RUTGERS HEALTH
Ernest Mario School of Pharmacy
Department of Medicinal Chemistry

Graduate Program in Medicinal Chemistry

Graduate Student Handbook

Graduate Program in Medicinal Chemistry

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Foreword

Welcome to the Graduate Program in Medicinal Chemistry.

The Graduate Student Handbook covers the processes required for obtaining a graduate degree in Medicinal Chemistry at Rutgers University. This handbook is meant to serve as a guide and cover a multitude of topics. If there is any topic that is not clear, please reach out directly to myself or the graduate program administrator.

Sincerely,

Graduate Program in Medicinal Chemistry

Dr Jun Wang – Graduate Program Director (junwang@pharmacy.rutgers.edu)
Ms. Hui Pung – Graduate Program Administrator (huipung@pharmacy.rutgers.edu)

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1. Getting Started at Rutgers University

By the time you get this booklet, you will probably have already found an apartment or dorm room and be eager to start your career as a graduate student. Before this can happen, however, you need to register for classes. You must register for at least 9 credits per semester as a full-time student. You will be able to register for your classes online. If you have been awarded a Teaching Assistantship from the Department of Medicinal Chemistry or any other department, you must register for Teaching Assistantship (16:663:877) for 6 "E" credits. E-credits count toward full-time student status but do not count toward your degree requirement/graduation or your GPA. Textbooks are available from the Rutgers Bookstore (Barnes & Noble at Rutgers University) located at the Gateway Transit Building, 100 Somerset Street, New Brunswick, NJ 08901-2197 (732) 246-8448. Store hours are typically 10 AM - 6 PM (M-F), 10 AM – 4 PM (Sat.), closed (Sun). You should refer to the graduate program homepage frequently for information and notices (https://pharmacy.rutgers.edu/about/med-chem-graduate-program-2) .

1.1. Medicinal Chemistry Graduate Program

Dr. Jun Wang serves as Director of the Medicinal Chemistry Graduate Program. Ms. Hui Pung assists Dr. Wang. For graduate program-related questions, don't hesitate to contact Ms. Hui Pung (huipung@pharmacy.rutgers.edu).

The executive committee of the Medicinal Chemistry Graduate Program consists of the following faculty members:
Dr. Jun Wang (Medicinal Chemistry)
Dr. Longqin Hu (Medicinal Chemistry)
Dr. Matthew Moschitto (Medicinal Chemistry)
Dr. Joel Freundlich (Pharmacology, Physiology & Neuroscience – NJMS)
Dr. James Simon (Plant Biology, SEBS)

The executive committee has primary responsibilities, including but not limited to revising policies of the graduate program, resolving issues between graduate students and advisors, approving new members to the graduate program, making decisions on student dismissal due to poor performance or ethics issues, etc.

1.2. Course Registration

The number of courses you should take will depend on whether you are a full-time or part-time student. Full-time status requires a minimum of 9 credits; most courses are 3 credits each. You should plan on taking 3 courses during your first semester. If you have been awarded a Teaching Assistantship, you will also register for 6 "E-credits" of Teaching Assistantship (16:663:877). These credits count towards your total credits per semester but do not show on your transcript (they carry no weight). It is a good idea to try to complete the course requirements for your degree during your first two years, especially if you are supported as a teaching assistant. As part of your TA package, you are eligible to register for a total of 24 credits each year so you may be able to register

for 6 credits of Research in Medicinal Chemistry (16:663:701,702) during the Summer Session following the academic year for which you were a TA. Doing this can help minimize the cost to your advisor, should you be awarded a Graduate Assistantship, since the faculty member is responsible for paying your tuition. For online registration, please visit: https://sims.rutgers.edu/webreg/. You will need to enter your net ID and password, which you should have obtained once you were accepted into the program. To activate your net id, go to https://netid.rutgers.edu/index.htm.
If any questions arise during course registration, reach out the Office of the Registrar:

Office of the Registrar, New Brunswick
Records Hall
620 George Street, Room 140
College Avenue Campus
New Brunswick, NJ 08901
Office Hours: Monday – Friday, 8:30 AM - 4:30 PM
(848) 445-7000, Press 4, https://nbregistrar.rutgers.edu/

1.3. Expectations and Academic Requirements

Your decision to study Medicinal Chemistry at Rutgers was most likely multi-faceted. You may have wanted to attend a school on the East Coast for proximity to family and friends; you may have wanted to attend a large school for the wealth of resources that are present; perhaps you have already decided to do research for a particular professor in our program. No matter your reason for coming here, you desire to study medical chemistry, graduate with either an M.S. or Ph.D., and then find employment in your field. It takes on average, 2-3 years to earn a M.S. and 5-6 years to earn a Ph.D. The faculty members of this program are here to help you achieve your goals in the most rapid manner. There are expectations, however, to obtain a degree.

