Director is a process involving mutual interaction and decision-making on the part of students and faculty. To facilitate this process, all incoming students who are admitted to the department through the normal recruiting process are required to participate in the research-group selection process, enroll in Chem 6901 (Introduction to Research), and follow the procedure described below. Entering graduate students who participated in the departmental Summer Research Program for Early Admission during two summers prior to entering the departmental graduate program have the option of requesting either immediate assignment of a Research Director or participation in the general Research Director selection process. The Chair of the Department makes official assignments of graduate students to research groups.

Events and activities initiating the research-group selection process will be scheduled in August during the new student orientation period. Incoming students will be able to view and discuss research with current graduate students at a departmental poster session. In addition, students will be required to meet with a minimum of three faculty members to discuss research interests, research projects, and to receive advice about coursework selection.

Enrollment in Chem 6901 provides students with an opportunity to spend time in three faculty research groups during their first semester of graduate studies. Following completion of the initial research group selection activities, students will provide the DGS (or designee) by a designated deadline with a list of at least three faculty with whom they would like to spend their first research group rotation (**ranked in the order of preference**). Students will then be assigned to their first research group rotation. Every effort will be made to accommodate the preferences of each student. One week prior to the end of the first and the second research rotation periods, students will provide the Director of Graduate Studies (or designee) with a listing of at least three faculty (**ranked in order of preference**) with whom they would like to spend their next research rotation. [Following the second research group rotation, students may request placement into a specific research group. Such students would then complete their third research group rotation on a topic complementary/orthogonal to their specific research interests.] Students who have previously participated in a summer research opportunity with Vanderbilt chemistry faculty may elect to have that experience count as one of their three required research group rotations

provided that they also fulfill the Chem 6901 rotation report requirement. Special Students may elect, within their first semester of regular graduate study, to receive one credit hour of Chem 6901 for their combined research experience(s) upon fulfilling the Chem 6901 rotation report requirement. Each rotation will be in a different research group and will last approximately five weeks. A typewritten report for each rotation experience must be submitted near the end of each research group rotation period to the faculty member who supervised the rotation experience and copied to the DGS. The report should not exceed two pages including all figures, schemes, and references. Note that individual faculty members may require additional supplemental documents. For students entering in Fall Semester 2018, the research group schedule is as follows:

Rotation 1:	19 August – 20 September	report due on 30 September
Rotation 2:	23 September – 25 October	report due on 4 November
Rotation 3:	28 October – 5 December	report due on 15 December

Grades awarded to students in Chem 6901 will be determined from grade recommendations provided by the faculty mentors of each rotation experience. A similar research group rotation experience will be scheduled during Spring Semester for students entering the chemistry graduate program at Spring Semester. Students should register for 1 hour of Chem 6901 for the semester the research rotations take place.

After completion of the research group rotation experience, the Chair of the Department will interact with the entering class of graduate students to discuss the process of Research Director selection. By 15 December (for fall admission) or 15 May (for spring admission), students must submit to the Chair (or designee) a list of three names of possible Research Directors (**ranked in the order of preference**), those faculty with whom the student spent a research rotation, and those faculty with whom the student discussed research on an individual basis. Student choices of Research Director are not limited to those faculty members with whom students spent a research group rotation. With this information, the Chair of the department will make the official assignments of Research Director in a timely fashion. Every effort will be made to accommodate the preferences of each student.

Thesis work may be supervised jointly by several faculty, sometimes including those from more than one area and even from other departments; however, a single major professor is the most common



choice. One faculty member must be designated as the Faculty Advisor of record.

#### **D. Course Program**

The Graduate School requires a total of 72 graduate credit hours of which at least 24 must be in formal course work (Quality Hours). These 24 hours must be in courses that carry graduate credit (see the Graduate School Bulletin). Graduate students who have earned graduate credit in lecture or seminar courses elsewhere with grades of B or above should decide, in consultation with their Research Director, no later than the beginning of the student's second year about transferring course credit to their Vanderbilt record.

