



2011-2012

**Department of Chemistry
Graduate Studies
Handbook**

Duke University

Department of Chemistry

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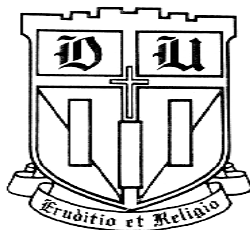
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Steven W. Baldwin, Ph.D.

Director of Graduate Studies

Graduate Student Handbook

This information applies to the academic year 2011-2012 and is accurate and current, to the best of our knowledge, as of August 2011. Inasmuch as changes may be necessary from time to time, this handbook and the matters contained therein are not binding on the Department of Chemistry or Duke University, and this handbook should not be construed as constituting a contract between Duke University and any individual. The Department of Chemistry reserves the right to change the program of study, academic requirements, lecturers, teaching staff, the announced calendar, and other matters described in the handbook without prior notice.

NOTE: *In January 2007, the Department of Chemistry moved into a new state-of-the-art research facility, the French Science Center. The move was completed by May 2007. The new building, totaling over 275,000 square feet, is a shared research facility with groups from Biology, Physics, Mathematics and the Medical Center occupying space.*

The move saw an increase for the Chemistry Department for research space, teaching space and instrument support space. Research space will go from approximately 29,250 square feet to 37,000 square feet. Teaching space went from approximately 14,000 square feet to 15,500 square feet and instrument support went from approximately 1,900 square feet to over 2,700 square feet.

To contact the Graduate Studies Office please email the Director of Graduate Studies Assistant, Caroline Morris at caroline.morris@duke.edu.

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2011-2012 Academic Calendar

FALL 2011

August 23	Tuesday. New undergraduate student orientation begins
August 24	Wednesday. 11:00 a.m. Convocation for new undergraduate students; 4:00 p.m. Convocation for graduate and professional school students
August 29	Monday. 8:30 a.m. Fall Semester classes begin; Drop/Add continues
September 5	Monday. Labor Day. Classes in session
September 9	Friday. Drop/Add ends
September 22	Thursday. 4:30 p.m. Founders' Day Convocation
September 25	Sunday. Founders' Day
October 7	Friday. Last day for reporting midsemester grades
October 7	Friday. 7:00 p.m. Fall break begins
November 2	Wednesday. Registration begins for Spring Semester, 2012
November 11	Friday. Last day to withdraw with W from Fall 2011 classes
November 16	Wednesday. Registration ends for Spring Semester, 2012
November 17	Thursday. Drop/Add begins for Spring 2012
November 22	Tuesday. 10:30 p.m. Thanksgiving recess begins
November 28	Monday. 8:30 a.m. Classes resume
December 2	Friday. Graduate classes end
December 3 - 12	Saturday-Monday. Graduate reading period
December 9	Friday. Undergraduate classes end
December 10 - 12	Saturday-Monday. Undergraduate reading period
December 13	Tuesday. Final examinations begin (9:00 a.m.)
December 18	Sunday. 10:00 p.m. Final examinations end

SPRING 2012

January 8 - 10	Sunday - Tuesday. Undergraduate Winter Forum
January 11	Wednesday. 8:30 a.m. Spring Semester begins: The Monday class meeting schedule is in effect on this day ; Regular class meeting schedule begins on Thursday, January 12; Classes meeting in a Wednesday/Friday meeting pattern begin January 13; Drop/Add continues
January 12	Thursday. Regular class meeting schedule begins
January 16	Monday. Martin Luther King, Jr. Day holiday: classes are rescheduled on Wednesday, January 11
January 25	Wednesday. Drop/Add ends
February 20	Monday. Registration begins for Summer 2012
February 24	Friday. Last day for reporting midsemester grades
March 2	Friday. 7:00 p.m. Spring recess begins

March 12	Monday. 8:30 a.m. Classes resume
March 28	Wednesday. Last day to withdraw with W from Spring 2012 classes
April 4	Wednesday. Registration begins for Fall Semester 2012; Summer 2012 registration continues
April 13	Friday. Registration ends for Fall Semester 2012; Summer 2012 registration continues
April 14	Saturday. Drop/Add begins for Fall 2012
April 18	Wednesday. Graduate classes end
April 19 - 29	Thursday-Sunday. Graduate reading period
April 25	Wednesday. Undergraduate classes end
April 26 - 29	Thursday-Sunday. Undergraduate reading period
April 30	Monday. Final examinations begin May 2 Wednesday. Undergraduate reading period (9:00 AM - 2:00 PM)
May 5	Saturday. 10:00 p.m. Final examinations end
May 11	Friday. Commencement begins
May 13	Sunday. Graduation exercises; conferring of degrees

SUMMER 2012

February 20	Monday. Registration begins for all Summer sessions
May 16	Wednesday. Term I classes begin. The Monday class meeting schedule is in effect on this day. (Therefore, all summer classes meet this day.) Regular class meeting schedule begins on Thursday, May 17; Drop/Add continues
May 17	Thursday. Regular class meeting schedule begins
May 18	Friday. Drop/Add for Term I ends
May 28	Monday. Memorial Day holiday. No classes are held
June 13	Wednesday. Last day to withdraw with W from Term I classes
June 25	Monday. Term I classes end
June 26	Tuesday. Reading period
June 27	Wednesday. Term I final examinations begin
June 28	Thursday. Term I final examinations end July 2 Monday. Term II classes begin
July 4	Wednesday. Independence Day holiday. No classes are held.
July 5	Thursday. Drop/Add for Term II ends
July 30	Monday. Last day to withdraw with W from Term II classes
August 9	Thursday. Term II classes end
August 10	Friday. Reading period (Until 7:00 p.m.)
August 10	Friday. Term II final examinations begin, 7:00 p.m.
August 12	Sunday. Term II final examinations end

Chemistry Faculty Directory

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Chemistry Department Administrative, Clerical and Technical Staff

Administrative Staff

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The Graduate Program in Chemistry

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The Graduate Program in Chemistry

I. Introduction

The goal of our graduate course and examination scheme is to emphasize research and research accomplishment at an early stage, and to incorporate appropriate training devices in a flexible manner so that individual needs/goals of both the student and research advisor can be met. The scheme is an attempt to use our best collective wisdom in agreeing upon certain basics of training while at the same time recognizing that individuals and groups often differ in the mode and timing of the research training vehicles. We also recognize that our course and examination scheme must be effective in helping to identify at an early stage students who need additional help or supervision.

The concept of a "major" is not formally recognized. A student's committee, coursework, and his/her path through the examination scheme are individually designed by the student in conjunction with his/her advisor and supervisory committee, and are planned according to the particular research area and topic involved.

The major requirements of the Ph. D. program are:

- 22 Units of Graded Course Work
- Responsible Conduct in Research Training (12 credits)
- Research Progress Report/Prelim Document
- Preliminary Examination
- Oral Presentation Requirement
- Propositional Examination
- Ph.D. Dissertation and Examination
- Each of these requirements, along with other features of the graduate program, is described in the following sections.

II. Features of the Program

A. Graduate School Requirements

The Graduate School does not require registration for a fixed number of course units for the Ph.D. degree and leaves the specific course requirements up to the individual graduate programs. As a result, the course registration requirements for chemistry students primarily reflect the course requirements for the Ph. D. program in chemistry described in the next section. It should be noted that the M. S. Degree is not a prerequisite for the Ph. D. Degree.

In addition to any course requirements of the department, the Graduate School requires (1) payment of six semesters of full-time tuition or five if transfer credit has been approved, (2) a supervisory committee for the student's program of study, (3) continuous registration, (4) preliminary examination, (5) dissertation, and (6) final examination. All of these requirements are incorporated into the graduate program in chemistry. The Graduate School also requires training in the Responsible Conduct of Research (12 credits) through participation in a series of workshops sponsored by the Graduate School. International students whose native language is not English must enroll in English language courses offered through the Graduate School, **during their first year**, unless formally waived from this requirement by the Graduate School.

Students electing or required to move out of the PhD program and pursue the M. S. degree are required to register for a total of 30 units of graduate credit, and must present acceptable grades for a minimum of 24 units of graded graduate course work (the additional 6 units would normally be research units for chemistry students or English courses for international students). There is also a limit of 6 credits of 100-level courses for a M.S. degree. Of the required 24 graded units, at least 6 units must consist of graduate level course work taken outside of the student's major area of concentration. The course program will be arranged through consultation with the student, the Director of Graduate Studies, and the student's research advisor.

The student is referred to the Bulletin of the Graduate School of Duke University and to the Graduate School for more detailed information concerning general degree requirements:

<http://gradschool.duke.edu/academics/policies/index.php>

B. Teaching Requirement

The Department of Chemistry recognizes that teaching is an important component of the professional development of its doctoral students. Therefore, the normal expectation is that all chemistry graduate students, even those with full outside financial support, will teach at least one-half of a standard Teaching Assistant load for a minimum of two semesters during the first 3 years of graduate student tenure. This requirement can be revised if a student can show he/she has acquired equivalent teaching experience in post-undergraduate work prior to coming to Duke. Most students satisfy this requirement in their first year.