These expectations include:

- Demonstrate yearly progress towards your degree.
- Demonstrate an understanding of your project.
- Maintain at least a 3.00 GPA with less than two grades of C or C+.
- Complete all course requirements in a timely manner. It is strongly recommended to take 3 courses during your first year.
- Keep a detailed and up to date laboratory notebook.
- Pass qualifying exam by the end of year 2

Rutgers University will not confer graduate degrees (either M.S. or Ph.D.) to students having a grade point average (GPA) < 3.00. Rutgers also limits the number of grades of C or C+ work that a graduate student can use to fulfill degree requirements. It is the policy of the Medicinal Chemistry Graduate Program to limit students to a MAXIMUM of two grades of C or C+. Ph.D. students who exceed two C/C+ grades will not be allowed to continue towards a Ph.D. and will instead be reclassified as terminal M.S. students, where the qualification of M.Sc degree will apply.

1.4. Academic Integrity

Integrity and honesty are the cornerstones of modern science. At all levels, scientists perform experiments and are expected to report their observations in an honest and unbiased manner. At the doctoral level scientists are routinely placed in positions of trust. For example, Ph.D. level scientists are often asked to review manuscripts and grants for scientific accuracy and relevance before they are released to the public. As human beings, scientists are not immune to the many temptations of ethical lapses. Pressure to obtain results that are expected to retain funding on a project, to inflate the yields of reactions, to ignore significant by-products of reactions, not to record reactions that did not work as planned, to cheat on an exam, to plagiarize on a term paper, to "borrow" an idea from a grant proposal you are reviewing, etc are all very real. Yet the cost of these breaches in integrity, if revealed, could be the end of your career. Students are encouraged to consult and read through the Chemical Professional's Code of Conduct, which can be found at: https://www.acs.org/content/acs/en/careers/career-services/ethics/the-chemical-professionals-code-of-conduct.html. This document was approved by the Council Committee on Professional Relations of the American Chemical Society on August 28, 2019 and adopted by the Board of Directors on December 6, 2019.

Rutgers University has a Policy on Academic Integrity for Undergraduate and Graduate Students Rutgers University, New Brunswick Campuses. This can be found online at: http://academicintegrity.rutgers.edu/. Rutgers Graduate School New Brunswick also published a pamphlet on Academic Integrity: Issues for Graduate Students, which can be found at https://studentconduct.rutgers.edu/processes/academic-integrity. This document includes definitions of various violations of academic integrity, including cheating, fabrication, facilitating academic dishonesty, plagiarism, and denying others access to information or material. A brief description of these terms is given below. For complete descriptions, please refer to the website mentioned above.

Cheating – the use of inappropriate or unacknowledged materials, information, or study aids in an academic exercise.
Fabrication – the falsification or invention of information or data.
Facilitating Academic Dishonesty – Knowingly or negligently allowing your work to be used by others when it is expected that each student is to do his/her own work.
Plagiarism – the representation of the words or ideas of another as one's own. Failing to properly cite a direct quote or paraphrase of another's words.
Denying Others Access to Information or Material – making reference works or materials unavailable to others by stealing or defacing books, journals, reserve materials, or altering or deleting computer files belonging to another.

How can you avoid plagiarism when writing an academic or scientific paper? Suppose you use someone else's words in your paper. In that case, you must enclose those words in quotation marks and then provide a footnote or reference number that refers to a reference citation in which the original words are reported. If a quotation is used from a book or paper that quoted those same words, your citation must be to the original report. If you paraphrase another author, you would properly cite that section as "to paraphrase so and so's comment..." and then footnote or reference that statement as

before. If you copy material directly from a website, you must properly cite that by referencing the exact web address of the page. If you use someone else's words, whether enclosed in quotes or not, and do not provide a reference or footnote number immediately following those words, you have committed plagiarism. It is also plagiarism if you use words or ideas from someone else and list those sources among your references but fail to link the reference and what it refers to in the text.