Chem 6900 (Professional Development) is required for two registrations for each Ph.D. student. Students are also required to take at least the 1 hour option of Chem 5130, Advanced Analytical Chemistry, which covers the design and analysis of experimental data.

Students are required to register for Chem 6902 (Practicum in Chemistry Instruction) for zero hours, non-credit for each semester that they serve as a teaching assistant. The faculty who supervise the teaching assistant assignment will award the letter grades for Chem 6902. These letter grades will appear on student transcripts but will not be used in grade point average (GPA) calculations.

Enrollment in Chem 6903 (Readings in Advanced Chemistry) is restricted to qualified students only. Students who have earned 24 total hours minimum of graduate credit and who have a cumulative GPA of at least 3.700 can, with permission of their Research Advisor, enroll in 3 hours of Chem 6903. Students enrolled in this course must complete demonstrable advanced work, such as literature reviews, intra-group or inter-group seminars, or participation in proposal development.

The Graduate School requires at least a B average (3.0 GPA) in formal course grades for a student to remain in academic good standing on the basis of GPA. Grades in the research courses Chem 7999 (Master's Thesis Research), 8999 (Non-candidate Research), and 9999 (Ph.D. Dissertation Research) are excluded from the computation of this average. The Graduate School has adopted a grading system based upon a 4.0-point scale with adjustment of quality point values for "+" and "-" grade designations. A student whose cumulative grade point average falls below B (3.0) is not in academic good standing and will be notified by the Graduate School that he or she must show substantial progress toward achieving academic good standing during the next semester. To demonstrate substantial progress

by the student in such a situation, the Department of Chemistry will expect that the student perform with a semester GPA of 3.0 or greater during that semester and will have brought his or her cumulative GPA up to at least the level of B- (2.7) by the end of that semester. Any student not meeting these conditions will be dropped from the chemistry graduate program. For students meeting those conditions but who have not yet achieved academic good standing, the department will indicate to the Graduate School that satisfactory progress is being made and will request that the student be allowed one additional semester to achieve academic good standing. We anticipate, but we cannot guarantee, that this request will be granted. In addition, no student may have a cumulative GPA average below the B (3.0) average required by the Graduate School for a total of more than two semesters during his or her graduate career. Students who complete three semesters of study (not necessarily in consecutive order) each with a cumulative GPA below 3.0 will be dropped from the graduate program immediately at the end of the third term below academic good standing. Intermediate summer sessions are ignored in these calculations, provided that no course work is taken during the summer terms.

Chemistry graduate students are not normally allowed to retake courses, and courses may not be dropped after the initial course change period each term. Students wishing to drop any course during change period are permitted to do so only with the approval of their Faculty Advisor (or the Director of Graduate Studies if a Faculty Advisor has not been chosen yet). Students must complete their first year of graduate study having completed a minimum of five academic quality-point courses in addition to their registrations in Chem 6900 and Chem 6901 and any one-hour courses completed. Students who fail to complete this requirement will be recommended by the Director of Graduate Studies to the Chair for immediate dismissal from the chemistry graduate program. Students earning a grade of failure in any course will be recommended by the Director of Graduate Studies to the Chair for immediate dismissal from the chemistry graduate program.

Courses carrying graduate credit as formal course offerings of the Department of Chemistry are listed below. Some of these courses may not be currently offered, as indicated in "The Bulletin of Vanderbilt University, The Graduate School" and the published "Schedule of Courses." Students should consult the Bulletin of the Graduate School for listings of graduate courses in other departments. The

specific course program appropriate for each student should be determined in close consultation with the student's Research Director.