C. Course Requirements

Students in the chemistry graduate program are required to complete 22 units of graded course work by the end of Fall term of their second year in the program. During their first semester students normally register for a minimum of 12 units of graded courses (e.g. three full chemistry graduate courses or the equivalent). In the second semester they take another 8 to 10 units of coursework, and in the third semester complete any remaining courses as necessary to achieve the total of 22 units (e.g. a total of five and a half chemistry graduate courses or the equivalent). Courses offered outside of chemistry by other departments may be substituted for chemistry courses with the permission of the Director of Graduate Studies. Since many such courses carry a different number of units than the chemistry courses (e.g. 3 units vs. 4 units for a full course), the way these courses count toward the required 22 units, and the way they are counted in the evaluation of the course grade point average (described in Section II. L. below), will be established in advance in consultation with the DGS.

If a student has taken appropriately advanced chemistry or chemistry-related courses before arriving at Duke, he/she may request a waiver of a portion of the 22 credit requirement. The request must be submitted by the end of the first three weeks of the 1st semester of the PhD program and be accompanied by a written explanation about the course(s) to be counted in place of Duke graduate courses. The DGS will render a decision on the request. Credits may not be counted if they were previously used to satisfy the requirements of another degree (AB, BA, BS, MS, etc.), and no more than 12 credits can be waived.

Students should also register for enough units of graded research (Chem 375/376) in the second year to give them at least 30 total units of degree credit, typically by taking 6 units of graded research during each semester of the second year. While these do not count toward the 22 units of courses required for the Ph.D. degree, they do count toward the total number of credits required for a M. S. degree, should such a degree become a desirable or necessary alternative to the Ph. D. degree.

A list of the graduate courses in chemistry can be found elsewhere in this handbook (Section V) and is also available on the department web site and in the Graduate School Bulletin.

D. Research Orientation Seminar and Research Group Affiliation

During the Fall semester, all entering students are required to attend a program of seminars offered by the faculty (CHM 377). These talks provide an introduction to the faculty and their research interests and acquaint the students with research within the Department in all areas. At the completion of the seminars, students arrange personal conferences with those faculty members whose research is of interest to them. Students are then affiliated with specific research groups by a process of mutual selection administered by the department Chair. These affiliations are usually completed by the beginning of the second semester. The selection procedure will be discussed in greater detail with entering students during the Fall.

E. Supervisory Committee

After a student has affiliated a research director, a supervisory committee is appointed by the Director of Graduate Studies to plan, in consultation with the student, the remainder of his/her doctoral program and, with the approval of the Dean of the Graduate School, to conduct the preliminary and final examinations. Committee assignments are normally made during the Fall of the second academic year. At this time, the Director of Graduate Studies will solicit from the research advisor a proposed set of committee members, with the expectation that the advisor will consult with the student regarding the proposed committee. While making every effort to accommodate the proposed committee structure, the Director of Graduate Studies shall be responsible for revising proposed committee compositions in order to balance committee assignments among the faculty in a reasonable manner.

The supervisory committee consists of at least four members, with at least three normally from the Chemistry Department, and is chaired by the student's research advisor. At least one member (referred to by the Graduate School as the minor area representative) should be from a chemical sub-discipline outside of the student's research area, or possibly from another department. In some situations, especially those involving interdisciplinary research programs crossing department boundaries, it may be desirable or necessary to have a five-person committee. The same committee normally administers the final Ph.D. examination, although an appropriate faculty member from another department may replace the minor area representative if desired. If a change in committee members becomes necessary, a committee request change form must be filed through the Director of Graduate Studies Office prior to finalizing the Ph. D. Examination.

F. Preliminary Examination Document

A written research progress report, with copies provided for each member of the supervisory committee, will be submitted by each student to the Director of Graduate Studies no later than **January 20, 2012** of the Spring semester of year two. As well as demonstrating accomplished research and an understanding of the project, this report is to measure (and correct) the student's organizational and technical writing ability, and should be completed with minimal input from the research advisor. The report will be evaluated by all members of the student's supervisory committee, each providing critical comments and suggestions for revisions, both on the prelim document itself and the Chemistry Thesis Assessment Protocol (ChemTAP) worksheets provided. The report and comments will be returned to the student by **February 10, 2012**. A final and updated version of this report will serve as the written document for the preliminary examination and will be considered part of the examination.

The report should normally include several sections, beginning with an **Abstract** of no more than 100 words. The body of the report will include an **Introduction** section that should state the broad goals and specific aims of the research, point to the significance and/or relevance of the research, and should provide sufficient background to place the research in the context of past and ongoing work in the research area, *e.g.* the literature. There should be a brief section outlining relevant **Methods** employed in the research, with expanded experimental details appended outside the body of the document as necessary. The Results section should summarize progress to date, followed by a **Discussion** section and finally a description of **Future Work**. The body of the document should contain **no more than 2500 words**, not counting figures, references, and any appended experimental details. Students are encouraged to consult the ACS Style Guide and/or research journals in their research area for guidance on matters of style and format.

The preparation and submission of the research report emphasize research accomplishment at an early stage. The report also provides practice in technical writing, an important part of graduate training. Finally, the report serves as a first concrete step toward the preliminary examination, since the revised and updated version will also serve as the written document that guides the examination.

**Early each Spring semester there are preliminary examination writing workshops organized by Dr. Katherine Franz. Information and sign-up for the workshops will be sent out to students in advance via email.*

G. Preliminary Examination

The preliminary examination will normally be conducted during the Spring semester of year two and will be carried out in accordance with the regulations of the Graduate School as described in the Graduate School Bulletin. **Students must file for and receive approval from the Graduate School (signed by Dean David Bell) confirming their Preliminary Exam Faculty Committee members at least 60 days prior to the exam date.** In the interests of consistency and fairness, every effort will be made to schedule all preliminary examinations during a time window in the Spring semester to be designated by the Director of Graduate Studies. (According to Graduate School policy, all preliminary examinations must be held while school is officially in session.) **At least one week prior** to the preliminary exam, the student will distribute to the members of the examining committee (the Supervisory Committee) the final and updated version of preliminary examination document along with the evaluations and comments of the initial report, which will serve as the written document for the examination. A one-page abstract

should also be provided to the main office at this time for use in publicizing the seminar.

Just prior to (and considered part of) the preliminary examination, the student will present a brief (no longer than 30 minute) public seminar summarizing the research project and background, work accomplished to date, and projected plans for the future. The rest of the preliminary examination will be conducted in private with the student's the Supervisory Committee, with the goal of determining whether or not the student should be admitted to candidacy for the Ph.D. degree. This portion of the examination will involve questions from the committee aimed at measuring the student's general and specific background, knowledge of the particular research project involved, research results obtained to date, and planning for how the research will evolve into the dissertation. Because the research advisor is familiar with the student, it is expected that the bulk of the questions will come from the other members of the committee so that they can adequately evaluate the candidate. In particular, the advisor will refrain from assisting the student in answering questions. Students should be prepared to provide and discuss materials such as primary data or laboratory notebooks.

At the conclusion of the examination, which should normally take no longer than 2 hours total, including the brief oral presentation, the committee members will deliberate and each will vote to pass or fail. This decision will be based on material in the written Research Progress Report, performance on the questioning during the exam, and input from the research advisor. Specifically, students will be evaluated on the following:

- Fundamental understanding of the research area;
- Specific understanding of the research project and its significance;
- Productivity and progress to date on the research project;
- Future research plans toward the dissertation; and
- Evidence of and capacity for growth as an independent scientist.

According to Graduate School regulations, passing the preliminary examination requires a passing vote from the chair of the committee, and no more than one negative vote from the other committee members (e.g. at least three passing votes including the chair for a four person committee, or at least four passing votes including the chair for a five person committee; if the chair casts a negative vote the student will not pass the examination).

In the case of failure, the committee has several options. If the committee determines that the deficiencies that led to failure are potentially correctable, then the committee may permit the student to retake the examination, with the second preliminary examination occurring no later than the end of the Fall semester of year three. **The committee must retain its original membership for the retake of the preliminary exam. No professors may be substituted, except in exceptional cases that must be approved by the Dean of the Graduate School.**

If the committee concludes that the student should not be allowed to retake the preliminary examination, or if the student fails the second preliminary examination, then the student may be either excluded from the graduate program altogether, or allowed to write and defend a thesis for the M. S. degree (see the Master's Program section of the Graduate Student Handbook for more details). In the latter case, the committee, in conjunction with the DGS will specify a timeline for completion of the Master's degree. Failure to pass the Preliminary examination by the end of the

Fall semester of year three will result in exclusion from the Ph.D. program.

H. Oral Presentation Requirement

The ability to make an effective oral presentation is an essential skill for every Ph.D. chemist, and this skill is best developed through experience. To ensure that Ph.D. students have a sufficient range of such experiences, the department requires that each graduate student give at least two formal, public scientific presentations, with at least one of them oral (as opposed to a poster presentation), during their graduate career. The student should provide the Director of Graduate Studies office with appropriate documentation of these presentations. For example, such presentations might be given at local, regional, or national meetings of the American Chemical Society or other appropriate professional organization, or as part of a seminar program at Duke or other academic institution. To help defray the expense of attending professional meetings Conference Travel Awards are available through the Graduate School to students who have passed the preliminary examination. Details can be found at:

http://gradschool.duke.edu/documents/financial_support/conftrav.pdf

Students may find the various workshops offered by Duke's Center for Instructional Technology or the Center for Teaching, Learning, and Writing to be of help in developing aspects of their presentation skills. Students are strongly encouraged to attend the departmental seminar series, not just to hear about science, but also to learn by example the art of giving an effective presentation.