What are the penalties for violating academic integrity? Rutgers has categorized the various violations into four levels of severity:

Level One – for minor infractions such as working with another student on a laboratory or homework assignment when such work is prohibited; failure to footnote or properly acknowledge in an extremely limited section of an assignment.

Sanctions may include: an assigned paper or research project on a relevant topic; a make-up assignment at a more difficult level; a grade of zero on the assignment. Records of students convicted of Level One offenses are maintained on file until graduation.

Level Two – dishonesty of a more severe nature or affecting a more significant portion of the coursework. Examples include plagiarism on a more extensive level, using data or materials in a lab experiment without acknowledging the source, e.g. if you use a starting material prepared by someone else but do not acknowledge that fact, receiving assistance from others on an assignment without acknowledging that fact, cheating on a take-home exam.

Sanctions may include receiving a failing grade for the assignment, a failing grade in the course (for cheating on a take-home exam), and disciplinary probation. Records of students convicted of Level Two offenses are maintained on file until graduation.

Level Three – Dishonesty that affects a major or essential portion of work done to meet course requirements. Included here are the following: copying on an hourly or final exam, plagiarism of major portions of a written assignment, facilitating copying during an exam, using prohibited materials during an exam, altering an exam before submitting for regrading, acquiring or distributing an exam from an unauthorized source prior to the exam, presenting someone else's work as your own, using purchased term papers, denying others access to materials, and fabricating data.

Cases of Level Three and Four dishonesty will be brought before a disciplinary board organized by the Dean of the Graduate School. The minimum sanction will be a one semester suspension from the university. Faculty are ethically bound to report convictions of Level Three and Four offenses on any letters of recommendation they may write for the students.

Level Four - The most serious level of dishonesty. Included here is: any violations of academic dishonesty after returning from a suspension, having someone else take an exam for you, fabrication or falsification of data, plagiarism in a thesis, dissertation, manuscript submitted for publication, **or in other work represented as one's own as a**

graduate student, sabotaging another students work, willful violation of the ethical code of the profession for which you are preparing (Medicinal Chemistry).

The sanction for Level Four violations is permanent expulsion from the university and a notation of "academic disciplinary separation" permanently attached to your transcript.

As stated in the Rutgers policy: "violations of academic integrity by graduate students will presumably be penalized more severely than violations by first semester first year students." In other words, graduate students should know better! You are here to learn and become proficient in aspects of medicinal chemistry. This will never happen if you copy work from others.

1.5. The Laboratory Notebook

The most crucial document for a graduate student isn't their thesis or dissertation but their Laboratory Notebook. It serves as a comprehensive record of all lab activities and is crucial for future reference by advisors and colleagues. It's essential for compiling experimental data needed for the thesis or dissertation. Failure to uphold notebook standards can lead to severe consequences, including dismissal. Laboratory notebooks are property of each individual laboratory and Rutgers University and must never leave the lab building. Laboratory notebooks should be always kept in the laboratory or office. Students should record details promptly during work and avoid using scraps of paper. Each laboratory has their own specific guidelines for laboratory notebook that must be followed.

Some general guidelines include:

- The laboratory notebook should always be written in black or blue ink. If a mistake is made, one should draw a line through the line and rewrite below. If a page is to be skipped due to an error place a large x through the page.
- Each page should be dated before starting an experiment.
- Document quantities of materials and reagents in mass or volume units, including moles or millimoles.
- Describe every step of the experiment, from setup to purification.
- Draw chromatographic results directly in the notebook and attach or reference spectral data for products as collected.
- Include physical descriptions, yields, and results obtained (yields, IC_{50} etc.).
- The laboratory notebook should always be written in the past tense and passive voice. For example, one would write, “$NaBH_4$ was added to the flask,” and not write, “I added $NaBH_4$.”
- Notebooks are never allowed to leave the laboratory, office space, or computer lab. They are not to be locked in a drawer or locker. When completed, they should remain either on your bench or on the designated shelf in the laboratory.

