University of Utah

# **DEPARTMENT OF MEDICINAL CHEMISTRY**

# <u>GUIDELINES FOR</u> GRADUATE STUDY

# 2010-2011

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# 1 GUIDELINES FOR GRADUATE STUDY AND GRADUATE SCHOOL PROCEDURES

#### FIRST YEAR - Fall and Spring Terms

- ! Register for 11 credit hours per term (required and/or elective course work, plus any remaining hours in MD CH 7970). See the Departmental Graduate Office regarding specific subsections of this course.
- ! Register for Seminar (MD CH 7890, 1 credit hour per term); see Chapter 5.
- ! Do a maximum of three lab rotations in different laboratories of your choice. See Chapter 4.
- ! Choose your dissertation advisor and begin dissertation research.
- ! Discuss supervisory committee composition with your advisor.

#### FIRST YEAR - Summer Term

! Register for 3 credit hours in MD CH 7970. See the Departmental Graduate Office regarding specific subsections of this course.

#### SECOND YEAR - Fall and Spring Terms

- ! If you have not selected a dissertation advisor and formed a supervisory committee, do so before the end of the Fall Term.
- ! Register for 11 credit hours per term (required and/or elective course work, plus any remaining hours in MD CH 7970).
- ! Register for Research Seminar each term (MD CH 7890, 1 credit hour), and give a "Research-in-Progress" report one time during the academic year (see Chapter 5).
- ! Continue dissertation research.
- ! Formulate Supervisory Committee of 5 members (composition: 3 or 4 Medicinal Chemistry faculty, including advisor, plus 1 or 2 outside faculty as members; Research and Adjunct faculty may be members but may not act as Chair, with the exception of Professor Jones).

- ! Obtain "Request for Supervisory Committee Form" from Graduate School website; return draft to Departmental Graduate Office for final copy preparation and signatures. <u>http://www.gradschool.utah.edu/students/forms/supervisory.pdf</u>
- ! Take the Preliminary Examination as detailed in Chapter 6. This includes defense of the research proposal before an Examination Committee; this represents the oral qualifying examination. Send a memo to Supervisory Committee members, as well as the Departmental Graduate Office, outlining date/time/place of the meeting.
- ! When the supervisory committee approves the oral defense, you will submit to the Departmental Graduate Office the "Report of the Qualifying Examination for the Ph.D. ..." with committee signatures. http://www.gradschool.utah.edu/students/forms/doctoral/gualifying.pdf

## STUDENTS ENTERING THE DEPARTMENT IN YEAR-2

Students transferring into the Department of Medicinal Chemistry at the close of their first year in one of the Interdepartmental Graduate Programs: your procedures are identical to those described above for the SECOND YEAR, assuming that two conditions have been met.

- (1) You have previously done a research rotation in a Medicinal Chemistry faculty lab and have selected a dissertation advisor.
- (2) You have completed the core courses offered by the respective program in your first year, and you are not on academic probation (GPA below 3.0).

If either of these conditions has not been met, consult with the departmental Graduate Advisor, Dr. Darrell Davis.

#### SECOND YEAR - Summer Term

- ! At the start of Summer Term non-resident U.S. Citizens must apply for Utah residency, once you have accumulated 40 credit hours. This includes acquiring Utah registration for your vehicle.
- ! Register for 3 credit hours in MD CH 7970. See the Departmental Graduate Office regarding specific subsections of this course.

#### THIRD YEAR - Fall and Spring Terms

- ! Register for 11 credit hours per term (required and/or elective course work, plus any remaining hours in MD CH 7970).
- ! Register for Seminar (MD CH 7890, 1 credit hour per term), and give a "Research-in-Progress" presentation one time during the academic year.
- ! Hold initial Supervisory Committee meeting to outline your research project and to obtain approval of course work, if this was not done following your Preliminary Examination in the second year. Send memo to supervisory committee members, as well as the Departmental Graduate Office, outlining date/time/place of the meeting. Further details are in Chapter 6.
- ! Continue dissertation research.
- ! Normally, the one-semester requirement for a Teaching Assistantship is fulfilled during the third or fourth year.

## THIRD YEAR - Summer Term

! Continue dissertation research. Register for 3 credit hours in MDCH 7970.

## **REMAINING YEARS**

- ! Register for 11 credit hours per term including MD CH 7890: Seminar, MD CH 7970 is to be attended, but DO NOT register for it. (Based on TBP eligibility)
- ! Give one "Research-in-Progress" presentation each year.
- ! Continue/complete dissertation research.
- ! Hold Supervisory Committee meetings every nine to twelve months. Send a memo to all Supervisory Committee members, as well as to the Departmental Graduate Office, outlining date/time/place of the meetings. Following each meeting file the current version of the Graduate Student Progress form, which you took to the meeting, with the Departmental Graduate Office.
- ! One term but no earlier than one year before graduation submit a completed "Program of Study for Ph.D. ..." to the departmental graduate office, with appropriate signatures. The department will then submit this form to the Graduate School. <u>http://www.gradschool.utah.edu/students/forms/doctoral/program\_1.pdf</u> <u>http://www.gradschool.utah.edu/students/forms/doctoral/program\_2.pdf</u>

! Begin writing dissertation. To ensure that the required format is being used, obtain a copy of "A Handbook for Theses and Dissertations" from the Thesis Editor's office (the cost is about \$4) The Thesis Editor accepts only approved formats.