The poster printer will be operated by Mark Kohler (mark.kohler@duke.edu) for academic year 2011-2012. Contact Mark directly to discuss use of the poster printer.

These two required formal presentations are in addition to presentations at group meetings, to the shorter and more focused presentations given to the examination committees at the preliminary and propositional examinations, and to the public seminar given at the Ph.D. defense. It is hoped that together these various presentations will expose students to the range of presentation types they will encounter in their professional careers.

I. Research Propositional Examination

All Ph. D. students are required to pass a research propositional examination in which they defend an original research proposal in front of a three-member faculty panel during the Fall semester of year four. The preparation and presentation of the research proposal provides the student with a mechanism for developing the ability to conceive, evolve, plan, and defend an original research project independent of the research advisor. The primary intellectual content of the proposal must represent a significant departure from the student's dissertation research, so that it represents an independent intellectual exercise.

In preparation for this examination, the student shall submit a completed pre-proposal form (Appendix VI) of no more than 200 words that succinctly summarizes the proposal. The pre-proposal should state the specific topic to be investigated (hypothesis), the methodology or approach to be employed, and should briefly justify the importance of the work. This pre-proposal will first be submitted to the research advisor for their signature indicating that the proposal is sufficiently removed from the dissertation research of the student. The pre-proposal with the

advisor's signed approval should be submitted to the DGSA office by **August 1, 2011** of the Summer following academic year three. The DGS will then appoint several three-member faculty panels who will review the abstracts and later carry out the examinations. Each abstract will be reviewed by the members of the appropriate panel, who will each indicate to the student whether they approve of the proposal topic and will provide feedback and comments for focus as appropriate. The student should receive this feedback by **August 15, 2011**. If the student fails to receive pre-approval from each of the panel members, the student should revise the proposal or initiate a new one to the satisfaction of the panel, with the revised proposal due **September 1, 2011**. Students are encouraged to discuss ideas with their advisor prior to submitting a pre-proposal. All proposals must be pre-approved in this fashion by **September 12, 2011** of the fourth year. The goal of this pre-approval process is to ensure that the proposed research topic is generally in keeping with expectations and sufficiently removed from the dissertation research of the student.

The pre-proposal submission form is included as Appendix VI.

The propositional examinations will be administered by the same set of three-member panels during the first two week of November (**November 1-November 15, 2011**). The student should submit to the DGSA office by **October 14, 2011** a written version of the research proposal to be provided to the examining panel; the written proposal ***should not exceed 1500 words in length, including figures, and references***. The examination itself shall not take more than one hour. At the beginning of the examination, the student will be given 15 minutes to summarize the proposal topic and its significance, to be followed by questions from the panel. At the end of the examination each member of the panel will vote to pass or fail. At least two passing votes by the panel members are required to pass the examination. Comments regarding the examination shall be passed on to the student as well as the individual grades of pass or fail, and, along with a copy of the propositional report, will be made part of the student's record. Should the student's performance be considered unsatisfactory in any aspect, the examining panel may require additional work by the student, and will set a timetable for the successful completion of such additional work. An unacceptable performance may require resubmission of another proposal, an improved version of the original proposal, or any other action deemed appropriate by the examining panel. The decision by the panel members to pass or fail will be based on the following expectations:

- The proposal should be focused and specific, with the written proposal stating the problem to be addressed clearly and succinctly at the very beginning of the document.
- The proposal should identify and address a single scientific problem or hypothesis and develop it fully.
- The proposal should support and defend the significance and originality of the work.
- The proposal should describe the experiments or methodology that will be employed to address the problem.
- The proposal should discuss possible outcomes and interpretations of results.
- For additional guidance in preparing proposals, students may wish to consult the web-sites of funding agencies that routinely support chemical research, such as NIH, NSF, ACS-PRF, and the Research Corporation. The "Funding Opportunities" section of the Duke Office of Research Support web-site at <http://www.ors.duke.edu> also has links to various "Grant Writing Resources" that can provide additional help.

J. Dissertation

The Ph.D. dissertation in Chemistry is a comprehensive report of a piece of original research done under the direction of a member of the faculty and representing not less than an academic year's work. The dissertation should include a comprehensive survey of the literature on the subject and should be written so as to be understandable without supplementary study by chemists not familiar with this special field.

Ph.D. dissertations are expected to contain new information that will be published in a reputable chemical journal, or the equivalent. All doctoral dissertations will be published electronically through [ProQuest/UMI Dissertation Publishing](#), a comprehensive electronic service for publishing, archiving, and disseminating graduate research. Dissertation and theses will be available on [DukeSpace](#), in addition to [ProQuest](#), once any embargo term placed on the document by the student author has expired

A guide for the preparation of Theses and Dissertations is available at the Graduate School web address: <http://gradschool.duke.edu/academics/theses/index.php>.

K. Final Examination

The final Ph.D. examination is given when the dissertation has been completed to the satisfaction of the research advisor and after the dissertation has received preliminary approval by the Graduate School at the format check meeting. The examining committee is usually the same as for the preliminary examination, although an appropriate faculty member from another department may replace the minor area representative if desired. In addition, a one-page abstract of the dissertation should be given to the DGS Assistant in the main office at least one week before the exam for publicity purposes. Additional arrangements for the final Ph.D. examination are described in the Appendices to this handbook.

The final Ph.D. examination is the culmination of the doctoral program, and consists of a public seminar followed by a closed examination (generally one to two hours in duration) of the candidate and the candidate's dissertation work by the Ph. D. supervisory committee. In the public seminar the candidate has the opportunity to explain the essence of his/her work to the examining committee and the public in general, and in the closed portion to defend the dissertation in more specific detail before the Ph.D. committee alone. The review and examination of the dissertation and the candidate's work is a serious task taken on by the student's committee, and careful and thorough review is expected. So that sufficient time can be had to carefully read the dissertation, **it should be submitted to the examining committee no later than two weeks before the scheduled final examination**; failure to do so may result in the examination having to be rescheduled, possibly to the following semester. Additional details and instructions for preparing the dissertation, for its submission, and for setting up the defense can be found at the Graduate Student web address: <http://gradschool.duke.edu/academics/theses/index.php>.

L. Seminar Program

Departmental seminars are an integral and essential component of graduate studies and of the intellectual and professional life of the department. They provide an opportunity to learn about the latest techniques, theories, methodologies, and exciting research areas. In addition, they present an opportunity to interact and exchange ideas with colleagues and visitors, and another venue for studying the art of giving an effective oral presentation. Thus, it is incumbent upon graduate

students to attend as many departmental seminars as possible.

M. Academic Standards for Continuation in the Ph. D. Program

In Fall 2004, the Graduate School formally changed its grading system from E, G, S, F to A, B, C, F and adopted a minimum Graduate Grade Point Average (GPA) of 3.0 as a condition for continuation in a given graduate program. Consistent with this policy, a GPA of 3.0 or better on 22 units of graded courses will be required for continuation in the chemistry Ph.D. program.

<i>The Graduate School and Engineering Management</i>	
A+	4.0
A	4.0
A-	3.7
B+	3.3
B	3.0
B-	2.7
C+	2.3
C	2.0
C-	1.7
F	0.0
NC	0.0

Note: In the Chemistry Department, full-semester chemistry doctoral-level 300 are counted as 4 credits and half semester courses as 2. All such doctoral level, and most Master's level, courses in other natural science departments will counts as 4 or 2 toward the doctoral degree's 22-credit requirement, depending on the length of the class. However, the Graduate School counts the courses towards a 30-credit Master's degree solely on the basis of their credit listing in ACES, e.g. a 3 credit graduate biochemistry course will counts as 3 credits for a Master's degree by the Grad School.

To monitor academic progress, the GPA for each student will be determined by the DGS office at the end of each semester of study. If a student's performance at the end of the first semester of graduate study indicates that he/she is unlikely to qualify for continuation in the Ph.D. program unless his/her performance substantially improves, the student will be placed on academic probation. At the end of the first year, a Continuation Committee makes recommendations on all first-year students as soon as possible after course grades become available for the Spring semester. This Committee is composed of the Director of Graduate Studies and four other members of the departmental faculty, appointed to the committee by the Chair of the Department. On the basis of the course record of the student, the Committee typically recommends one of the following: (1) that the student continue with the prescribed doctoral program, (2) that the student remain one additional year to complete a master's degree with an acceptable thesis, (3) that the

student is not eligible to continue in a degree program in the department. Recommendations other than continuation are made collaboratively with the Chair of the Department and the Director of Graduate Studies. It should be noted that a GPA of 3.0 or better is not a guarantee of continuation in the Ph.D. Program, although continuation generally is recommended in such cases. In the case of a student who does not complete the required 22 units of course work until the end of the third semester, the Director of Graduate Studies shall review the GPA again following the end of the third semester. If the GPA falls below 3.0, the Director of Graduate Studies shall convene another Continuation Committee to make a recommendation on the status of the student in the program following the procedures described above for the first-year continuation evaluation.

