

***A Guide to Doctoral Study
in the
Photochemical Sciences***

2015-2016

***Center for Photochemical Sciences
Bowling Green State University
Bowling Green, Ohio***

Table of Contents

Student Responsibilities 3

Program Coordination 4

Requirements for the Ph.D. 5

Ph.D. Timeline 8

Academic Honesty..... 11

English Requirement 12

Center Principal Faculty 14

Student Responsibilities

Welcome to Bowling Green State University and the Center for Photochemical Sciences. You have been selected for the Ph.D. program in Photochemical Sciences because of your outstanding record and potential to carry out graduate study at the highest level. The next years will be among the most challenging and rewarding times of your life as you work towards your doctoral degree in photochemical sciences.

Graduate students have certain responsibilities to uphold. Following are the major responsibilities of doctoral students in the Center for Photochemical Sciences:

Teaching

Graduate teaching assistants have teaching assignments during the academic year and during the summer. When classes are in session, students **MUST** be present to fulfill teaching assignments. Personal plans should not be made until students are assigned these teaching responsibilities.

Research

After the first academic year of the graduate program, students have a responsibility to complete their research projects. Students report directly to their dissertation advisor and any special arrangements must be approved by their advisor. Personal plans should not be made without advisor approval.

Courses

Students are responsible for completing the required courses for the degree. This includes the W. Heinlen Hall Lecture Series in the summer. Personal plans should not be made until the dates of the Hall Lecture Series are known.

Vacation

No vacation is allowed when classes are in session (this includes summer), when conducting research, and during the Heinlen Hall lecture in the summer.

Permission to take vacation must be approved by your advisor. Your vacation request should be submitted in writing to your advisor with a copy of your request submitted to the Chemistry Graduate Studies office. Failure to do so may result in a stipend reduction.

When the vacation has been approved, it is the student's responsibility to make sure that his/her teaching assignment is being covered and to notify the course professor of the coverage.

The Ph.D. program in the photochemical sciences is coordinated by several persons who will advise students in different capacities.

Ph.D. Coordinator

The Ph.D. Coordinator serves as the general academic advisor for all Ph.D. level students. Students entering the program will consult with the Ph.D. Coordinator about course selection and related questions (including drop/adds).

The Ph.D. Coordinator is Dr. Ksenija Glusac. Dr. Glusac's office is located in Room 211, Physical Sciences Laboratory Building. Her phone number is 372-3229 and e-mail: kglusac@bgsu.edu.

Graduate Secretary

The Graduate Secretary coordinates all aspects of the program with the exception of course work. Questions related to administrative aspects of the program should be addressed to the Graduate Secretary.

The Graduate Secretary is Hilda Miranda, and she located in the Graduate Studies Office, Room 132B, Overman Hall, and the phone number is 372-2033.

Orientation to Graduate Study

All entering students will take standard placement examinations in organic chemistry, physical chemistry, and biochemistry to assess their strengths in these areas. Students who perform above average will be placed in chemistry core courses. Students whose undergraduate preparation is incomplete will be placed into appropriate remediation courses.

Entering students, in conjunction with the Ph.D. Coordinator, will plan a program of study which will include the basic Ph.D. degree requirements and also allow the student to take courses best suited for his/her needs and interests.

Students must maintain a 3.0 cumulative grade point average to remain in good academic standing. The Center principal faculty will evaluate the overall progress of the student at the end of the first year of study. If satisfactory progress is not demonstrated, appropriate action will be taken.

Requirements for the Ph.D.

Course Requirements

The primary requirement for the Ph.D. in Photochemical Sciences is the completion of the dissertation. Course requirements are also mandated by the Graduate College. All students must take the following core courses in chemistry and the photochemical sciences: CHEM 5420, Organic Reaction Mechanisms; CHEM 5660, Spectroscopic Methods in Organic Chemistry; CHEM 6140, Quantum Chemistry and Spectroscopy; PCS 7010, Photochemistry and Photophysics 1; PCS 7020, Photochemistry and Photophysics 2; and PCS 7040, Special Topics in Spectroscopy. In addition, students are expected to participate in the weekly Department of Chemistry seminar programs and the W. Heinlen Lecture Series in the summer.