## FINAL TERM

- ! Register for MD CH 7980: Faculty Consultation (3 credit hours), for the term in which the final oral examination is held. Whether you register for additional hours depends on your tuition waiver status; consult the Departmental Graduate Office before registering.
- ! Complete writing your dissertation.
- Provide your Supervisory Committee with copy of the dissertation at least 14 days before oral defense.
- ! Present the final seminar on dissertation research. This seminar is given in conjunction with the Final Oral Examination; see Chapter 7.
- ! Orally defend the dissertation before the Supervisory Committee. Send a memo to all supervisory committee members, as well as the Departmental Graduate Office, outlining date/time/place of the meeting, and containing an abstract of your thesis and a short biographical sketch. The dissertation defense should be advertised as a public seminar.
- ! The defending student will provide the "Report of the Final Oral Examination" form for committee signatures at the time of the exam. (NOTE: In order to graduate, the "Report of the Final Oral Examination" *MUST* be received by the Graduate School no later than four weeks *BEFORE* the last day of finals for that particular term.)

http://www.gradschool.utah.edu/students/forms/doctoral/oral.pdf

! "Final Reading Approval" pages and signature pages that must be bound into the dissertation may be obtained on the web at: <u>http://www.gradschool.utah.edu/thesis/forms/signature\_phd.pdf</u>

- ! Make required corrections to dissertation and obtain Thesis Editor's signature on "Dissertation Release" **NO LATER than the last day of finals of the term in which you plan to graduate.**
- ! Make desired numbers of dissertation copies, as described in "A Handbook for Thesis and Dissertations," on "Thesis Editor approved bond paper". A checklist of the procedures to be followed will be given to the student by the Thesis Editor. The student will turn the thesis in to the Thesis Editor. A minimum of three copies are required: one for the department and two for the library. Additional copies (for yourself, your advisor, etc.) are also turned in at this time. After approval, the Thesis Editor will send a release to the Graduate Office. The Thesis Editor will also make arrangements for the thesis to be bound. All binding costs are the responsibility of the student. Payment is made to the Thesis Editor.

# **2** GUIDELINES FOR TUITION WAIVERS AND TEACHING ASSISTANTSHIPS

# **GRADUATE STUDENT TUITION WAIVERS**

- Students in a Master's program are limited to two years (4 semesters) of tuition benefit support.
- Students in a doctoral program who entered with a Bachelor's degree are limited to five years (10 semesters) of tuition benefit support.
- Students in a doctoral program who also received a Master's degree at the University of Utah are limited to five years of tuition benefit support (2 years for a Master's + 3 additional years for a doctorate).
- Students entering a doctoral program with a Master's degree from another

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- ! The full policy document is available on The Graduate School web page at <u>http://www.gradschool.utah.edu/tbp/guidelines.php.</u>
- ! Your familiarity with this policy is acknowledged through your signature each year when you read the policy statement in the departmental graduate office.
- ! For GPA requirements pertaining to the award of tuition waivers see page 8.

# **TEACHING ASSISTANT (TA) REQUIREMENT**

Graduate students in the Department of Medicinal Chemistry are required to engage in one term as a teaching assistant.

- ! **Course selection.** Courses will be selected from suitable graduate or upper-level undergraduate courses as determined by the faculty.
- ! Students should feel free to consult the Departmental Graduate Office for availability of TA openings.
- ! **Timing.** The TA requirement will be normally fulfilled during the student's third year in the program.

#### ! Obligations.

1. TAs should attend all lectures and be familiar with all materials covered in class and in the homework.

- 2. TAs should contribute in a substantive way to the pedagogical needs of the course. This will be determined by the instructor and the particular nature of the course. For example, TAs would be expected to undertake one or more of the following activities: (a) deliver one or more lectures in the course; (b) lead problem-solving or discussion sessions prior to examinations; (c) participate in preparation and grading of the examinations.
- 3. TAs should plan on spending 3-4 hours/week in class and an average of an additional 3 to 5 hours/week for the other pedagogical activities related to the course. It is recognized that the additional assignments will be "patchy" in nature, with greater effort required for lecture and examination preparations.
- 4. Financial support. The TA will remain supported by his/her research advisor during the TA assignment.