In addition to the academic standards set forth by the department, it is important to be aware of the other academic regulations of the Graduate School, in particular the regulation that “a grade of F in a major course normally occasions withdrawal from a degree program not later than the end of the ensuing semester or term; a grade of F in any other course occasions at least academic probation.”

Students approved for continuation in the Ph.D. program at the end of the third semester will be free of any additional grade level requirement. However, the Review Committee that evaluates the progress of advanced students shall take into account a poor grade performance in making recommendations for specific students. In exceptional cases, the Review Committee has the prerogative of recommending several levels of remedial action including termination of further pursuit of graduate work or termination of departmental support.

N. Review of Professional Progress of Advanced Students

At the completion of the first year of study, each student will receive a letter from the Director of Graduate Studies detailing the student’s academic standing. In general this will be based on the student’s performance in the academic course work taken during the first year in the program (see Section M). If the student has not achieved the necessary minimum grade point average (3.0) required for good standing, in most instances the student will be placed on academic probation with specific performance expectations for the upcoming academic year spelled out in detail. In rare instances, if the student’s academic performance in the first year has been unusually weak, the student’s graduate program may be terminated.

The Graduate School requires all graduate students beyond their initial year of study to file annually with the Director of Graduate Studies a written report that details their progress towards the PhD degree. For second year students in chemistry, this report can be the document that was submitted as part of the preliminary examination during the spring semester. At the completion of the second year of study, each student will receive a letter from the Director of Graduate Studies that summarizes the results of the preliminary examination and makes note of any specific recommendations from the student’s PhD committee.

All chemistry graduate students in their third year of study and beyond are required to submit an annual progress report, guidelines for the preparation of which are presented below. This report serves as the basis for the department’s annual review of the professional progress of its advanced graduate students. By **May 20**, each student should submit copies of this report to his/her research advisor and to the other members of the PhD supervisory committee, with one additional copy being submitted to the DGS office. By **May 20**, the DGS is required to certify to the Graduate School that all reports from advanced chemistry students have been received.

The annual progress report should normally be no more than two pages in length, and should include:

- a description of progress made over the previous year (including a listing of coursework, dissertation research, publications, scientific presentations, completed portions of the dissertation, etc.);
- an approximate target date for the final PhD defense; and
- an indication of future plans after successful completion of the PhD (post-doctoral, university teaching, law school, etc.).

Depending on the academic year of the student, these annual progress reports will be processed in the following different ways:

Third Year Students. For students completing the third year of study, supervisory committee members should alert the research advisor to any concerns they may have. The research advisor will then indicate to the DGS office whether the student's progress has been excellent, good, satisfactory, or unsatisfactory. If the student's progress is deemed satisfactory or better, the research advisor should convey this information to the student, preferably in a one-on-one meeting. If the student's progress is deemed unsatisfactory, the research advisor should indicate to the DGS the nature of the problem and recommend that the student's PhD advisory committee be convened in the early Fall of the student's fourth year of study. Also, because the Fall semester of the fourth year is also the time for students to present and defend an original research proposal, the research proposal committee can recommend that a student's PhD advisory committee be convened should serious concerns arise during the research proposal defense.

Fourth Year and Beyond Students. For students finishing their fourth year of study and beyond, the supervisory committee members and research director will respond to the annual progress reports in the same manner as for third year students. In addition, each advanced graduate student will meet with the PhD supervisory committee early in the following fall semester (**no later than Nov. 30**). Using the annual progress report as a discussion starting point, it is expected that this meeting will last thirty minutes or less as the committee determines the student's professional trajectory, including developing post-graduation plans. At the conclusion of the meeting the research director will provide the DGS with a summary of any specific recommendations. The research director will also convey the sense of the committee to the student.

From the Chemistry Department's perspective, these annual reviews are meant to create a positive sense of direction for the student, and to enhance communication between the student, research advisor, and supervisory committee. Its purpose is also to prevent potentially bad situations from developing, and to aid and direct the student at all stages of the PhD program. It is one way in which the faculty is able to express to the student what the faculty feels is important in graduate education.

O. Standards of Conduct

Duke University and the Department of Chemistry expect graduate students to adhere to the highest standards of academic and professional conduct in their roles as students, teachers, and researchers. The expectations of the University with respect to standards of conduct and academic integrity can be found on the Graduate School website at:

<http://gradschool.duke.edu/academics/standards/index.php> and at the Academic Integrity Council website at: <http://www.integrity.duke.edu/>

For information on how to properly cite sources and avoid plagiarism students are referred to the Duke University Library website at: <http://library.duke.edu/research/guides/citing/>

Most students are probably familiar with how these issues apply to print materials, but may be less certain in the case of web-based materials or published figures, for example. Students are encouraged to consult the above website for more information and to consult with their research advisor or other chemistry faculty regarding proper guidelines.

To ensure that graduate students have proper training in the Responsible Conduct in Research (RCR), Duke University will require all Ph.D. students to participate in a specified number of hours in RCR training as a formal requirement to obtain the degree. To satisfy this requirement, each Ph.D. student must attend one Fall Orientation RCR Workshop and participate in at least three supplementary RCR Forums within the first three years of his/her program. RCR training is a formal requirement of the Ph.D. degree, and students must complete 12 hours. Official transcript credit will appear in student records as GS310A (campus) or GS311 (RCR Forums) and can be viewed in STORM or ACES. *Beyond RCR Orientation*, each PhD student must normally complete 6 additional hours of training. This is usually accomplished by attending three separate 2-hour RCR Forums. Please be reminded of the following, and review our RCR web site (links below):

Fall 2011 RCR Orientation Class (Required for all entering PhD students)

[Natural Sciences and Engineering](#) (GS 310A-02: Campus workshop)

Friday, Aug. 26, 2011, 9:00am-5:00pm

Durham Hilton Hotel, 3800 Hillsborough Road, www.durham.hilton.com

(Continental breakfast and buffet lunch provided))

Welcome letter, schedule and pre-registration information (to be posted after July 1). There is NO pre-registration for RCR Orientation -- Admissions provides a list of matriculants.

Any PhD matriculant who cannot attend (due to visa delays, overseas study, etc) must contact **douglas.james@duke.edu** to request permission for delaying RCR Orientation until the next year. RCR Orientation is not optional -- it must be completed, and the sooner the better. The university has nearly 450 entering PhDs each year that must fulfill this requirement.

The Graduate School will monitor each student's participation in RCR training and the student will receive recognition when this requirement has been met. More information on this requirement and on the various workshops can be found on the Graduate School website at:

http://gradschool.duke.edu/academics/degree_reqs/rcr/index.php

P. Appointments and Vacation Periods

The normal appointment period for full-time research assistants and teaching assistants is from September 1 to May 31 in a given academic year. Students are also normally expected to be in residence and carrying out research during the Summer. Summer appointments extend from June 1 to August 31. Some research assistants may be on 12-month appointments (September 1-August 31).

All students are expected to be in residence **one week before the beginning of classes** for the Fall and Spring semesters. First year students are expected to be in residence 2 weeks before the beginning of classes for departmental and Graduate School Orientation. For 2011-2012 academic year the first day of Orientation is **August 15, 2011** and Fall semester classes start **August 29, 2011**. In addition, students holding teaching appointments during the Summer must be in residence one week prior to the Summer term(s) of their appointment.

Teaching Assistants must complete all of their teaching responsibilities before leaving at the end of a semester and should consult with the Laboratory Managers before making any vacation and travel arrangements.

Arrangements for vacation periods should always be made in consultation with the consent of the research advisor.

Q. Master's Program

Students are only admitted to the Ph.D. program. Students subsequently placed in the M.S. program by choice, or by not making satisfactory progress in the Ph.D. program, are required to complete the registration requirements of the Graduate School, including a total of 30 units of registration, 24 of which must be taken for a grade. Of the required 24 graded units, at least six units must consist of graduate level course work taken in a field (or fields) of chemistry other than the field of specialization. Students who begin in the Ph.D. program would normally satisfy these requirements with the 22 units of graded coursework required for the Ph.D., along with additional units of graded research taken during the second year (Chem 375/376). A thesis is required for the M.S. degree in chemistry and is defended in an oral examination with a three-member M.S. supervisory committee assigned according to the regulations of the Graduate School (the committee would normally be a subset of the original Ph. D. supervisory committee). Additional details on these regulations can be found at the Graduate School web address:

http://gradschool.duke.edu/academics/degree_reqs/ma_reqs.php

The final examination for the M.S. degree is oral and is one to two hours in length. The major portion of the examination is on the thesis, but general questions on both chemistry and subjects taken as related work are in order. The Master's thesis should be submitted to the student's committee no later **than two weeks before the scheduled examination**. Additional arrangements for and details of the final Master's examination can be found in the Appendices to this Handbook. The Master's defense consists of a seminar followed by an oral exam. The student has the option of requesting a public or private seminar, but the oral exam is closed, with the student and faculty committee members present only.