<b>Course Number</b>	<b>Title</b>
5010 (203)	Inorganic Chemistry
5020 (202)	Introduction to Bioinorganic Chemistry
5030 (306)	Physical Methods in Inorganic Chemistry
5040 (305)	Nanoparticles
5050 (207)	Introduction to Organometallic Chemistry
5120 (211)	Instrumental Analytical Chemistry (if no previous similar course)
5140 (311)	Analytical Mass Spectrometry
5150 (312)	Electrochemistry: Theory and Analysis
5160 (315)	Separation Methods: A Practical Approach
5170 (314a)	Special Topics in Analytical Chemistry
5209 (320a)	Organic Structure, Mechanism, and Reactions (2 hrs)
5210 (320)	Organic Structure, Mechanism, and Reactions (4 hrs)
5220 (225)	Spectroscopic Identification of Organic Compounds
5230 (222)	Physical Organic Chemistry
5240 (223)	Advanced Organic Reactions
5310 (231)	Biophysical Chemistry: Thermodynamics in Chemical and Biological Systems
5320 (338)	Quantum Chemistry
5330 (339)	Spectroscopy
5340 (340)	Applications of Group Theory
5350 (331)	Statistical Thermodynamics
5360 (330)	Advanced Quantum Chemistry
5410 (333)	Molecular Modeling Methods
5420 (337)	Computational Structural Biochemistry
5600 (250)	Chemical Literature
5610 (350a)	Chemistry of Inorganic Materials

<b>Course Number</b>	<b>Title</b>
5620 (350b)	Chemistry of Biological Materials
5630 (235)	Macromolecular Chemistry: Polymers, Dendrimers, and Surface Modifications
5710 (224)	Bioorganic Chemistry
5720 (226)	Drug Design and Development (formally Medicinal Chemistry)
6050 (304)	Special Topics in Inorganic Chemistry
6150 (314b)	Special Topics in Analytical Chemistry
6250 (324)	Special Topics in Organic Chemistry
6340 (332)	Special Topics in Chemical Physics
6350 (334A/B)	Special Topics in Physical Chemistry
6710 (336)	Biochemical Toxicology and Carcinogenesis
6900 (301a/b)	Professional Development
6902 (360)	Practicum in Chemistry Instruction (0 hours, non-credit)
6901 (380)	Introduction to Research
6903 (385)	Readings in Advanced Chemistry

#### **E. Research**

The major part of time and effort in graduate school will be spent in graduate-level research. For research requirements, the student should refer to Sections E, G, H, I and J of this document. The normal expectation is that a graduate student once joining a research group will remain in that research group until completion of a graduate degree program with thesis. Should that degree be the M.S. degree and should that graduate student wish to continue in the Ph.D. program of the department in another research group, it will be necessary for the student to re-apply for admission to the chemistry graduate program. Only under situations of exceptional circumstance will the Chair permit graduate students to switch groups without completing a M.S. degree with thesis and without following this re-application procedure. Students who have completed a M.S. degree with thesis in the department and who have re-entered the Ph.D. track should expect an increase in the time required to complete the Ph.D. degree. For such students, an accelerated schedule of deadlines for Ph.D. degree requirements might be specified as conditions of re-admission.

**F. Responsible Conduct in Research (RCR) Training**

All graduate students are required to complete a two-part training program in responsible conduct in research (RCR) by the end of their first year (<https://gradschool.vanderbilt.edu/research/rcr.php>). The first part is a web-based Collaborative Institutional Training Initiative (CITI) program and is typically completed during orientation ([https://vanderbilt.edu/researchintegrity/docs/CITI\\_Training\\_SOP.PDF](https://vanderbilt.edu/researchintegrity/docs/CITI_Training_SOP.PDF)). The second part entails a day-long, discussion-based course (RCRG 6303-6307) and is completed on the Friday following the end of the spring semester. Please make any vacation plans accordingly.

**G. ARM and Ph.D. Committees**

The evaluation and monitoring of the academic and research progress of each graduate student is conducted through interactions between the student and two faculty committees. These faculty committees are the Academic and Research Monitoring (ARM) Committee and the Ph.D. Committee. The members of these committees are chosen by the student in consultation with student's research director, subject to the approval by the Chair of the Department. The Dean of the Graduate School formally appoints faculty to Ph.D. Committees. In all decisions rendered by these committees, a simple majority vote of committee members must agree to each decision.