Dissertation Advisor (Fall 2015)

During the first semester, each Ph.D. student selects a member of the graduate faculty who will serve as his/her dissertation advisor. The dissertation advisor must be one of the Center principal faculty or be involved in a photochemical research project. The dissertation advisor should be closely involved in developing the student's degree program, supervising research, guiding the student through the qualification and preliminary examinations, and preparation and defense of the dissertation. Students will interview three graduate faculty members (see Appendices). This form should be returned to the Graduate Studies Office indicating preference of advisor in rank order. The Center faculty will evaluate the choices and make the final selections.

Dissertation Committee (Summer 2016)

A student's dissertation committee consists of at least four members. One member will be the dissertation advisor. The student, together with his advisor, will select two additional graduate faculty members (see form in Appendices). One of these committee members must be a principal member of the Center for Photochemical Sciences. The fourth member will be appointed by the Graduate College. The student can select additional members for his/her dissertation committee, however, his/her selection is subject to approval by the Center and the Graduate College.

The dissertation committee will evaluate the preliminary examination, supervise the research for the dissertation, and administer the final oral examination. This committee must be formally appointed by the dean of the Graduate College on the recommendation of the dissertation advisor prior to the preliminary examination taken by the fifth semester.

Qualification Examination (Fall 2016)

The qualification examination will be a 10-15 page paper that describes the research progress made through the student's first summer in the program (see Qualification Exam

Guidelines in Appendices). This paper should convey the student's knowledge of the scientific literature surrounding his/her program as well as describe the results, which have been obtained to date. In particular, the student's paper should clearly demonstrate how the student's research project relates to other work done in the field. The student's dissertation committee will administer an oral examination on this topic (see form in Appendices). The timing of the qualification examination allows students who do not demonstrate the ability to complete the Ph.D. degree an opportunity to make alternative choices about graduate study.

Preliminary Examination (Spring or Fall 2017)

The preliminary examination consists of the preparation and defense of an original research proposal where the student will be required to develop a comprehensive plan to study some problem in a related area to (but not directly with) the Ph.D. dissertation proposal (see Preliminary Exam Guidelines in Appendices). The original written proposal will be distributed to the student's dissertation committee **at least two weeks** before the scheduled oral examination. Approval of this proposal by the committee will satisfy the written examination requirement. For the oral examination, students will be required to defend this proposal in a presentation to his/her dissertation committee.

Preliminary examination application forms (see Appendices) should be submitted to the Graduate Studies Office four weeks before the exam. The student is responsible for formally notifying his/her committee of any required meeting. Each committee member must have, in hand, proposals for the preliminary exam **at least two weeks** before the exam is scheduled.

Dissertation Topic (Fall 2017)

After passing the preliminary exam, the student submits the abstract and topic of his/her proposed dissertation research to the Center. The dissertation topic approval form is then forwarded to the Graduate Studies Office (see Appendices).

Candidacy for Ph.D.

A student becomes a candidate for the Ph.D. degree after successfully completing the qualification and preliminary examinations and obtaining approval of his/her dissertation topic.

Ph.D. Dissertation

The dissertation represents a comprehensive, original scholarly work with the student as the primary contributor. In general this work will be appropriate for publication as a major article (or series of articles) in a refereed journal. The dissertation committee supervises the dissertation work. Primary supervisory responsibility rests with the dissertation advisor.

Requirements for the Ph.D.

The Graduate College specifies the form and style to be used in writing the dissertation. These are described in the **Thesis and Dissertation Handbook** available on the Graduate College web site at: [www.bgsu.edu/content/dam/BGSU/graduate-college/doc/Thesis and Dissertation Handbook_07.01.14.pdf](http://www.bgsu.edu/content/dam/BGSU/graduate-college/doc/Thesis%20and%20Dissertation%20Handbook_07.01.14.pdf).