Neglecting proper notebook upkeep can lead to delays in publication and thesis preparation, placing financial strain on your advisor. Continued negligence after warnings may result in loss of financial support, expulsion from the research group, or program termination. Approval of your thesis or dissertation hinges on reporting all necessary analytical data for each new compound.

1.6. Security of Research Results

Drug discovery projects often lead to intellectual properties for patent filing. Students must keep the experimental design and results confidential, especially before publishing the results in peer-reviewed journals. Students should obtain written approval from their advisors when submitting abstracts to present unpublished results in conferences and seminars. For collaborative projects involving other research groups within or outside Rutgers, students should copy their advisor in communications when exchanging experimental design ideas and results. When in doubt whether certain information is confidential, the best approach is to discuss it with their advisors before disclosing it. Submitting manuscripts for publication without the advisor's approval is a severe violation of ethics that can result in termination from the graduate program.

1.7. Selecting an Advisor

Some students enter the program knowing exactly whom they wish to have as their research advisor. Most students, however, have only a vague idea of the types of research opportunities that exist. It is suggested that students review the professors' websites that are part of the program. The student should then contact several faculty members to set up individual meetings to gain greater insight into the types of research projects available. Students are encouraged to rotate in two to three labs before choosing a lab for the thesis project. Students should notify and set up a rotation schedule with faculty before the second week of the semester. Rotation also gives faculty a chance to evaluate students. Students must understand that this is a mutual agreement between the students and the faculty. **You should decide to work with an advisor by the end of your first semester at Rutgers**. However, students can join a lab without rotation upon mutual agreement between a student and the faculty. In such a case, students should still sign up for the rotation course. **Graduate students in the Ph.D. program who fail to select an advisor will be transferred to the M.Sc. program.** Another consideration to bear in mind is the current funding level of the faculty, and not all faculty have openings for graduate students each year. The best approach is to contact faculty as early as possible. A listing of faculty members who can serve as research advisors (department in parenthesis), arranged according to research interests, is shown below. Note that faculty in the Medicinal Chemistry graduate program include members within and outside the Medicinal Chemistry department. **Teaching assistantships from the EMSOP are reserved for students who choose to work with the primary faculty in the Medicinal Chemistry department including Dr. Longqin Hu, Dr. Matthew Moschitto, and Dr. Wang.** Teaching assistantship is generally for the first two years, and year 3 to year 5/6 should be funded by the advisor's research fund or fellowships. For students who choose to join labs other than Drs. Hu, Moschitto, and Wang, their advisor is expected to provide financial support

through research grants or teaching assistantships from other graduate programs from year 2 to year 5/6.

Medicinal Chemistry and Drug Discovery

Dr. Longqin Hu (Medicinal Chemistry)
https://sites.rutgers.edu/longqin-hu/
Longhu@pharmacy.rutgers.edu

Dr. Matthew Moschitto (Medicinal Chemistry)
https://sites.rutgers.edu/moschitto-lab/about/
m.moschitto@pharmacy.rutgers.edu

Dr. Jun Wang (Medicinal Chemistry)
https://sites.rutgers.edu/jun-wang-lab/
junwang@pharmacy.rutgers.edu

Dr. Joel Freundlich (Pharmacology, Physiology & Neuroscience – NJMS)
https://njms.rutgers.edu/departments/labs/freundlich/index.php
freundjs@rutgers.edu

Dr. Leslie Jimenez (Chemistry)
https://rutchem.rutgers.edu/people/faculty-bio/160-jimenez-leslie
jimenez@chem.rutgers.edu

Dr. Lawrence Williams (Chemistry)
https://chem.rutgers.edu/people/faculty-bio/199-williams-lawrence-j
lwilliams@chem.rutgers.edu

Computational Chemistry

Dr. William Welsh (Robert Wood Johnson Medical School)
https://www.molbiosci.rutgers.edu/faculty-research/faculty/faculty-detail/90-w-x/422-welsh-william-j
welshwj@rwjms.rutgers.edu

Dr. Vlad Kholodovych* (RBHS, OIRT/High Perf & Research Comp)
https://research.rutgers.edu/people/vladyslav-vlad-kholodovych
vlad.khol@rutgers.edu

Natural Products Isolation and Structure Elucidation

Dr. James Simon (Plant Biology, SEBS)
https://plantbiology.rutgers.edu/faculty/simon/James-Simon.html
jimsimon@rutgers.edu