# **3** GUIDELINES FOR CURRICULUM

# The First Year Medicinal Chemistry Curriculum Closely Follows that for the Biological Chemistry Program

# FALL YEAR 1

**COURSES (Credits)** 

•		,
BLCHM	6400	Genetic Engineering (2)
BLCHM	6450	Biophysical Chemistry (2)
BLCHM	6410	Protein & Nucleic Acids Biochemistry (2)
BLCHM	6430	Structural Methods (2)
INTMD	7570	Research Ethics (1)
MD CH	7890	Research Seminar in Medicinal Chemistry (1)
MD CH	7970	Thesis Research (1)

# <u>SPRING</u> <u>YEAR 1</u>

# COURSES

- PH TX 6690 Professional Skills Development (2)
- MD CH 7891 Medicinal and Biological Chemistry (2)
- CHEM 7460 Protein Chemistry (2)
- MD CH 7890 Research Seminar (1)
- MD CH 7970 Thesis Research

Electives

# FALL YEAR 2

# COURSES

CHEM	7200	Organic Synthesis I (2)
CHEM	7240	Physical Organic Chemistry I (2)
MD CH	7890	Research Seminar in Medicinal Chemistry (1)
MD CH	7970	Thesis Research

# <u>SPRING</u> <u>YEAR 2</u>

# COURSES

Electives

MD CH 7890 Research Seminar (1)

MD CH 7970 Thesis Research

# 

CORE COURSE							
BLCHM 6400	Genetic Engineering	2					
This course covers	essential techniques used in genetic engineering. Assuming modest backgrou	ind in					
biology, the course	introduces fundamental aspects of molecular biology including mechanisms for	or					
storage of information	on in DNA and transfer of this information to RNA and protein molecules.						
BLCHM 6410	Protein and Nucleic Acids Biochemistry	3					
The Biochemistry co	ourse covers the structure and function of nucleic acids and proteins, as well a	as the					
thermodynamics an	d kinetics of their interactions with each other and with other biologically impo	rtant					
molecules.							
BLCHM 6430	Structural Methods	3					
This course provide	s an integrated approach to the applications of NMR and X-ray crystallograph	y in					
structural biology.							
BLCHM 6450	Biophysical Chemistry	2					
Topics covered incl	ude: Basics of thermodynamics and statistical mechanics, with applications in						
biochemistry; transp	port phenomena; enzyme kinetics and inhibition; kinetic isotope effects; princip	oles and					
applications of abso	orbance, fluorescence, and CD spectroscopies.						
MD CH 7891	Medicinal and Biological Chemistry	2					
Biological chemistry	$\prime$ in the context of modern drug discovery and development. This course is interval $\prime$	ended					
for graduate studen	ts interested in a chemical approach to biological problems.						
CHEM 7200	Contemporary Organic Synthesis I	2					
Survey of the most	important preparative reactions in organic synthesis. Emphasis is placed on						
mechanism and ste	reochemistry where appropriate. Introduction to retrosynthetic analysis. Readi	ng					
assignments from p	rimary and review literature.	-					
CHEM 7240	Physical Organic Chemistry I	2					
Mechanistic organic	chemistry for first-year graduate students; weekly homework problems; exter	nsive					
use of handouts and	d literature materials.						
PH IX 6690	Professional Skills Development	1					
Preparation of grant	t applications and process of grant review.						
INTMD 7570	Research Ethics	1					
Ethics in scientific re	esearch for graduate students.						
MD CH 7890	Research Seminar in Medicinal Chemistry	1					
Formal seminars an	nd informal presentations of current research results. Includes a tutorial in						
presentation methods.							
MD CH 7970	Thesis Research: Ph.D.	1-5					
Doctoral thesis rese	earch.						

#### **ELECTIVE COURSES available to Medicinal Chemistry students include:**

MD CH 6520 Natural Products Chemistry and Biosynthesis 1 Natural products and related synthetic compounds; biogenesis, metabolic pathways, structure elucidation and synthesis of alkaloids and other heterocycles, steroids, and terpenes.

#### MD CH 6550 Site-Specific Drug Targeting

1.2 Approaches to the chemical preparation and delivery of bioconjugates of pharmaceuticals and biophysical probes to selected cellular targets. Biochemical studies of affinity probes, immunoconjugates, prodrugs, liposomes, membrane mimetics, and chemically-modified polysaccharides, peptides, and nucleic acids are included.