III. Normal Timeline for the Ph. D.

FIRST YEAR STUDENTS

Fall:

- Attend RCR Orientation, which takes place week before classes start to complete 6 of the required 12 RCR credits
- Register for Continuation, Chem 377, and 10-12 credits of graduate classes
- Register for any English courses deemed necessary for intl. students (if student can register for only one, Oral English course recommended first)

Spring:

- Chair's office will finalize formal affiliation with Primary Investigator
- Register for Continuation and 8-12 credits of graduate classes
- Register for any English course deemed necessary for international students
- Attend RCR Forums when available, each worth 2 credits towards required 12.

Summer:

- Register for Continuation

SECOND YEAR STUDENTS

Fall:

- Register for Continuation
- Register for remaining courses necessary to achieve 22 graduate credits
- Register for Chem 375 Research, 6 credits
- Complete all required English courses for international students by end of this semester
- PI submits recommendation for supervisory committee. PI may consult with student or make the decision alone. Supervisory committees finalized by DGS office in mid-October
- Attend RCR Forums when available, each worth 2 credits towards required 12.

Spring:

- Register for Continuation
- Register for Chem 376, 6 credits
- Turn in preliminary examination document DGS office with copies for all supervisory committee members. Mid-January
- Supervisory committee members return preliminary examination document, with comments and evaluation, to DGS office to be passed back to students for revision of document. Mid-February
- Submit finalized prelim document to supervisory committee at least one week in advance of the prelim exam. Mid-March
- Attend RCR Forums when available, each worth 2 credits towards required 12.

Summer:

- Register for Continuation

THIRD YEAR STUDENTS

Fall:

- Register for Continuation
- Work towards meeting Oral Presentation requirements by this point

Spring:

- Register for Continuation
- Turn in to DGS office Annual Progress Report summing up academic milestones and research completed during that academic year. Mid-May

Summer:

- Register for Continuation
- Propositional abstract due to Asst. office in early July
- Prop committee will return approved or unapproved prop abstracts with comments and evaluation to Asst. to DGS to return to student in mid-August
- Submit revised abstract for review by prop committee by Sept. 1

FOURTH YEAR STUDENTS

Fall:

- Register for Continuation
- All propositional abstracts approved by committee by Aug. 1
- Submit finalized written version of the research proposal to be provided to the examining panel by Oct. 14
- Sit propositional exams during first 2 weeks of November

Spring:

- Register for Continuation
- Turn in to DGS office Annual Progress Report summing up academic milestones and research completed during that academic year. Mid-May

Summer:

- Register for Continuation

FIFTH YEAR AND BEYOND STUDENTS

- By this time student have presented often enough to have fulfilled 2 Oral Presentation requirements.
- Students should be working toward completing dissertation in the next year.

***** The dept. will no longer support students through department funding as TAs after completing 5.5 year in the program (typically after Fall of the sixth year). Students will only be eligible to receive support only through faculty supported positions such as RA or external funding mechanisms, such as those associated with the IGERT, PSTP, MSTP, SBB, CBIMMS, or other inter-departmental programs.**

IV. Registration Guidelines

A. Registration for Summer and Fall

With the exception of new entering students who register for the Fall on their arrival at Duke, registration for both Summer and Fall semesters is done during the Spring semester. All students need to be sure to register for continuation for both Summer and Fall, and registration for the Summer should be for Summer – Full Term (not term 1 or term 2). Below we give separate registration guidelines for students according to their year as of the Fall semester.

All students must register for *Continuation* for Fall, Spring and Summer, regardless of how few or how many courses they are enrolled in.

ALL STUDENTS: Continuation for Fall AND Continuation for Summer – Term Full

Note: Chemistry graduate students normally do not register for courses during the Summer: special arrangements and permission form the Director of Graduate Studies would be required to do so. Since no doctoral level courses are offered during the summer, Ph.D. student typically do not register for classes during summer session. Tuition for any courses taken for the summer must be paid from non-departmental funds.

First Year Students: 12 units of graded courses
1 unit of CHM 377 – Research Orientation Seminar

Note: Students wishing to take courses outside the department should obtain prior approval from the Director of Graduate Studies.

First Year International Students: GS200A or GS200B as required

Second Year Students: 6 units of CHM 375 – Graded Research

Any remaining graded courses as necessary to achieve the required total of 22 units.

Note: Students wishing to take courses outside the department should obtain prior approval from the Director of Graduate Studies.

Third Year and Beyond Students Continuation every semester

B. Registration for Spring

Registration for Spring semester is done during the Fall semester.

ALL STUDENTS: Continuation

First Year Students: 8-10 units of graded courses

First Year International Students: GS200A or GS200 B as required

Second Year Students: 6 units of CHM 376 – Graded Research

Third Year and Beyond Students: Continuation every semester

DROP/ADD

Note From the Dean of Graduate Studies Office, Dr. David Bell:

The Graduate Studies office would like to emphasize the importance that all changes in course registrations should take place before the end of drop/add, which is typically 2 weeks after the first

day of classes. Any changes thereafter will be treated as course withdrawals and not drops and will thus appear on your student transcript as a W. Moreover, after the end of the drop/add period, we cannot transform audits into courses taken for credit, nor can we do the inverse. The students must make the final decision about the courses he/she are planning to take by the end of the drop/add period.

Students must also take a mandatory sequence of Responsible Conduct in Research credits, consisting of six credits in year 1 and an additional 3 RCR forums. These credits are a Graduate School requirement and completion of these credits will appear on the students' transcript. These credits do not count toward completion of the Master's or Ph.D. degree.

V. Graduate Courses in Chemistry

Provided below are descriptions for of all the chemistry graduate courses that have been approved by the Graduate School and that appear in the Bulletin of the Graduate School, with the exception of special topics courses that are sometimes offered on an ad hoc basis. Due to staffing and other considerations, not all of these courses are offered every semester, and courses listed as Fall courses may some time be given in the Spring, and vice versa. Students should contact the DGS office to find out which courses will be offered in a given semester.

Graduate chemistry courses at UNC-Chapel Hill can be found at:

<http://www.chem.unc.edu/courses/>

Graduate courses at NC State University can be found at:

http://www2.acs.ncsu.edu/reg_records/crs_cat/CH.html

Full Semester Courses (4 units each) * indicates courses taught in Fall 2011

301. Analytical Chemistry. Fundamental considerations of chemical measurements, optical spectroscopy, mass spectrometry, and separation methods.

311. Biological Chemistry. Chemistry of the major classes of biological molecules, including nucleic acids, amino acids and proteins, carbohydrates and lipids. Topics to be covered include structure, reactivity and synthesis, and the interaction of biological molecules.

**307. Biosensors.* Biosensors are defined as the use of biospecific recognition mechanisms in the detection of analyte concentration. The basic principles of protein binding with specific reference to enzyme-substrate, lectin-sugar, antibody-antigen, and receptor-transmitting binding. Simple surface diffusion and absorption physics at surfaces with particular attention paid to surface binding phenomena. Optical, electrochemical, gravimetric, and thermal transduction mechanisms which form the basis of the sensor design.

312. Chemistry and Biology of Nucleosides, Nucleotides and Nucleic Acids. Synthesis, biosynthesis, and reactivity of nucleic acids and their polymers. Mechanisms of DNA and RNA coding, decoding, transmission and in vitro evolution. Covalent and reversible interactions of nucleic acids with small molecules and macromolecules.

** 318. Chemical Biology.* The application of chemical concepts and methods to solving problems in molecular and cell biology, with emphasis on the use of small molecules to elucidate and control information transfer in biological systems. Provides relevant background on both useful chemical tools and new biological targets.

*321. *Inorganic Chemistry*. A survey of the physical methods used to probe the electronic, magnetic and geometric structure of inorganic compounds, with particular emphasis on examples from bioinorganic chemistry. Topics include group theory, vibrational spectroscopy, electronic spectroscopy, magnetism, epr, Mossbauer and X-ray crystallography.

*331. *Organic Chemistry*. Bonding and structure, stereochemistry, conformational analysis, substitution, addition, and elimination reactions, carbon reactive intermediates, concerted reactions, photochemistry, carbon alkylation, carbonyl addition, nucleophilic substitution, electrophilic additions, reduction, cycloadditions, rearrangements, main group organometallics, oxidation.

332. *Organic Synthesis*. Synthetic Design, retrosynthetic analysis, synthetic methods, total syntheses.

334. *Physical Organic Chemistry*. Reactive intermediates: carbocations, carbanions, carbenes, radicals, photochemistry. Prerequisite: Organic Chemistry 331.

336. *Bioorganic Chemistry*. Basic enzymology, mechanisms of enzymatic reactions, cofactors, oxidoreductases, C1 chemistry, carbon-carbon bond formation, carboxylation/decarboxylation, heme, pyridoxal enzymes, thiamine enzymes. Prerequisite: Biological Chemistry 311 or equivalent.

*341. *Quantum Chemistry*. Foundations and approximate methods in quantum chemistry, with an emphasis on their applications to molecular structure and modeling.

342. *Quantum Mechanics*. Quantum Mechanics with special emphasis on chemical applications. Topics included are: linear algebra, the uncertainty relations, angular momentum, perturbation theory, time-dependent phenomena, molecules in electromagnetic fields, group theory, and electron correlation. Prerequisite: Quantum Chemistry 341 or permission of instructor.