Dr. Qing-Li Wu* (Plate Biology, SEBS)
https://plantbiology.rutgers.edu/faculty/wu/Qing-Li-Wu.html
qlwu@sebs.rutgers.edu

Dr. Chi-Tang Ho (Food Sciences, SEBS)

https://foodsci.rutgers.edu/faculty/Ho/
chitang.ho@rutgers.edu

Structural Biology
Dr. Edward Arnold (Chemistry)
https://cabm.rutgers.edu/person/eddy-arnold
arnold@cabm.rutgers.edu

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* Associate Members – MS students only

2. Seminars

Seminars are usually held in EMSOP rooms 247, 248, or 288. Most seminars are from 12:30-1:30 on Tuesdays throughout the semester and will be announced in advance. **ALL students are expected to attend ALL seminars and provide feedback to the presenter.** However, you should **only register** for the course, Seminar in Medicinal Chemistry (16:663:601,602), in the semester in which you plan to **present** your seminar. If a student does not present during the semester in which they signed up for Seminar in Medicinal Chemistry, they will receive an incomplete grade which will be updated upon giving their seminar (there is no penalty for this). Students presenting a seminar over the summer can sign up for Seminar in Medicinal Chemistry during the subsequent fall semester. Students in the M.S. program must present one seminar, while Ph.D. students must present two seminars. Attendance is taken at all seminars. The dress code for the seminar presenter is business casual or above. If you have two or more unexcused absences in any semester, you must prepare and present an additional seminar during the following semester.

When ready to present a seminar, you should consult first with your PI concerning a seminar topic. After their approval you should send an abstract/outline of your topic with associated references to Dr. Matthew Moschitto (m.moschitto@rutgers.edu) who will approve the topic. After approval and when ready, you will reach out to the Graduate Program Administrator (Hui Pung: huipung@pharmacy.rutgers.edu) who will schedule a date for your seminar. Two weeks prior to your seminar, you will send your title and abstract to Ms. Hui Pung who will send out an announcement concerning your seminar.

Seminars should be prepared using PowerPoint. A seminar should be about 45 minutes long with 15 minutes of questions and answers. Seminar topics can include new investigations into small molecule drug discovery (approved drugs, drugs in clinical trials in the last year), new methods in drug discovery, methods in synthetic organic methodology (both new methods and overviews of important methods). The goal of selecting a seminar topic is to teach your audience something new. Students should refrain from using review articles to guide topic selection and should instead focus on primary literature.

3. The Master of Science Program

Two options are available within the M.S. program:

- **M.Sc. with thesis**. At least 22 course credits are required (including one credit of Seminar in Medicinal Chemistry). A student selects a research adviser and completes an original research project under his or her direction. The student then writes and defends a thesis to complete the degree requirements. Students must complete Rotations in Medicinal Chemistry in a satisfactory manner for a M.S. with thesis.
- **M.Sc. without thesis**. 31 course credits are required (including one credit of Seminar in Medicinal Chemistry and three credits in *Non-Thesis Masters Programmatic Study in Medicinal Chemistry* (16:663:620)). In the *Non-Thesis Masters Programmatic Study in Medicinal Chemistry* (16:663:620), students are required to write a literature review or conduct a small research project that has been approved by an advisor culminating with a final written critical essay. The literature review or the critical essay must be submitted and defended before your committee.

Students in the Ph.D. program do not earn a M.S. degree along the way.

The M.S. degree curriculum is outlined below:

Required Core Courses (16 credits):
- Medicinal Chemistry: Research Techniques and Principles (16:663:501) - Fall
- Principles of Drug Design (16:663:502) - Spring
- Molecular Biology and Biochemistry (3 credits) (16:115:511) - Fall
- Interpretation of Organic Spectra (16:160:515) – Spring
- Modern Synthetic Organic Chemistry (16:160:503) – Spring (as of 2024-25)
- Seminar in Medicinal Chemistry (16:663:601 or 602)

Thesis option:
- Electives (3 credits)
- Lab Rotation (3 credits) (16.663.508)
- Research in Medicinal Chemistry (16:663:701,702) (9 research credits)

Non-Thesis option:
- Electives (12 credits)
- Non-Thesis Masters Programmatic Study in Medicinal Chemistry (16:663:620) (3 credits)

Lab Rotation

M.Sc. students with thesis option must sign up for the lab rotation course (3 credits) in the first semester of the first year. **M.Sc. students with non-thesis option should not sign up for lab rotation.** It is recommended that students rotate in two to three labs before deciding on a lab to join for the thesis project. However, students can join a lab without rotation upon mutual agreement between a student and the faculty. In such a

case, students should still sign up for the rotation course. It is recommended that you begin your research project as soon as possible. You should plan on working in the lab year-round to minimize the amount of time needed to earn your degree. A minimum of 15 hours per week is required for a passing grade in Laboratory Rotations.