MD CH 7095 Molecular Modeling and Biomolecular Simulation 2 Summary: This survey course, including a hands-on computational component, will cover computational and simulation methods for understanding the structure, dynamics and interactions of biological molecules with an emphasis on topics relevant to therapeutic design, delivery and disposition. Possible topics will include molecular modeling, atomistic simulation, molecular docking, drug design, ADME, homology modeling, high performance computing, and protein structure prediction. We will first review

fundamental principles of molecular interaction and then survey various modeling approaches to highlight their ranges of applicability and limitations. Experience with computers will be very helpful for the laboratory component. CHEM 7210 Contemporary Organic Synthesis II 2 Design of synthetic approaches to complex organic molecules; retrosynthetic analysis and functional group compatibility is stressed; numerous examples of synthetic strategies from the literature are presented and analyzed. CHEM 7250 Physical Organic Chemistry II 2 Discussion, lecture, Continuation of CHEM 7240. CHEM 7270 Organic Spectroscopy I 2 Solution of complex organic structural problems using UV, IR, MS and NMR. Emphasis is placed on NMR. CHEM 7280 Organic Spectroscopy II 2 Discussion, lecture. Continuation of CHEM 7270. CHEM 7460 2 Protein Chemistry This is a one half semester course which focuses on the mechanisms of chemical reactions involving peptides and proteins and methods for their study. CHEM 7470 Nucleic Acid Chemistry 2 Discussion, lecture. Continuation of CHEM 6460. **PHCEU 7010** Systematic and Cellular Pharmacokinetics 4 Fundamental aspects of drug transport and effects from a systems physiology to a cellular level. Pharmacokinetics is taught with emphasis on understanding compartmental and non-compartmental modeling, physiologic modeling, and cellular drug transport to characterize the effectiveness of drug delivery systems. **PHCEU 7020** Homogeneous and Heterogeneous Equilibria in Pharmaceutical and **Biological Systems** 4 Physicochemical fundamentals of dosage form design. Molecular thermodynamics approach to establishing principles of solutions, structures of liquids and solids, complexation, ion-solvent interactions, and multiple equilibria of organic solutes. Physiochemical examination of peptides and proteins, and protein structures. Thermodynamics of nucleic acids including temperature effects, cooperativity and hybridization equilibria. Principles of colloid and interfacial sciences applied to pharmaceutical dosage formulations. PHCEU 7030 Macromolecular Therapeutics and Drug Delivery 4 Introduction to polymers in pharmaceutics and drug delivery. Transport phenaoena in drug delivery syst ems. Macromolecular and vesicular carriers. Biorecognition and drug targeting. Protein, oligonucleotide. and gene delivery systems. PHCEU 7040 Drug Stability 4 Principles of kinetics and mechanisms of organic reactions and structure-reactivity relationships applied to pharmaceutical systems. Mechanisms of the degradation and stabilization of drugs, proteins, and DNA. PH TX 5631 Metabolism of Drugs and Foreign Compounds 2 Biochemical mechanisms involved in, and factors affecting, metabolism and toxicities of drugs, food additives, pesticides, industrial chemicals, and naturally occurring toxic agents. PH TX 6500 **Biochemical Mechanisms of Signal Transduction** 2 Mechanisms by which extracellular signals, through receptors, regulate transmembrane signaling systems that control production of second messengers within target cells. PH TX 6610 Principles of Toxicology and Pharmacology 4 General principles, testing procedures, toxic responses, and target organ toxicities. PH TX 6630 Mechanisms of Toxicity 2 Mechanisms of chemically induced injury to living systems. Biologically reactive chemical intermediates, cellular responses to chemical injury, and carcinogenesis and genetic toxicity. PH TX 6650 Enzymology of Xenobiotic Metabolism 2

Enzyme nomenclature, distribution, properties and characteristics; physiological and xenobiotic regulation of activity and pharmacological and toxicological consequences of enzyme activation, induction, and inhibition.

MBIOL 6440 Gene Expression 1.5 Advanced topics in prokaryotic and eukaryotic gene expression including transcription, RNA processing and export and translation. Core courses for the molecular biology graduate program.

 MBIOL 6480
 Cell Biology
 3

 Advanced topics in cell biology including topics in cell structure and methods, membrane, protein trafficking, cell growth and differentiation, and signal transduction; core course for molecular biology graduate program.
 3

 ONCSC 6150
 Biostatistics
 2

 Statistical methods in Biology
 2

 ONCSC 6300
 Concepts of Developmental Biology. The course is based on reading and discussion of primary literature. Registration is limited to 20 students.

Total credit hours registered for in any semester (Fall, Spring) should total 11 by adding MD CH 7970: Dissertation Research to make up the difference.

No specific number of credit hours is required for completion of the Ph.D. degree with the exception of a minimum of 18 credit hours in MD CH 7970: Dissertation Research. Be sure to use the correct section number, corresponding to your advisor. Decisions on extent and type of course work, documented on the Graduate School's "Program of Study for the Ph.D. ..." form, requires discussion with and approval by a student's supervisory committee.

#### ! GPA requirements.

At all times, a cumulative GPA of 3.0 in course work and a grade of B- or above in all core classes is required to remain "in good standing" and to avoid academic probation. A grade below C- is not accepted for credit toward a graduate degree. Tuition waivers from The Graduate School are suspended at the end of the semester in which a cumulative GPA falls below 3.0. Discharge from the Medicinal Chemistry Graduate Program will occur if removal from probation is not accomplished within two terms (summer term excluded). Students who are no longer eligible for tuition waivers due to poor academic performance are responsible for payment of their tuition.