The completed dissertation must be submitted to each member of the dissertation committee **not less than two weeks** prior to the date of the scheduled final oral examination. Failure to meet this deadline can cause the final oral examination to be rescheduled. Additional corrections to the manuscript are often required following the oral examination. Information on thesis and dissertations is available on the Graduate College web site.

Final Oral Examination

The dissertation committee will administer the final oral examination after all research is completed and the dissertation written. This examination will consist of a public oral presentation (see Appendices for ETD Approval form).

Graduation

A formal application for the doctoral degree must be filed at least 14 weeks prior to the commencement at which student expects to receive his/her degree.

Year One

Fall 2015

Graduate Record Examination (GRE Exam) - International students who have not taken the GRE prior to admission must take a computer version the first semester of graduate study.

CHEM 5660. Spectroscopic Methods in Organic Chemistry. Organic structure determination by spectroscopic techniques, with emphasis on infrared, ultraviolet, and nuclear magnetic resonance spectroscopy, and mass spectrometry.

CHEM 6140. Quantum Chemistry and Spectroscopy. Application of quantum mechanics to atomic and molecular structure and chemical bonding. Introduction to computational chemistry.

PCS 7810. Seminar in Photochemistry. Selected topics in photochemical sciences.

Dissertation Advisor - Students are required to select their dissertation advisor during the first semester in residence. Students submit advisor choice to the Center and are subject to Center approval.

Spring 2016

CHEM 5420. Organic Reaction Mechanisms. Fundamentals of organic reaction mechanisms and methods for their elucidation. Includes coverage of selected topics of physical organic chemistry, stereochemistry principles, and reactive intermediates.

PCS 7010. Photochemistry and Photophysics 1. Generation and nature of excited states. Evolution of excited states including radiative and nonradiative processes and energy transfer. Discussion of experimental techniques and modern instrumentation for characterization of excited states.

PCS 7810. Seminar in Photochemistry. Selected topics in photochemical sciences.

Summer 2016

Dissertation Committee - Dissertation Committee members should be selected no later than August 2015.

CHEM 6830. Problems in Chemistry. Students must write a paper on some aspect of the Hall Lecture Series.

Ph.D. Timeline

CHEM 6900. Directed Research in Chemistry. Students must write a paper on his/her summer laboratory research.

Year Two

Fall 2016

PCS 7020. Photochemistry and Photophysics 2. Photochemical reactions with discussions of various reaction types including absorption and emission of light, intersystem crossing, energy transfer, electron transfer and symmetry rules that govern these processes. Also covered are general descriptions of many different type of photoreactions including inorganic photoprocesses, organic and organometallic photochemistry, photobiochemistry, polymer photochemistry and photoelectrochemistry applications, rules for orbital symmetry governed reactions and experimental techniques in photochemistry.

Qualification Exam - All students must complete the qualification exam during semester three in residence. The exam consists of a written portion (10-15 pages) and an oral exam administered by the student's dissertation committee.

Spring 2017

PCS 7040. Special Topics in Spectroscopy. Selected "hot topics" under a rapid advance in recent years focusing on photochemistry, photophysics, nanoscience, flash introduction to computational chemistry and photochemistry, single-molecule spectroscopy, and scanning probe microscopy. Overview of fundamental concepts and technical applications of emerging frontiers in photochemical sciences.

Preliminary Exam - Students should arrange to take their preliminary examination during the fourth semester in residence or no later than the fifth semester. Application forms should be submitted to the Graduate Studies Office four weeks before the exam. The student is responsible for formally notifying his/her committee of any required meeting. Each committee member must have the preliminary proposal, in hand, at least two weeks before the exam is scheduled.

Year Three

Fall 2017

Dissertation Topic - Students must submit their proposed dissertation abstract and topic to the Center by semester five.

Candidacy for Ph.D. - Students who have followed this timeline, passed the examinations, and had the dissertation topic approved are now candidates for the Ph.D.

Spring 2018 - No major requirements.