Dissertation Committee

M.Sc. students with thesis option must assemble a dissertation committee consisting of the student's advisor, two other faculty members from the medicinal chemistry program and one committee member (must be a Ph.D.) from outside the program to serve on your M.Sc Dissertation Committee. The outside member can be from a different department at Rutgers or from industry (but must not be a member or former member of the research groups of any of the other committee members). Your committee is a valuable resource for suggestions relating to your research project. The dissertation committee needs to be finalized by the Fall semester of the second year.

For M.Sc. students with thesis option, you must select a research advisor by the end of your first semester of full-time study. It is recommended that you begin your research project as soon as possible. You should plan on working in the lab year-round to minimize the amount of time to earn your degree. Together with your advisor you will select two other faculty members from the medicinal chemistry program to serve on your M.S. Thesis Committee. Your committee is a valuable resource for suggestions relating to your research project. As your research project nears its end you will begin writing your thesis. This is an iterative process between you and your advisor, with your advisor offering corrections and suggestions for improving the written document. The School of Graduate Studies – New Brunswick requires that you strictly adhere to their guidelines when preparing your thesis or dissertation. A style guide can be found online at https://grad.rutgers.edu/academics/graduation/electronic-thesis-and-dissertation-style-guide. This guide gives detailed information about the order and physical layout of pages in the written document, margins, type of paper required, etc.

While the School of Graduate Studies - New Brunswick does not specify any criteria for the characterization of new compounds, this is central to medicinal chemistry and this program requires that all new compounds be adequately characterized. This means that you should include tabulated ^{1}H and ^{13}C-NMR spectra for all new compounds, IR spectra, where appropriate (listing all peaks that are diagnostic for specific functional groups). Proof of composition should be included wherever possible. This can be either high-resolution mass spectral or combustion analysis results. Specific rotations should be reported for optically active compounds. Other data can be reported as necessary. In general, criteria for characterization should conform to that specified in the American Chemical Society Guidelines for Authors (https://researcher-resources.acs.org/publish/author_guidelines?coden=jmcmar#data_requirements). For all compounds, the color and physical form (solid, liquid, oil, etc) should be reported. The mass (or volume) and the number of moles (mmol or μmol) of all reactants and reagents and the mass and percent yield of all products should be reported.

When a suitable document has been completed, you will schedule a date for your defense and submit copies to each member of your committee (allow them at least two

weeks to read the thesis). During the defense, the members of your committee will ask questions about the work you performed. They may also ask questions relating more to your general background and preparation. Suggestions may also be made for ways to improve the written thesis. It is wise to act on these suggestions and make the necessary corrections or additions to the thesis. When everyone is satisfied that you have met all the requirements for the M.S. degree in Medicinal Chemistry, they will sign the appropriate forms. You will also need to submit those forms as well as a final copy of your thesis to the School of Graduate Studies as per their website requirements (https://grad.rutgers.edu/academics/graduation). All degrees and diplomas are conferred at the May commencement ceremony, but students who file their application and complete all degree requirements by the announced deadlines in October or January will have their diplomas dated accordingly.