A full statement of the policy can be found at:

http://www.gradschool.utah.edu/students/index.php

The active link is currently under the "Students" tab

# **4** GUIDELINES FOR LABORATORY ROTATIONS

First-year graduate students in the Department of Medicinal Chemistry who have not undertaken a fixed research program are required to complete up to three laboratory rotations with different faculty members within the department. In addition to helping students choose a dissertation advisor, the rotations provide exposure to areas of research that might not otherwise be experienced, familiarize students with ongoing departmental research emphases and personnel, and teach experimental techniques that may be useful in subsequent dissertation research. An agreement to carry out the rotation, and identification of the project topic, requires concurrence of both the student and faculty member.

Satisfactory performance in all laboratory rotations is required in order to be considered "in good standing" and to be recommended for retention in the graduate program. Satisfactory performance will be defined in detail by each faculty member, but will generally include:

- 1. Initial discussion with the faculty member concerning conceptual and methodological details and expected outcomes of the rotation project;
- 2. Performance of laboratory and library work commensurate with the rotation project;
- 3. Attendance at and participation in group research meetings;
- 4. Submission of a one to two page rotation report to your rotation advisor and also to the Departmental Graduate Office. These reports should be sent as email attachments. The report will include (a) a description of the background of the rotation project; (b) a statement of the specific problem addressed during the rotation; (c) a description of the experimental approach to the problem; (d) a summary of the experimental results; and (e) a thoughtful discussion of the results, along with the appropriate conclusions. The emphasis of the report will be on the explanation of the scientific problem and experimental approach, rather than on obtaining a large body of results.

Assessment of performance will be made by the faculty rotation advisor in conjunction with the full faculty. Students may be subject to dismissal from the Medicinal Chemistry Graduate Program by majority vote of the faculty if their performance in laboratory rotations is considered unsatisfactory.

# **5** GUIDELINES FOR SEMINARS AND PRESENTATIONS (MD CH 7890)

**FIRST-YEAR MEDICINAL CHEMISTRY STUDENTS:** Medicinal Chemistry students in their first year of graduate study should register for MD CH 7890 (1 credit hour) in the Fall and Spring terms; the class will be graded on a CR/NC basis. The first four to six weeks (depending on the number of students) of MD CH 7890 in the Fall term will consist of a practical training course for first-year students in the art and technical skills of oral presentation. This includes an impromptu talk, a technical definition, a description of a technical process, a persuasive speech, and a scientific presentation. Students will choose one or two closely related papers from the current literature of general medicinal chemistry interest for presentation to and discussion by the group. Overhead transparencies, or computer PowerPoint files should be prepared and used to facilitate the presentation.

**FIRST-YEAR STUDENTS ROTATING THROUGH MEDICINAL CHEMISTRY LABS:** First-year rotation students from other programs will be required to attend Medicinal Chemistry seminars and research-in-progress, but will not be required to make a presentation.

SECOND-, THIRD-YEAR, ETC., MEDICINAL CHEMISTRY STUDENTS: In the second year of their graduate tenure, students will present a 30-minute "Journal Club" presentation on an important research topic from the current literature. In each subsequent year of their graduate tenure, students will be required to present a 30-minute "Research-in-Progress" (RIP). In addition, students in the 3<sup>rd</sup>, and subsequent years, are encouraged to present one literature paper per year for discussion, if suitable time slots are available. Students will continue to register for 1 credit of MD CH 7890 per term throughout this time.

Research-in-progress will meet periodically throughout fall and spring terms, except during finals week and term breaks. It will be interspersed with the regular Thursday afternoon seminars at 4:00 p.m. Assignments of student presentations will be made by the journal club faculty coordinator who is also the departmental seminar coordinator. Two 30 minute RIPs will be presented at each session.

**TYPES OF PRESENTATIONS: Research-in-Progress (RIP)** is required once per year after the first year and will consist of a 30-minute update on the student's current research.

A **Dissertation Seminar** is required during the student's final year and will be presented to the department on the same day as, and immediately prior to, the final oral defense. The Dissertation Seminar does not necessarily need to be presented on a Thursday;

however, it should start no later than 3:00 p.m. in order to allow time for the final Oral Examination (see Chapter 7).

**SEMINARS BY OUTSIDE SPEAKERS:** Students registered in MD CH 7890 will attend regular Medicinal Chemistry seminars by visiting speakers, usually Thursday afternoons (inter-dispersed with RIP). Visiting seminar speakers will set aside time for a group discussion with the graduate students and postdoctoral associates. **All students are required to attend these sessions and RIP presentations.** 

## GRADING is handled on a CR/NC basis.

**CRITIQUE OF RIP PRESENTATION:** Your presentation will usually be critiqued by your dissertation advisor (or his/her designated replacement). Satisfactory performance will be based on (a) comprehension of subject matter; (b) clarity of oral presentation; (c) depth of coverage; (d) quality and effective use of audio/visual material; and (e) management of the question/answer period. Satisfactory performance, and continued improvement in your presentation skills are expected in order for the student to remain in good standing in the Medicinal Chemistry Graduate Program.