Year Four or Beyond

Fall 2018 - No major requirements.

Spring 2019 or Beyond

Students will finish their degree requirements at different times. The following is intended only as a general guideline. In the event the student plans to participate in University graduation ceremonies, each candidate should find an online Graduate College schedule prior to the semester of graduation.

Final Examination/Seminar - The final oral examination involves a public seminar conducted by the student's dissertation committee and faculty advisor.

Final Examination Results - The results of the examination must be submitted to the Graduate Studies Office. In the event the student wishes to participate in formal University commencement ceremonies, this must be completed six weeks before.

Dissertation Manuscript - The student is responsible for assuring that each of their dissertation committee members has a completed copy of their dissertation not less than two weeks prior to the scheduled examination date. Failure to meet this deadline can cause the final examination to be rescheduled. Additional corrections to the manuscript are often required following the oral examination. The degree requirements are not complete, however, until the final approved manuscript is submitted in pdf form electronically to OhioLINK (www.bgsu.edu/gradcoll/etd/page26501.html). In the event the student wishes to participate in commencement ceremonies, the manuscript must be finished four weeks prior.

Commencement - Formal application for graduation must be done online through MyBGSU 14 weeks prior to commencement.

Academic Honesty

Academic honesty and the honor code are important aspects of graduate education. Following are the Department of Chemistry's and the Center for Photochemical Sciences' guidelines for academic honesty and our honor system:

- During exams, quizzes and finals students are required to work by themselves with no discussion.
- Students are not to look at each others' exam papers during the exam or bring any unauthorized materials.
- Should the monitor leave the room briefly, students are expected to be on their honor to remain silent and work by themselves during an exam.
- On take-home exams, students are bound by the honor code to work independently.
- In the dissertation and any written examination or paper, students must give proper credit to sources and not copy anyone's words directly in any way that implies they are the student's original words and thoughts.
- There are some homework assignments and other projects in class where students are encouraged or required to work together with other students. If there is any doubt about working independently, students should clarify the assignment with the professor.

The University penalty for cheating on any assignment is an immediate zero score on that assignment. The Departmental penalty can be more serious, according to the nature of the infraction, and may include expulsion from the graduate program.

All students who received a bachelor's degree from an international university will be required to take English courses as part of their degree requirements. The number of courses required will depend upon the student's English placement test results taken prior to the beginning of the student's first semester of enrollment. Exemption from any of the following courses is determined by the ESOL office.

- One speaking class - ESOL 5040 (English for International Teaching Assistants I). Students scoring 20 or below on iBT TOEFL will also be required to take ESOL 5030 (Intermediate Listening and Speaking).
- One writing class – ESOL 5000 (Academic Composition I) and/or ESOL 5010 (Academic Composition II). Students must register for the writing course determined by their placement test results. During the first week of class the instructor will determine if the student has improved in his English skills and either be exempted from the writing class or moved to the next level.

Pavel Anzenbacher - Associate Professor, Chemistry: development of advanced photonic materials in supramolecular materials for molecular sensing and materials used in fabrication of flat displays; design and synthesis of new chromophore materials for applications in flat displays and development of OLED materials; design and synthesis of photosensitizers developed for photodynamic therapy of cancer (PDT). pavel@bgsu.edu

George S. Bullerjahn - Professor, Biological Sciences: regulation of nutrient-stress-inducible genes in cyanobacteria; examination of structural requirements for productive electron transport in photosynthesis by studying the protein-protein interactions occurring between the copper protein plastocyanin and its reaction partners (Photosystem I and cytochrome f). bullerj@bgsu.edu

John R. Cable - Associate Professor, Chemistry: effects of hydrogen bonding on structures of conjugated solutes; electronic spectroscopy on jet-cooled isolated molecules and their clusters with hydrogen bonding solvents. cable@bgsu.edu