*344. *Statistical Mechanics*. Fundamentals of quantum and classical statistical mechanics using the ensemble approach. Introduction of modern techniques and applications including the renormalization group treatment of phase transitions and linear response theory of time-dependent statistical mechanics. Prerequisite: Chemistry 343 or consent of instructor.

346. *Biophysical Chemistry*. The interrelationships between structure, function, and mechanisms of biological macromolecules. Principles of dynamics, including kinetics, reactivity and transport, and structure, including thermodynamics, NMR, fluorescence, and CD spectroscopy.

Half Semester Courses (2 units each) * indicates courses taught in Fall 2011

302. *Spectrochemical Analysis*. Advanced topics in spectroscopic analysis, emphasizing absorption, emission and luminescence techniques and applications to biomolecules. Prerequisite: Analytical Chemistry 301 or permission of instructor.

304. *Separation Science*. Fundamental separation chemistry, practical aspects of chromatographic methods, larger scale processes. Prerequisite: Analytical Chemistry 301 or permission of instructor.

306. *Biomolecular Mass Spectrometry*. Advanced topics in the mass spectral characterization of biopolymers with an emphasis on protein and DNA analysis. Fundamental and practical aspects of the ionization processes and the instrumentation associated with MALDI- and ESI-mass spectrometry will be discussed along with applications of these techniques to structural problems in chemistry and biochemistry. Prerequisite: Analytical Chemistry 301 or permission of instructor.

314. *Chemical Genomics*. Information transfer, restructuring and decoding in biological systems. Gene expression and evolution of function. Functional consequences of gene expression.

316. *Techniques in Biochemistry*. Purification and study of biological molecules, including macromolecules. Chromatography, spectroscopy (IR, UV/vis, fluorescence, CD), electrophoretic methods, immunological methods, analytical ultracentrifugation and their application to the study of biomolecules.

320. *Physical Methods in Inorganic Chemistry*. Physical methods to be covered include paramagnetic NMR, EPR, magnetism, NQR, Mossbauer spectroscopy, photoelectron spectroscopy, and x-ray analysis.

322. *Chemical Applications of Group Theory, Including Spectroscopy*. Topics to be covered include symmetry, point groups, group theory, character tables, electronic absorption spectroscopy, infrared spectroscopy, Raman spectroscopy, and microwave spectroscopy.

324. *Bioinorganic Chemistry*. Topics to be covered includes metal activated enzymes in hydrolysis, oxygen carriers, nitrogen fixation, iron storage and transport, photosynthesis, protein electron transfer, and DNA mediated electron transfer.

326. *Inorganic Reaction Mechanisms*. A discussion of the mechanism of reactions of coordination compounds and transition metal organometallics in solution. Examples include ligand substitution, isomerisation and redox reactions, catalysis, and linear free energy relationships.

328. *Synthesis and Synthetic Methods in Inorganic/Organometallic Chemistry*. A discussion of inorganic synthetic methods including supramolecular chemistry and organometallic reactions

329. *Special Topics in Inorganic Chemistry*. Lectures, oral reports, and discussions on advanced topics and recent advances in the field of inorganic chemistry. Topics may include: bioinorganic chemistry, fluxional molecules, homogeneous catalysis, synthesis and properties of selected groups of compounds, and new physical methods.

333. *NMR*. Structural elucidation of organic and inorganic compounds by NMR. Fundamentals of data acquisition (pulse sequences, detection), multi-dimensional techniques, study of dynamic processes and their application to the determination of structure.

336. *Bioorganic Chemistry*. Basic enzymology, mechanisms of enzymatic reactions, cofactors, oxidoreductases, C1 chemistry, carbon-carbon bond formation, carboxylation/decarboxylation, heme, pyridoxal enzymes, thiamine enzymes.

338. *Organometallic Chemistry*. Bonding, electron counting and structure. Ligand substitution, oxidative addition/reductive elimination, transmetallation, CO and olefin insertion, beta-hydride elimination, metathesis and attack on coordinated ligands. Cross-coupling, Heck coupling, catalytic hydrogenation, olefin polymerization, carbocyclization, hydroformylation and related carbonylation chemistry Wacker oxidation. Transition metal carbene complexes, transition metal oxo complexes.

342. *Quantum Mechanics*. Special emphasis on chemical applications. Topics include: linear algebra, the uncertainty relations, angular momentum, perturbation theory, time-dependent phenomena, molecules in electromagnetic fields, group theory, and electron correlation.

*343. *Statistical Thermodynamics*. Introduction to statistical thermodynamics, with an emphasis on ideal systems and selected model approaches to more complex systems, e.g. lattice models.

345. *Kinetics*. The phenomenology and theory of chemical dynamics and reaction rates.

*348. *Solid State and Materials Chemistry*. Introduction to the structure, physical and electronic properties of solid-state materials.

Variable Credit Courses * indicates courses taught in Fall 2011

315. *Advanced Biomedical Imaging Seminar*. For grad students in BME, Chem, MSTP focusing on imaging from three distinct perspectives: (i) technology (x-ray based, magnetic resonance, optical, and sonographic modalities), (ii) design and synthesis of imaging probes (cellular, vascular, targeted probes), and (iii) imaging paradigm (anatomical, functional, metabolic, etc.).

333. *Nuclear Magnetic Resonance*. Structural elucidation of organic and inorganic compounds by NMR. Fundamentals of data acquisition (pulse sequences, detection), multidimensional techniques, study of dynamic processes and their application to the determination of structure.

338. *Organometallic Chemistry*. Bonding electron counting and structure. Ligand substitution, oxidative addition/reductive elimination, transmetallation, CO and olefin insertion, beta-hydride elimination, methathesis and attack on coordinated ligands. Cross-coupling, Heck coupling, catalytic hydrogenation, olefin polymerization, carbocyclization hydroformylation and related carbonylation chemistry, Wacker oxidation. Transition metal carbene complexes; transition metal oxo complexes.

339 A/B. *Special Topics in Organic Chemistry*. Advanced topics and recent developments in organic chemistry.

346. *Biophysical Chemistry*. The interrelationships between structure, function, and mechanisms of biological macromolecules. Principles of dynamics, including kinetics, reactivity and transport, and structure, including thermodynamics, NMR, fluorescence, and CD spectroscopy.

349 A/B. *Special Topics in Physical Chemistry*. Advanced topics and recent developments in physical chemistry.

*375. *Research*. Instruction in methods used in the investigation of original problems. Individual work and conferences. Each student's advisor submits grades on student lab work and research to the DGS.

376. *Research*. Instruction in methods used in the investigation of original problems. Individual work and conferences. Each student's advisor submits grades on student lab work and research to the DGS.

379. *Special Topics in Professional Development*. Representative topics include ethics, communication (oral and written), preparation for career in college teaching, preparation for a career in chemical industry, preparation for career in government.

VI. Useful Web Links for Graduate Students

A. General Links

The Graduate School

<http://www.gradschool.duke.edu>

Graduate Student Affairs

<http://www.gradschool.duke.edu/gsa>

Graduate and Professional Student Council

<http://gpsc.duke.edu/>

Standards of Conduct

<http://gradschool.duke.edu/academics/standards/index.php>

Academic Integrity Council

<http://www.integrity.duke.edu>

Responsible Conduct in Research

http://gradschool.duke.edu/academics/degree_reqs/rcr/index.php

Citing Sources and Avoiding Plagiarism

<http://www.lib.duke.edu/libguide/citing.htm>

Guide for the Preparation of Theses and Dissertations

<http://gradschool.duke.edu/academics/theses/index.php>

Career Center

<http://www.studentaffairs.duke.edu/career>

Registrar's Office

<http://registrar.duke.edu>

Bursar's Office

<http://finance.duke.edu/bursar/>

Bursar's Office: Payroll Deduction

<http://www.bursar.duke.edu/Payments/index.php#pd>

Housing Administration

<http://www.studentaffairs.duke.edu/rlhs>

Safety

<http://www.safety.duke.edu>

Duke Student Health Service

<http://www.studentaffairs.duke.edu/studenthealth>

B. Links for International Students

International House

<http://www.studentaffairs.duke.edu/ihouse>

Visa Services

<http://www.visaservices.duke.edu/>

English for International Students

<http://www.duke.edu/web/eis>

C. Interdisciplinary Programs and Centers

Structural Biology and Biophysics

<http://sbb.duke.edu/>

Pharmacological Sciences (PSTP)

<http://pharmacology.mc.duke.edu/grad/PSTP%20Program.htm>

Integrated Toxicology

<http://www.duke.edu/web/toxicology/>

Biomolecular and Tissue Engineering

<http://bte.egr.duke.edu/>

Biologically Inspired Materials and Material Systems

<http://www.cbimms.duke.edu/>

Bioinformatics & Computational Biology

<http://www.genome.duke.edu/CBB/certificate/>

Bioinformatics and Genome Technology

<http://www.genome.duke.edu/>

Computational Science and Engineering

<http://www.cs.duke.edu/>

APPENDIX I

Registration Procedure and Information

The Assistant to the Director of Graduate Studies will manually open your registration each semester, once you have emailed a request to her office. It must be manually open for you each semester. You can access ACES at the URL: <http://www.registrar.duke.edu/index.html>. Instructions on how to register for courses can be found on the chemistry website at: <http://www.chem.duke.edu/graduates/registration.php>.