The selection of faculty members for the ARM Committee must be completed prior to taking the Examination. The ARM Committee is composed of the student's Research Director (Committee Chair) and two other graduate faculty members who have expertise closely related to that of the student's research area of interest. The responsibility of the ARM Committee is to monitor the academic and research progress of the student. This includes monitoring student responsibility in following directives from their Research Directors in a timely fashion with respect to safety, laboratory practice, experimental direction and protocols, and ethical conduct in research. Both students and their ARM Committees have the right to schedule additional reviews to ensure that students receive appropriate guidance in their research. Students are required to meet with their ARM Committee at the Preliminary Examination (see Section G) and immediately following presentation of the Independent Research Proposal at least six months prior to the Final Defense (see Section I).

The student's Ph.D. Committee consists of not fewer than four members of the graduate faculty and must include the three members of the student's ARM committee and at least one additional faculty

member. A listing of graduate faculty begins on page 190 of the Graduate School Catalog (<http://www.vanderbilt.edu/catalogs/grad/graduate.pdf#grad>). Three members of the Ph.D. Committee must hold a faculty appointment in Chemistry and one member should hold their primary appointment in a department other than Chemistry. Should an existing Ph.D. Committee lose one or more faculty members, the new minimum of four faculty members will automatically apply.

The responsibility of the Ph.D. Committee is to administer the Ph.D. Qualifying Examination, monitor progress of the dissertation, and administer the Ph.D. dissertation final defense. The Ph.D. Committee will meet with each student for the Ph.D. Qualifying Examination. A description of this examination is provided in Section H. The final meeting of the Ph.D. Committee is usually at the public defense and final examination of the thesis, with a private meeting of the student with the Ph.D. Committee occurring immediately following the public presentation.

#### **H. Preliminary Examination**

Students must complete a Preliminary Examination requirement by **31 October** of their second year of graduate study (or 31 March for students entering Spring Semester). The Preliminary Examination represents the student's first experience to defend his or her research in both written and oral formats. Students will provide their ARM Committee members with a written summary of their research progress to date. The written document should be in proposal format and consist of a research objective and specific aims, a statement of the significance of the research and brief background review of relevant literature, and a detailed progress report of their research results of their proposed thesis research. Students will meet with their ARM Committee no sooner than one week following the distribution of their written summary to give an oral presentation of their research summary followed by discussion with their committee members. The research report should be two pages in length including all figures, schemes, and references, plus a half-page abstract/project summary; the oral presentation should be 20-30 minutes.

Outcomes of this Preliminary Examination are Pass, Conditional Pass, or Failure and are communicated to the Director of Graduate Studies (or designee) via email correspondence. Students earning a Conditional Pass must remove any imposed conditions by the date stipulated by the ARM Committee or by completion of their Ph.D. Qualifying Examination or else they will be dropped from the

chemistry Ph.D. program. Students earning a grade of Failure will be immediately placed on research probation and must attain good standing in their research by the date stipulated by the ARM Committee or by completion of their Ph.D. Qualifying Exam or else they will be dropped from the chemistry graduate program.

### **I. Ph.D. Qualifying Examination**

Students must complete their Ph.D. Qualifying Examination requirement by **15 March** of their third year of graduate study (15 October for students entering in Spring Semester). Students must earn a total of at least 24 quality hours of graduate coursework with a GPA of 3.0 or better prior to taking this examination. The results of the Ph.D. Qualifying Examination must be completed within a period of four weeks, and a student is permitted only two opportunities to pass this examination. Students present their Ph.D. Qualifying Examination to their Ph.D. Committee. The student will inform the DGS of the faculty members recommended to serve on the student's Ph.D. Committee and the date, time, and location of the Qualifying Examination by submission of the appropriate forms, which can be found at: [https://gradschool.vanderbilt.edu/academics/steps\\_to\\_graduation/index.php](https://gradschool.vanderbilt.edu/academics/steps_to_graduation/index.php), by email. The Director of Graduate Studies will then request that the Graduate School officially appoint the Ph.D. committee and schedule the exam. These requests must be made at least two weeks in advance of the exam date. The Dean of the Graduate School approves the formation of the student's Ph.D. Committee, the scheduling of the Ph.D. Qualifying Examination, and notifies each Ph.D. Committee member of the time, date, and location of the exam.