Malcolm Forbes -

Ksenija D. Glusac - Associate Professor, Chemistry: Study of organocatalytic motifs for solar water splitting. The projects include: (i) electrocatalytic water oxidation using iminium cations; (ii) photocatalytic water reduction using NADH analogs; (iii) light-driven pH gradient using photoacids and photobases. The experimental techniques we use are synthesis, electrochemistry and femtosecond pump-probe spectroscopy. kglusac@bgsu.edu

Jeremy K. Klosterman - Assistant Professor, Chemistry: design and synthesis of functional supramolecular architectures focusing on: development of modular approach to control fluorophore aggregation and orientation in the solid state in order to enhance solid-state emissive properties; application of emissive organic solids towards new practical chemosensors; and combination of multiple intermolecular interactions to enable the molecular realization of mechanically linked, topologically complex structures. jkloster@bgsu.edu

Neocles Leontis - Professor, Chemistry: investigating the binding of potent photosensitizers to complex nucleic acids using biophysical and biochemical methods. leontis@bgsu.edu

H. Peter Lu - Ohio Eminent Scholar; Professor, Chemistry: conformational dynamics and reaction in proteins and protein complexes under physiological conditions and single-molecule protein conformational dynamics and reactions in living cells; inhomogeneous interfacial chemical and biological reaction dynamics in solar energy conversion, bioremediation, and environmental systems. hplu@bgsu.edu

Massimo Olivucci - Research Professor; Director, Laboratory for Computational Photochemistry, Chemistry: investigation of the reactivity of organic and biological molecules in their electronically excited states using conventional and novel computational tools. Given the central role of photochemical reaction paths and conical intersections (as well as singlet/triplet surface crossings) in the investigation of the excited state reactivity of proteins (e.g., biological photoreceptors) or solvated molecules (e.g., dyes in solution), we also develop computational strategies based on a combination of ab-initio quantum chemical methods and molecular mechanics methods that allow the study of the effects of light irradiation on complex molecular systems. molivuc@bgsu.edu

Alexis D. Ostrowski - Assistant Professor, Chemistry: development of photo-active metallosurfactant materials; development and characterization of photo-responsive compounds for selective release of caged compounds; nanoparticle synthesis and development of multi-functional materials for biological applications. alexiso@bgsu.edu

Farida Selim - Assistant Professor, Physics: diluted magnetic semiconductors for spintronics; exciton dynamics in photonic materials; wide band-gap semiconductors for optoelectronics; physics of antimatter interactions; in flight positron-electron annihilation. faselim@bgsu.edu

Liangfeng Sun - Assistant Professor, Physics: discover and investigate the novel physical and chemical properties of the materials in the nanometer scale and apply them in photochemistry, bio-imaging, light-emitting devices and solar cells. lsun@bgsu.edu

Alexander N. Tarnovsky - Associate Professor, Chemistry: development of molecular-level understanding of the dynamics of chemical reactions occurring in solution; dynamics and mechanisms of ultrafast (femto- and picosecond) photoinduced processes. atarnov@bgsu.edu

Andrew T. Torelli - Assistant Professor, Chemistry: crystallographic studies of enzymes involved in the biosynthesis of thiamin and the posttranslationally-modified histidine residue known as diphthamide. torelli@bgsu.edu

R. Marshall Wilson - Research Professor, Chemistry: laser synthesis of new materials; development of reagents for the photochemical manipulation of biological systems. rwm@bgsu.edu

Zhaohui Xu - Associate Professor, Biological Sciences: use of genetic and biochemical approaches to develop microbial systems that can be applied to environmental processes, such as remediation of hazardous substances, development of detection or monitoring systems, and production of high value products from agricultural or industrial by-products or wastes. zxu@bgsu.edu

Mikhail Zamkov - Assistant Professor, Physics: electronic, chemical and optical properties of hybrid nanoscale materials prepared with sub-nanometer precision by means of colloidal syntheses. zamkovm@bgsu.edu

Alexey T. Zayak - Assistant Professor, Physics: atomistic simulations within density functional theory (DFT) using advanced electronic structure software for computing crystalline or molecular properties to understand basic mechanisms in materials chemistry and directly compare theory with experimental data. azayak@bgsu.edu