Make sure you have emptied your book bag.

FAQ: <http://www.registrar.duke.edu/registrar/studentpages/student/acesinfo.html>

DROP/ADD Rules

It has been emphasized the importance of making all course registration changes before the end of the drop/add period. The Dean's office will be very strict in respecting the drop/add cutoff date which is **September 9 at 5:00 p.m.** for the Fall 2010 semester. All changes in course registrations should take place before the drop/add. Any changes thereafter will be treated as course withdrawals (WP or WF) and not drops and will thus appear on the student's transcript. Moreover, after the end of the drop/add period, you cannot transform audits into courses taken for credit, nor can the Dean's office do the inverse. Students must make their final decisions about the courses they are planning to take by the end of the drop/add period on **September 9**.

Late Registration Fee:

You will be charged a \$25.00 late fee if you do not register by the deadline.

APPENDIX II

Scheduling for a Ph. D. or Master's Examination in Chemistry

1. At the start of each semester the Asst. to the DGS will have a meeting to go over all scheduling and policies related to Doctoral and Master's Examination for that semester.

In the event you *must replace or change a committee member*, you should first consult with your Research Advisor and obtain approval from both the advisor and the substitute committee member. You should then submit to the DGS office a letter explaining the reasons for the change and indicating the professor who has agreed to serve as a substitute on your committee. The DGS office will then submit a Change of Committee Request form to the Graduate School for approval by the Associate Dean of the Graduate School

2. To schedule a room for your seminar, contact the DGS Assistant office Caroline Morris at caroline.morris@duke.edu or 919-660-1503 to request a room reservation.

3. The Director of Graduate Studies office coordinates reservations for conference rooms. The Assistant to the Director of Graduate Studies will assist you in reserving one of the conference rooms for the question/answer part of your examination. (3 hours needed)

4. The DGS Asst. will then send an e-mail confirming your examination with your committee and will complete and submit the necessary announcement to the Graduate School. If you have a change in committee, you must notify the DGS office in writing at least two weeks prior to your exam or before your dissertation can be approved by the Graduate School. Failure to do so could possibly void the examination.

5. You must file for Degree Completion on ACES early in the semester during which you plan to complete degree requirements:

http://gradschool.duke.edu/academics/grad_deadlines.php

If there are any questions, please contact Dean David Bell's office at the Graduate School.

The Director of Graduate Studies Office will submit the signed Final Examination Ph.D. form or the Master's Form to the Graduate School after the examination form has been submitted. This form is required in order to get your Ph. D. or Master's signature card. (The signature card is usually given to the student upon having his/her dissertation's format checked).

Upon leaving Duke Chemistry Department you must go to complete a check-out form, provided to you by either the Asst. to the DGS or Janet Rosenthal. This form is also found in the back of the Use of Research Facilities Handbook.

***NOTE: So that the committee members will have sufficient time to read the dissertation carefully, it must be submitted to the examining committee no later than two weeks before the scheduled final examination.**

APPENDIX III

A Statement Concerning Ph.D. Dissertations in Chemistry

The Duke University Graduate Bulletin describes the Ph.D. dissertation* as a mature and competent piece of writing, embodying the results of significant and original research. Other material available from the Graduate School and items from Chemistry Department files indicate that the style of a dissertation should be that of a recognized chemical journal such as the Journal of the American Chemical Society.

It is conspicuous that these sources avoid any prescription as to content, length, and broad organization of a dissertation. It can be argued with some force that such a statement would be superfluous. A well-honored understanding about the broad outline and general content of a dissertation already exists because the educational aims of writing it are widely accepted. Indeed, the consensus on this point is a very old one and can be assumed to be as international in scope as the Western scholarly community. Thus, the Graduate School finds the phrase "a mature and competent piece of writing" sufficient to recall the common understanding.

Was the tradition not viable and enduring, a detailed description of a dissertation in chemistry and other fields would probably be desirable to guide the student.

Considering the situation in chemistry, a comparison with the quite different situation that prevails with regard to the graduate chemical curriculum is instructive. The curricula and the accompanying requirements for a Ph. D. reflect the changing nature of chemistry; differences in educational preparation of entering graduate students, and even changes in educational philosophy.

By implication, the dissertation is a constant factor in the Ph.D. program. Should it be? Can the function presently served by the writing of a dissertation be better performed in other ways? It will be argued that in only exceptional cases will other paths be equally fruitful.

Of the educational goals to be realized by the writing of a dissertation two stand out:

1. Education of the student in the area of organizing questions, ideas, and data relating to a particular problem in a fashion that will: (a) facilitate the candidate's critical appraisal of his/her experimental data and methods, (b) assist him/her in developing an understanding of the new ideas and understandings implicit in his/her work, (c) help him/her to identify the logical steps to be taken next to extend the grasp of the subject already won.
2. Collection in a permanent document, for the education of scholars who will follow, a detailed account of the research and study of the candidate that presents: (a) the background of his/her problem, (b) the student's experimental strategies and procedures and (c) his/her data (d) the conclusions drawn from the investigations and study, insights developed, and such speculative comments as seem desirable.

The rapid pace of scientific communication today encourages preparation of journal papers at as early a stage of research as seems justified. How should such documents relate to the dissertation requirement? If the candidate prepares such papers, the first goal listed above will be met. To meet the second goal it is proposed that accepted manuscripts or reprints may properly be considered a part of a dissertation.

- Conventional usage will be followed. Thus, a “dissertation” is a document prepared by a Ph.D. Candidate and a “thesis” is the document in which a M. S. candidate describes the research he/she has completed.

The Graduate School requirements concerning style must, of course be followed. It may often still be desirable to add an introductory section and to expand the discussion tersely presented in the paper(s). It would be essential to report all “unpublished” data and to discuss experimental procedures and designs in sufficient detail that a clear account is left for others who will follow.

Finally, it should be noted that the route of paper writing is undoubtedly reserved to the select few. Research directors write most research papers, a process that in no way meets the goals set forth for the dissertation. It also seems likely that one or a set of student written theoretically oriented papers might well be a dissertation. In this case addenda might well be superfluous.

APPENDIX IV

Payment of Fees and Payroll Deduction

Graduate students serving as teaching assistants are supported with funds from the university and their fees (continuation, health, etc) and tuition are paid by the department directly to the university and are not included as part of the monthly “living” stipend check. Students supported on research assistantships are usually funded through federal research grants, which cover both the “living” stipend and funds to pay continuation and other fees. Some minor fees such as Student Activity and Transcript fee, plus parking or other bills on your account should be paid through payroll deduction. More information and forms for setting up payroll deductions are available at the Bursar’s Office web-site at <http://finance.duke.edu/bursar/Payments/index.php>.

US citizens and permanent residents may be eligible to take advantage of certain education-related tax deductions or credits, like the Lifetime Learning Credit, which may significantly reduce or even eliminate any tax burden associated with stipends. More information about these tax issues can be found at the Bursar’s Office web-site at <http://finance.duke.edu/bursar/TaxInfo/index.php>.

Paychecks

If you are a Research Assistant you will receive a paycheck on the 25th of the month. Teaching Assistants received 2/3 of their paycheck on the 25th and the remainder on the last business day of the month. If you are on a fellowship provided by Chemistry or any other department at the University you will receive a paycheck on the last business day of the month.

APPENDIX V

Master's Program General Information

General:

Although the department does not consider applications from potential graduate students seeking a Master of Science as the terminal degree, MS degrees are typically granted in the department each year. Students enter the Master's program by one of two general routes. The first is by the action of the department, and as such is an indication that there are serious reservations on the part of the faculty concerning the likelihood that a student will successfully complete the requirements for the Ph.D. Such a decision may occur at the end of the student's first year in residence and as such would be based largely on performance in the first year course work. It is also possible that based on a student's performance at one of his/her oral examinations, usually the Preliminary Examination, a student's supervisory committee might conclude that placement in the Master's program is an appropriate action. Alternatively, a graduate student may voluntarily decide to withdraw from the Ph.D. program and be placed in the Master's program. Reasons for such a decision are varied, but may include a change in career plans or any variety of non-professionally related personal reasons.

A departmental decision to place a student in the Master's program will usually include a recommendation that the student pursue either a terminal Master's degree, with no possibility for reinstatement to the Ph.D. program, or in rare instances a non-terminal Master's degree, with a final decision concerning reinstatement being deferred until after the Master's thesis defense, and usually dependent on several conditions previously established by the student's supervisory committee, the DGS, and the grad school.

Program and Registration:

Specific Graduate School requirements for the Master's degree can be found in the Bulletin of Duke University, Graduate School, and should be read with care by all students entering that program. A key feature of the MS degree is that a minimum of 30 units of registration be obtained before completion of the degree. Of these, at least 24 must be taken for a grade. There are often questions concerning the most appropriate way for a Master's student to obtain the required 24 units of graded work. Most students should have completed 20 to 22 units of graded coursework during the first year as part of the Ph. D. program, and the remainder of the required units can normally be made up through graded research credits in the second year. Any student contemplating a voluntary switch to the Master's program should anticipate these particular Master's registration requirements and carefully plan his/her various semester registrations. For this reason the department recommends that all students register for 6 units of graded research (CHM 375) in the Fall semester of his/her second year and 6 units of graded research (CHM 376) in the Spring semester of his/her second year. Nothing is lost by this action although some later difficulties may be avoided.