The Ph.D. Qualifying Examination consists of a written and oral defense by the student of their research project and their research progress to date. At least one week prior to the scheduled date of the examination, candidates will distribute a written summary of their research project to the members of their Ph.D. Committee. This written document should be in proposal format including a one-page specific aims page and a six-page research description including all figures and schemes but not including references, plus a half-page abstract/project summary. The objective and significance of the research project should be clearly stated, and an appropriate discussion of the meaning of research results should be included. Students should summarize their future research objectives. The candidate will make an

oral presentation of this report at the scheduled examination and will orally defend the contents of this report. The oral presentation should be ~ 30 minutes.

Outcomes of the Ph.D. Qualifying Examination are grades of Pass or Failure and are indicated to the Director of Graduate Studies (or designee) by completing and signing the Results of Qualifying Examination form provided by the Graduate School. Once signed by the Director of Graduate Studies, the form is then sent to the Graduate School. Candidates receiving a Failure will be given a second chance to pass this requirement usually within a four-week period. This period is to be included within the stated deadline for completion of this degree requirement. Students who do not meet this deadline will be dropped from the chemistry Ph.D. program.

When a student passes the Ph.D. Qualifying Examination, the student is admitted to candidacy for the Ph.D. degree by the Graduate School, having fulfilled all of the requirements for that status, and the Director of Graduate Studies (or designee) so informs the chemistry administrative office. Students admitted to candidacy for the Ph.D. degree must satisfy all remaining requirements of the Ph.D. degree.

#### **J. Independent Research Proposal and ARM Committee Review**

At least six months prior to the Final Defense, students must complete a mock written submission and subsequent defense of a research project original to their own thinking followed immediately by an ARM Committee Review. In consultation with their Research Director, students should choose to follow either relevant parts of the PHS 416 Research Training Plan format or the complete Petroleum Research Foundation Doctoral New Investigator Proposal format for their written proposal (see Appendix A). This requirement gives students experience in formulating and presenting a formal research proposal and develops the independent and creative thinking skills of the student. The Independent Research Proposal is a graduation requirement rather than a formal degree requirement.

Students present their Independent Research Proposal and associated oral defense to their Ph.D. Committee. The research proposal should be original to the student and shall always be in chemistry. Early during the development of this proposal, students should provide the title and a one-page summary to the members of the student's ARM Committee. If any member of the ARM committee should consider that the proposal described by this summary might be inappropriate, then the ARM committee will meet with the student to discuss the choice of this research proposal. The independent proposal should deal



with a problem of sufficient scope and quality that, if successful, the results could be published in reputable journals. Hence, the independent proposal will require defense of both merit and feasibility. In the development of the proposal, originality in concept or in problem solving should be stressed. The proposal should not be a routine extension of the dissertation or known chemistry.

Students should distribute their written proposal to their Ph.D. Committee at least one week in advance of the oral examination. Reference materials cited in the proposal must be returned to the library for the use of the committee. The oral examination assesses the originality, knowledge, and capacity for independent critical analytical thought by the student, as well as his or her ability as a scholar. This examination usually lasts about two hours, but the student's oral presentation of the original proposal is limited to approximately 25 minutes. Outcomes of this examination include earned grades of Excellent, Very Good, Good, Fair, or Flawed. Proposals earning a grade of "Flawed" by a majority of Committee members are unacceptable and are to be revised or repeated as dictated by the student's Ph.D. Committee. The Research Director should inform the Director of Graduate Studies of the outcome of this examination.