# 6 GUIDELINES FOR PRELIMINARY EXAMINATION AND SUPERVISORY COMMITTEE

#### **PRELIMINARY EXAMINATION**

Please read these guidelines for the Preliminary Examination carefully. Note particularly the time-frame, which is designed to be long enough to allow serious consideration of your proposal the proposed topics without compromising your progress in dissertation research.

- (a) The preliminary exam will be conducted by an Examination Committee. Your Dissertation Advisor will not attend the exam. An examination chairperson will be appointed in advance from members of the Supervisory Committee by your Dissertation Advisor. Guidelines for assembling a Supervisory Committee are given in the second section of this chapter. The examination chairperson's duties include ensuring that you understand the examination procedure and monitoring your progress during the exam period. At the examination chairperson's discretion, an <u>ad hoc</u> examination member may be included, to insure adequate expertise in coverage of the exam topics. The additional individual can be a faculty member from any department at the University of Utah. The total Examination Committee will usually consist of four, or five (with an <u>ad hoc</u> member) persons. A quorum for conduct of the exam will be three faculty members, two of whom must have primary appointments in the Department of Medicinal Chemistry.
- (b) You must choose a 10-week period during your second academic year in which to prepare and take the preliminary examination. You should try to minimize your other commitments (courses, etc.) during this period. You are encouraged to begin your preliminary exam before March of your second year, otherwise your 10-week exam period will automatically begin on the second Monday of March. Failure to schedule your preliminary exam is NOT an acceptable excuse for delaying your defense beyond the end of Spring Term of your second academic year.
- (c) The exam will consist of a written original research proposal, conceived and prepared by you, and then defended orally before the Examination Committee. The proposal should be in the format of a NIH postdoctoral research application <u>http://grants.nih.gov/grants/funding/416/phs416.htm</u>
- (d) Potential proposal topics must be approved by your Examination Committee and must be in the area of medicinal chemistry, broadly defined, and in which the

faculty have significant expertise. You will initially submit two proposal abstracts (on different topics), from which the Examination Committee will select the one you will develop into a full written proposal. You should realize that the selection of good original research topics and well defined specific aims is half the battle. We are looking for: 1) Hypothesis-driven research proposals. Avoid data collection expeditions. 2) Scientific importance. Clearly explain how and why your proposal addresses important aspects of fundamental problems in medicinal or biological chemistry. 3) Originality. The proposal should demonstrate an original approach to an important problem. You may, of course, propose to use well established techniques, but we want to see clear evidence that your proposal will offer some fresh new insight, model, or approach in solving your problem. 4) Definition and feasibility. You need to make it clear that you are proposing to do research that can actually be successful. It is therefore important to focus your ideas so that it is clear exactly what you propose to do and that you have considered possible pitfalls and reasonable alternative approaches. The proposed project should be one that you could accomplish in a two- to three-year period. 5) Suitable Topics. Be reminded that a major goal of medicinal chemistry is to connect chemistry with biological processes, structure and function. Another goal is to define the relationship between molecular structure and biological activity or mode of action. Preliminary Examination proposals should thus apply a chemical, mechanism-based approach to a biological problem. Several types of proposals and specific aims are usually poorly suited to a Medicinal Chemistry Preliminary Examination and should be avoided. These include but are not limited to ideas that are primarily: creation of mouse mutants, microarray and/or gene detection studies, including RT-PCR; studies primarily focused on cell biology; yeast twohybrid screens; 2-D gel electrophoresis protein surveys; and similar types of experiments from which the main results are descriptive, lack chemical content, and do not test or advance hypotheses.

The following format should be followed for both of the **two-page** abstracts (single spaced):

**Page 1: Background and Significance.** Concisely describe what is known in the area of proposed research, what outstanding questions remain to be answered, and why they are of fundamental interest.

**Page 2: Specific Aims.** Typically, an abstract has three to four specific aims each followed by a short paragraph outlining experiments that will allow this specific aim to be met. Up to five seminal literature citations may be used if desired.

The Examination Committee will select **one** of the two proposal abstracts to be developed into a full proposal. The Committee will also evaluate the quality of the

abstracts and suggest areas that need to be changed, expanded, clarified, etc., prior to preparation of the full proposal.

(e) You are then required to write the full proposal. The proposal should be written in the style of a NIH postdoctoral research grant application and include the sections described below. (You can also find this information at the NIH web site given above). Page limits (single-spaced text; Arial-11 or Helvetica-11 point font., 0.75 inch margins) are included for each section. The overall proposal may not exceed 10 pages (Excluding Cited References). These are not minimal expectations, they are limits not to be exceeded. It has been the experience of past committees that quality is not proportional to quantity; please be succinct. These documents must be written in clear, concise English using standard nomenclature conforming with current American usage.