Support:

Any departmental action, which places a student in the Master's program, is usually accompanied by a recommendation concerning future financial support. For instance, a student placed in the Master's program at the end of the first year may be offered support (tuition, fees, stipend) through the second year of residence. It is expected that this support will be sufficient to complete the course work, research, and thesis defense for the Master's degree. Students placed in the Master's program after the end of the first year may expect to be supported for up to one additional year

from the time of the departmental action, sufficient time to complete the necessary requirements. Any student who voluntarily enters the Master's program before the end of his/her second year of residence will continue to receive support through August of his/her second year but not thereafter. It is thus important that students contemplating such a change plan their course registrations in such a way as to maximize the available support. The support of any student voluntarily entering the Master's program after his/her second year will be terminated as soon as practicable, but certainly not later than the end of the semester in which the decision was made. This action is not intended to be punitive. Rather, it is consistent with the department's central mission, the training of Ph.D. level chemists, a policy reflected in initial departmental admissions decisions.

APPENDIX VI
Fourth Year Propositional Examination
Pre-Proposal
(Due August 1)

Student Name: _____

Advisor Name: _____

Reviewer Name: _____

Working Title:

Hypothesis/Topic (~75 words):

Methodology/Approach (~100 words):

Significant/Importance (~25 words):

Research Advisor Approval: I have reviewed the above pre-proposal and verify that it is sufficiently removed from the student's dissertation research.

Signature

APPENDIX VII

Chemistry Department Accident Insurance Policy and Medical Coverage

As per Graduate School policy, injuries incurred during the course of TA responsibilities are covered by Worker's Compensation. Injuries incurred during the performance of any other student activities (research, studying, etc.) are covered by the student's insurance, including the required Health Fee as well as supplemental health insurance for injuries that cannot be fully treated through the Duke Student Health Center. All full-time students and part-time degree candidates are required to enroll in the this supplemental insurance policy unless they show evidence that they are covered by other generally comparable insurance. See the Graduate School Bulletin for further details on the Student Health Program and Health Insurance.

For more details go to: <http://www.studentaffairs.duke.edu/studenthealth>

APPENDIX VIII

Duke University Graduate School

Childbirth and Adoption Accommodation Policy for Ph.D. Students at Duke University

Revision Date: September 29, 2008

Purpose

To allow the primary caregiver of a newborn child or a newly adopted child the possibility to devote full time care to an infant or an adopted child in the first weeks after birth or adoption. This policy guarantees PhD students *a minimum level of accommodation* during the transition to parenthood and reflects the Graduate School's ongoing commitment to supporting graduate students parents and a healthy academic work/family live balance.

Individual departments and degree programs have the discretion and are encouraged to exceed these guidelines where possible and appropriate. It is clear that the variety of PhD student academic requirements and responsibilities in different degree programs will have an impact on how those programs structure any accommodation beyond the minimum level required by the Graduate School. Programs have the flexibility to devise accommodation arrangements that correspond to what is possible and necessary in a given degree program context, provided the minimum accommodation is afforded.

Policy

The designated primary caregiver will be relieved of full-time graduate studies and duties for up to seven weeks after the birth or adoption of a child. If need be, up to two of those weeks may be situated before the projected birth or adoption date. The non-primary care giving parent may be relieved of one week of full-time graduate studies and duties in order to provide additional support to the primary caregiver.

Eligibility

In order to be eligible for accommodation, the designated primary care giver or the parent who is not the primary caregiver must

- 1) have been matriculated into a PhD program at Duke University;
- 2) be in good academic standing.

Note: If both parents are Duke PhD students, they may discuss with their respective degree programs and the Graduate School a feasible proposal for dividing up the eight week accommodation period in a different way if they so wish.

Accommodation Principles

1) **Enrollment Status:** PhD students benefiting from accommodation will remain registered as full-time students, and thus their eligibility for graduate student benefits remains intact (insurance, housing eligibility, student services, and the like). Eligible students who are also receiving stipend support would continue to receive that support.

2) **Suspension of Academic Requirements and Duties:** PhD students benefiting from accommodation are relieved of full-time academic and program responsibilities, such as the following: teaching assistant or research assistant duties, official academic examinations (qualifying examinations or preliminary examinations), research deadlines, coursework.

- a. Any scheduled coursework or examinations should be rescheduled as appropriate to avoid conflicts with the accommodation period and to provide reasonable time to complete these academic requirements.
 - b. The department or degree program will develop a plan to replace necessary duties and responsibilities, such as teaching and research. The Graduate School expects that the department or program will demonstrate the maximum flexibility possible.
- 3) The Graduate School will work with the department or degree program to determine expenses associated with the accommodation period and an appropriate cost-sharing arrangement with the Graduate School.
- 4) **Accommodation is not a leave of absence**, and the expectation is that the PhD student benefiting from accommodation will remain engaged in her or his academic and research work even if at a reduced level (assuming the good health of the student and the infant or child).

Funding

Eligible students who are receiving stipend support would continue to receive that support during the accommodation period. If a student is funded through a training or research grant the external sponsor will be expected to continue to pay the stipend to the extent allowable by the granting agency.

The department or degree program will develop a plan to replace necessary duties and responsibilities, such as teaching and research. Any additional costs incurred by the department or program due to replacement of compensatory work will be funded through the Graduate School. However, accommodations for students in Arts & Sciences and Engineering departments that have a surplus in their carryover bank will be funded through the bank.

Procedure

Requesting Accommodation

PhD students seeking accommodation should inform their department or program (normally through their Director of Graduate Studies) and the Graduate School office **in writing** no later than one month prior to the semester during which birth or adoption is expected to take place so that departments and programs can have adequate time to plan any necessary replacement needs.

The written request must indicate the 'expected' birth or adoption date.

Students will be expected to obtain the signature of their Advisor and Director of Graduate Studies, prior to submitting this form to the Senior Associate Dean, Academic Affairs for final approval.

If funding source changes are required, the Senior Associate Dean for Academic Affairs will notify the Office of Budgets and Finance to adjust student funding source accordingly.

Related Links

NIH Parental Leave Policy for Ruth L. Kirschstein NRSA Awards

<http://grants1.nih.gov/grants/guide/notice-files/NOT-OD-08-064.html>

Request for Childbirth and Adoption Accommodation

Students who wish to enact the provisions of the Childbirth and Adoption Accommodation Policy are asked to complete the following form. Upon approval from the Dean of the Graduate School, students will be entitled to maintenance of full-time student status, suspension of academic responsibilities, and continued stipend support.

Please submit this form at least one month prior to the beginning of the academic semester in which you will begin the leave period.

Completed forms should be submitted to the Senior Associate Dean, Academic Affairs, Graduate School, Box 90065, Suite 127 Allen Building or Faxed to 919-684-2277.

(Please estimate the start of your requested accommodation period and then adjust/confirm after the actual birth/adoption. Students are eligible to begin the accommodation period up to two weeks prior to birth or adoption date if they wish.)

Last Name: _____ First Name: _____ Middle: _____

Address: _____
(street apt. city, state, country postal code)

Phone: _____ Unique ID: _____ Department: _____

Admit Term: _____
I am requesting policy coverage beginning _____
(month/day/year)

Stipend funding source (To be completed by the Directory of Graduate Studies)

Advisor (indicating that the student has discussed revised completion schedule)
Signature: _____ Date: _____

Director of Graduate Studies (departmental approval indicating good academic standing)
Signature: _____ Date: _____
Senior Associate Dean, Academic Affairs, Graduate School

Signature: _____ Date

APPENDIX IX

Phi Lambda Upsilon (PLU)

Phi Lambda Upsilon (PLU) is a national Honor Society for Chemists that promotes high scholarship and original investigation in all branches of pure and applied chemistry. The Alpha Pi chapter at Duke University has existed on campus since 1944. PLU provides numerous academic and social activities for the entire chemistry department, including graduate students, undergraduate students, post-docs and faculty, in order to facilitate interdepartmental interactions and collaborative scholarship. Some examples of PLU activities include lectures by invited academic and professional speakers, department picnics, town hall meetings, outdoor Summer activities, and recruitment and orientation of new graduate students. In addition, PLU members are eligible to receive student travel grants from the national office to present a poster or an oral presentation at a national meeting.

All incoming graduate students are eligible for membership upon arrival at Duke and will have their initiation fees paid for by the department. The primary goal of the Alpha Pi chapter of PLU is to continuously improve the graduate school experience in the chemistry department at Duke, and so we invite you to bring any questions or concerns to 2011-2012 Officers:

President	Robert Harris
Vice-President	Degao Peng
Treasurer	Mary Glesner
Secretary	Yifei Wang

2011-2012 PLU Contact Information:

Robert Harris (Widenhoefer group)

2133 FFSC

919-660-1504

robert.j.harris@duke.edu

Degao Peng (Yang group)

5301 FFSC

919-660-1583

degao.peng@duke.edu

Mary Glesner (Therien group)

5324 FFSC

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Yifei Wang (Craig group)

2244 FFSC

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yifei.wang@duke.edu