Immediately following the Independent Research Proposal examination, the student will present an ARM Committee Review to their now assembled Ph.D. Committee. A two-page written description of the research accomplished by the student and an outline of anticipated dissertation chapters should be provided to the members of the student's ARM Committee along with the Independent Research Proposal. Possible outcomes of an ARM Committee Review are the following: pass; conditional pass; or failure. Students earning a grade of conditional pass might be required to do additional work and/or schedule additional ARM Committee meetings to reexamine the research progress of the student as deemed necessary. Students earning a grade of failure at an ARM Committee review are immediately placed on research probation. Additional work and/or ARM Committee meetings may be required of the student. The student will be terminated from the chemistry Ph.D. program if satisfactory progress in research has not been demonstrated by the date specified by the ARM Committee.

#### **K. Dissertation**

After having been admitted to candidacy, students should complete the remaining 72 hours of required graduate work and all remaining degree requirements. Near the completion of the research

project, Ph.D. candidates normally begin to write their Ph.D. dissertation. Detailed instructions available from the Graduate School (<http://gradschool.vanderbilt.edu/academics/theses/index.php>) should be consulted before writing the dissertation.

The final steps in the dissertation defense and approval process, as stipulated by the Graduate School, are the following:

(1) At least two weeks prior to the final dissertation examination, the candidate should distribute a copy of the completed dissertation to each member of the candidate's Ph.D. Committee. Committee members are invited to review the dissertation and to provide comments.

(2) At least two weeks prior to the final examination, the Chair of the Candidate's Ph.D. Committee, in consultation with the candidate, shall notify the Graduate School (via the Director of Graduate Studies or designee) in advance of the place and time of the final examination and the title of the dissertation. This is done by sending the DGS the appropriate form ([https://gradschool.vanderbilt.edu/academics/steps\\_to\\_graduation/index.php](https://gradschool.vanderbilt.edu/academics/steps_to_graduation/index.php)) by email. The Dean of the Graduate School then notifies the members of the Ph.D. Committee of the scheduled final examination and invites attendance by the university community.

(3) At least one week prior to the final examination presentation, the candidate and the Research Director must notify the Chair of the Department and the Department office (via the Director of Graduate Studies or designee) of the public presentation and defense of the dissertation by the student.

(4) Immediately following the public presentation, the candidate and the Ph.D. Committee meet to complete the final examination. The Ph.D. Committee meets in closed session to formulate a decision regarding the final examination and then informs the candidate of their decision. The Research Director informs the department and the Dean of the Graduate School (via the Director of Graduate Studies or designee) of the final decision of the Ph.D. committee by completing and signing the Results of Dissertation Defense form provided by the Graduate School. After obtaining the Director of Graduate Studies' signature, the form is then sent to the Graduate School.

#### **L. Financial Support & Teaching Assistantships**

The Vanderbilt Ph.D. Program in Chemistry has no teaching requirement. Financial support for all graduate students is by a Teaching Assistantship, a research fellowship through their research

director's grants, or related research fellowship. A graduate student in good standing can expect up to four years of Departmental financial support as a Teaching Assistant, but no more than six years of total support. The purpose of this rule is to encourage students to finish their Ph.D. work in a reasonable time. Continuation of support and the level of support, depends at all times on the student satisfactorily fulfilling all assigned responsibilities, registering for all advised course work, making satisfactory progress toward the degree, and the availability of financial resources. Students are required to register for zero hours of Chem 6902 (Practicum in Chemistry Instruction) for each semester they serve as a Teaching Assistant.

#### **M. Seminars**

All graduate students are to attend the Departmental and Graduate Student Seminar series; in addition, students may wish to attend the many other seminar series on campus that are specific to a particular research focus. Students need to possess adequate English proficiency to benefit from attendance at Departmental seminars and to develop the written and oral skills expected of professional scientists. By the end of their first year of study, students must possess, as a minimum, sufficient English proficiency to pass certification for laboratory instruction by the Vanderbilt Center for Teaching. Students failing to attain this minimum level of English certification will be dropped immediately from the chemistry graduate program by the Director of Graduate Studies.