**ABSTRACT (200 words):** This section should concisely summarize the main points presented in more detail in the proposal (e.g., what is the purpose of the study, why is it important, what is the general strategy, etc.).

**SPECIFIC AIMS (1 page):** You should provide a list of distinct specific aims, and the hypotheses to be tested, that clearly define the goals of your proposal. Each specific aim can be followed by two to three sentences for clarification.

**BACKGROUND AND SIGNIFICANCE (~2 pages):** This section should provide sufficient background information to allow the Committee to understand the planned experiments and their significance (remember that they are **not** experts in the field). References to pertinent literature must be included.

**RESEARCH PLAN AND METHODS (~7 pages):** This section must describe in detail the plan for attaining each specific aim. It should include the rationale for the experiment, description of experimental procedures (including methods), possible pitfalls and alternative strategies, expected outcomes, interpretation of the results, conclusions, and future directions. For the purpose of proposing future experiments, you may predict the outcome of proposed experiments, but you should also consider what approach will be taken if plausible alternative outcomes are observed.

**LITERATURE CITED (No page limit):** Use the current *Biochemistry* journal format including titles (citations sequentially numbered in text).

It is understood that the experiments described in the proposal should originate from the student. You may check with Committee members concerning the mechanics of preparing the proposal but you **may not discuss**  with Committee members any aspects concerning the selection and feasibility of topics, or the design of experiments to be used.

(f) You will then defend your proposal in an oral examination. At the beginning of the exam, you will be asked to leave the room so that the Committee can discuss the proposal. You will then be asked to give a short (approximately 20 minutes) formal presentation on your proposal. You should expect questions from the Examination Committee during and after your presentation. They will attempt to discover whether you are able (a) to demonstrate an understanding of the significance of the proposal with respect to the current state of knowledge in the field, (b) to demonstrate an understanding of both the theoretical and practical aspects of the methods and procedures in the proposal, and (c) to defend the rationale of the experimental designs and approaches.

Although the thrust of the questioning may focus on the proposal, inquiries of a more general nature can also be expected. You should therefore be prepared to answer questions concerning material covered in the Curriculum Core Courses. A detailed recall of the material is not required but a firm familiarity with general principles is expected. You are strongly encouraged to review the material covered in the Curriculum Core Courses prior to the examination.

When the examination is completed, you will once again leave the room so that your performance can be evaluated. A critical evaluation of the examination will then be made. A passing performance requires the approval of two of the three members of the Examination Committee (or three members in the case of a fourperson committee.) Students not performing to the satisfaction of the Committee on the written proposal and/or oral parts of the exam will either be failed outright or asked to address the deficiencies in a manner and schedule agreed upon by the Committee. If a student fails the exam, he or she may be allowed to retake portions of the exam, or may be dismissed from the Ph.D. program.

- (g) The following timetable for preliminary exams must be followed unless an exception is granted by the chairperson of your Supervisory Committee. It is your responsibility to see that this schedule is observed. Failure to respond in a timely fashion will be considered inadequate academic progress and may be grounds for dismissal from the graduate program. Remember that the entire examination, from declaration to oral exam, must occur within a 10-week period and that the overall exam must be completed by the end of Spring Term.
  - (i) You should now be reading the scientific literature and watching for suitable research topics. Keep a list.
  - (ii) You should choose a Supervisory Committee by the end of Fall Term of your second graduate year, and identify a 10-week period during the academic year

that will be relatively unencumbered. Both of these choices should be made in consultation with your Dissertation Advisor.

- (iii) The exam period begins when you declare your intention to begin the exam and obtain the agreement of the Examination Committee chairperson. You should not cease work in the laboratory on the pretense of beginning preliminary exam until you have formally declared your intent to **both** your Dissertation Advisor and the Examination Committee chairperson.
- (iv) You will inform the Departmental Graduate Office of the start-date of the exam period, as soon as it is known.
- (v) Within three weeks of the initial declaration, you must present the Examination Committee with the two proposal abstracts. The Committee will respond within one week, telling you which original proposal to pursue and giving you instructions concerning discrete directions to develop.
- (vi) The oral exam **must** occur within 10 weeks of the initial declaration (six to seven weeks after proposal topics are accepted). A range of acceptable dates will be established when the topics are accepted. Please be aware of the potential for conflicts in scheduling a meeting of Committee faculty members; *do not wait until the last minute to attempt to schedule the exam.*
- (vii) Out-of-town or illness-related absences of Examination Committee members should not be allowed to influence the overall duration of the Preliminary Examination. If you foresee significant delays in this regard, discuss with the Examination Committee Chair the possibility of substitution of one committee member.
- (viii)The written proposal must be submitted to Examination Committee members at least five working days prior to the scheduled exam. It is your responsibility to find a time that is suitable, schedule a room for the examination (typically a small conference room in HSEB or 201 BPRB), and to deliver copies of the proposal to the Committee members.
- (ix) The form for reporting the results of the examination ("Report of The Qualifying Examination for the Ph.D. . . . and Recommendation for Admission to Candidacy") for filing with the Graduate School is available on line at http://www.utah.edu/graduate\_school/forms.html. It is your responsibility to see that this form is completed properly. It is important to have this form completed during the week before your oral exam, and to bring this form to your preliminary exam. Once this form is completed, please bring it to the departmental graduate office for submission to the Graduate School.

Please also inform the Department of Medicinal Chemistry Graduate Coordinator when you have scheduled your Preliminary Exam, and the results when the exam is finished.

(x) Upon satisfactory completion of the preliminary examination as well as filing of the appropriate Graduate School forms, you will formally then be **admitted to candidacy** for the Ph.D. degree in the Medicinal Chemistry Graduate Program.

#### **SUPERVISORY COMMITTEE**

This committee advises the student concerning dissertation research and seminar topics, and presides over the writing and oral defense of the dissertation. This committee is **your** team and meeting with them through the years should be a positive, productive experience, not an adversarial one. **Students must have selected a five member Supervisory Committee by the end of Fall Term in the second academic year.** Do not delay in assembling your Supervisory Committee just prior to the preliminary exam.

- (a) You and your Dissertation Advisor should work together to form a Supervisory Committee, consisting of five members, with the Dissertation Advisor as the chairperson. Three members must have regular faculty appointments in the Medicinal Chemistry Department and at least one member must be from outside the department. The composition of the committee must be reported to and eventually approved by both the Department faculty and the Graduate School.
- (b) The first meeting of your full Supervisory Committee following the preliminary examination will take place during the first two weeks of the Fall Term of your third graduate year. At this meeting you will present an outline of your **Dissertation Research Plan.** Your Dissertation Advisor will attend. You will deliver a carefully thought out printed version of this document to your Supervisory Committee one week prior to the meeting.

The Plan will be a maximum of five pages, and will include: list of specific aims of your dissertation; introduction and rationale for the work; summary of preliminary results; outline of work you intend to carry out over the next year; and maximum of five important literature citations, using the same citation format as for your original research proposal in the preliminary exam.

At the time of this meeting the Committee will judge the acceptability of your written plan, your oral presentation, and your defense of the plan.

(c) You are required to meet with your Supervisory Committee annually until your graduation. To each meeting bring updated copies of your "Record of Graduate Student Progress" for distribution to committee members. (This form is available from the Departmental Graduate Office, or has been emailed to you.) At least four of the five Supervisory Committee members must be present at each meeting. Failure to schedule and hold committee meetings in a timely fashion may lead to dismissal from the Ph.D. program. More frequent meetings may be held if desired by the student and/or the committee. The student is responsible for scheduling these meetings, and for recording their completion. The latter is done by notifying the Departmental Graduate Office, either in writing or via email. It is also useful for the Dissertation Advisor to prepare a written report of each meeting to aid in gauging the student's progress.

# 7 GUIDELINES FOR FINAL ORAL EXAMINATION FOR THE PH.D. DEGREE

The final oral examination will be completed during the student's last term in the graduate program. If scheduling permits, the exam will be given just following the Dissertation Seminar on the same day.

The completed doctoral dissertation will be submitted to the student's supervisory committee no less than 14 days prior to the final oral examination. The final oral examination will consist of a 50 minute public seminar where the student will present a summary of their dissertation research. The general public will then be dismissed, and the examination will continue in private before the student's supervisory committee.

The supervisory committee will evaluate whether the student (a) passes, (b) should revise parts of the dissertation, (c) should retake the oral examination, or (d) fails. When a student satisfactorily passes the final oral examination, the supervisory committee signs off on the "Report of the Final Oral Examination." Upon satisfactory completion of recommended changes to the dissertation by the supervisory committee, the chair of the committee and the chair of the Department of Medicinal Chemistry sign the "Final Reading Approval" form. The candidate takes the form to the Graduate School for the signature of the Dean of the Graduate School and then delivers the entire dissertation with supervisory committee signature sheets and the "Final Reading Form" to the Thesis Editor for approval.

Note that the cost of binding the three copies of the final dissertation as required by The Graduate School (see: "A Handbook for Theses and Dissertations") are to be borne by the student. Preparation costs for preliminary copies as required by the Supervisory Committee are normally covered by the Dissertation Advisor as standard research expenses.

If a student fails the final oral examination, she/he has the option of retaking the oral examination one more time. After the second attempt if the student again fails to satisfactorily complete the examination, the student will be dismissed from the Graduate Program in Medicinal Chemistry.