The Departmental, Graduate Student, and other campus seminar series introduce students to the breadth of contemporary chemical research, help students develop critical thinking skills, and are vital to the professional growth and development of all researchers. All graduate students are required to give a seminar in the Graduate Student Seminar series in their third year. This seminar could be the student's final thesis defense if the final defense is scheduled during the student's third academic year.

#### **N. Vacation Policy**

The Departmental policy for graduate student vacation (both for RA's and TA's) is that students are entitled to two weeks of vacation during each twelve-month period they are in residence in addition to the normal faculty/staff holidays (NOTE 1: Faculty/staff holidays are specified on the University Holiday Schedule and do not follow the holiday and break times designated on the Vanderbilt University Academic Calendar. NOTE 2: Labor Day is listed as a University Holiday; however, it is not a holiday for

the College of Arts & Science. Faculty and graduate students are required to fulfill all teaching-related responsibilities on Labor Day). Students may choose to take these two weeks of vacation at any time during the year as long as it does not conflict with their assigned teaching and/or research duties and if the chosen period(s) are approved by their Research Director. Students, especially those from abroad for whom travel is lengthy and expensive, may wish to forego the two-week vacation in one year and take a four-week vacation in a later year. Unlike undergraduate school where the summer is vacation time, in graduate school the summer is part of the standard appointment and is a prime time for making research progress.

Any circumstance that requires the student to be away from the University for prolonged periods, even without pay, must be made known to and discussed with the student's Faculty Advisor and the Director of Graduate Studies in advance. Failure to do so could lead to termination of the student from the graduate program in chemistry.

#### **O. Outside Employment**

Graduate students in chemistry who wish to seek employment for any activities outside of those related to their duties as graduate students or as required by their financial award are required to follow Graduate School policy for approval of such employment. This policy states that such requests are to be submitted by the student in writing for approval by the student's Faculty Advisor and by the Chair of the Department and, upon receiving such departmental approval, must be submitted in writing to the Dean of the Graduate School for official approval.

Tutoring students in chemistry courses for hire is a special type of employment opportunity. Current policy regarding such tutoring for hire is the following; (1) teaching assistants shall not tutor for hire in courses in which they are employed as teaching assistants, (2) graduate students interested in tutoring for hire must receive written approval to do so (with copy to the Director of Graduate Studies) from either their Faculty Advisor or the Director of Graduate Studies if they have not yet chosen a faculty supervisor, and, (3) graduate students who have been approved for tutoring for hire as described above should submit their name to the Director of Undergraduate Studies for referral by students in those courses.

## Appendix A

PHS 416 Research Training Plan format for the Independent Research Proposal Requirement Format:  
<https://grants.nih.gov/grants/funding/416/phs416-1.pdf>

### Research Training Plan

Title (No more than 81 characters including spaces and punctuation)

#### **A. Specific Aims** (1 page)

Summary of proposal and goals

#### **B. Research Strategy** (6 pages)

##### **i. Background and Significance**

Background leading to the proposed work and direct health-relatedness of the project (for NIH).

##### **ii. Preliminary Studies**

No preliminary studies by the applicant have been initiated concerning the project described in the research proposal or add if previous work by the applicant has been accomplished in this area and describe briefly.

##### **iii. Research Design and Methods**

How the project will be carried out in the laboratory in terms of planned experiments and also an explanation of the anticipated results.

*Proposed timeline for the award period* (this is extra and is added to show the viability of the proposed project within a three year period – which is the maximum allowed for NIH funding at the postdoctoral level) – simple line chart with expected dates for key experiments mentioned within the project.

#### **C. Human Subjects Research**

n/a for the proposed research (or a very involved section if you do have this – refer to instructions)

#### **D. Vertebrate Animals**

n/a for the proposed research (or a very involved section if you do have this – refer to instructions)

#### **E. Literature Cited** (no page limit – ACS style format but also including the title of each article)