3.1. Suggested Timeline for full-time M.S. (Thesis Option) in Medicinal Chemistry

Students admitted in odd years:

Semester/Year	Course	Credits	Total
Year 1 Fall	• Med Chem Research Principles • Elective 1 and/or Molecular Biology and Biochemistry • Rotations	9	9
Year 1 Spring	• Modern Synthetic Organic Chemistry • Interpretation of Organic Spectra • Principles of Drug Design • Thesis research project	9	18
Year 2 Fall	• Elective 1 and/or Molecular Biology and Biochemistry • Seminar 2 • Thesis research project	4	22
Year 2 Spring	• Thesis research project	-	22
Year 3 Fall	• Dissertation and thesis defense		22

Students admitted in even years:

Semester/Year	Course	Credits	Total
Year 1 Fall	• Molecular Biology and Biochemistry • Elective 1 • Rotations	9	9
Year 1 Spring	• Modern Synthetic Organic Chemistry • Interpretation of Organic Spectra • Thesis research project	9	18
Year 2 Fall	• Med Chem Research Principles • Seminar 2 • Thesis research project	4	22
Year 2 Spring	• Principles of Drug Design • Thesis research project	-	22
Year 3 Fall	• Dissertation and thesis defense		22

3.2. Suggested Timeline for full-time M.S. (Non-Thesis Option) in Medicinal Chemistry

Students admitted in odd years:

Semester/Year	Course	Credits	Total
Year 1 Fall	• Med Chem Research Principles • Elective 1 (suggested Adv Organic) • Elective 2	9	9
Year 1 Spring	• Modern Synthetic Organic Chemistry • Interpretation of Organic Spectra • Principles of Drug Design	9	18
Year 2 Fall	• Molecular Biology and Biochemistry • Seminar 1 • Elective 3	7	25
Year 2 Spring	• Elective 4 • Non-Thesis Masters Programmatic Study in Medicinal Chemistry	6	31

Students admitted in even years:

Semester/Year	Course	Credits	Total
Year 1 Fall	• Molecular Biology and Biochemistry • Elective 1 (suggested Adv Organic) • Elective 2	9	9
Year 1 Spring	• Modern Synthetic Organic Chemistry • Interpretation of Organic Spectra • Elective 3	9	18
Year 2 Fall	• Med Chem Research Principles • Seminar 1 • Elective 4	7	25
Year 2 Spring	• Principles of Drug Design • Non-Thesis Masters Programmatic Study in Medicinal Chemistry	6	31

4. The Doctor of Philosophy Program

4.1. Graduate Course Curriculum

Required Core Courses for Ph.D. (20 credits)

- Medicinal Chemistry: Research Techniques and Principles (16:663:501) (3 credits, offered once every two years) – Fall
- Principles of Drug Design (16:663:502) (3 credits, offered once every two years) – Spring
- Interpretation of Organic Spectra (3 credits) (16:160:515) – Spring
- Modern Synthetic Organic Chemistry (3 credits) (16:160:503) – Spring
- Molecular Biology and Biochemistry (3 credits) (16:115:511) - Fall
- Independent Research Proposal (3 credits) (16:663:540)
  Independent Research Proposal must be your own ideas and not directly related to your thesis project. It is to be written using the National Institutes of Health (NIH) R21 grant style consisting of one-page Specific Aims and six-page Research Proposal. When complete (your advisor cannot edit it for you), schedule a meeting of the dissertation committee and submit copies of the written document to each member (allow at least two weeks for them to read the proposal). At the scheduled meeting, you will present your proposal to the committee (PowerPoint). Members of the committee may ask questions about anything in the proposal.
- Seminar in Medicinal Chemistry, two (2 credits) (16:663:601 or 602)

Electives: 6 Credits from the approved list or courses approved by the advisor.

Lab Rotation (3 credits) (16.663.508)

Research in Medicinal Chemistry (16:663:701,702) (43 research credits).

Graduate students in the Ph.D. program must sign up for the lab rotation course (3 credits) in the first semester of the first year. It is recommended that students rotate in two to three labs before deciding on a lab to join for the thesis project. However, students can join a lab without rotation upon mutual agreement between a student and the faculty. In such a case, students should still sign up for the rotation course and receive the credit. **You must select a research advisor by the end of your first semester of full-time study**. It is recommended that you begin your research project as early as possible. You should plan on working in the lab year-round to minimize the amount of time needed to earn your degree. Failure to select a research advisor will result in transitioning to the MSc program.

4.2. Dissertation Committee

Graduate students in the Ph.D. program must assemble a dissertation committee consisting of the student's advisor, two other faculty members from the medicinal chemistry program, and one committee member (have a Ph.D.) from outside the program to serve on your Ph.D. Dissertation Committee. The outside member can be from a different department at Rutgers or from industry (but must not be a member or

former member of the research groups of any of the other committee members). Your committee is a valuable resource for suggestions relating to your research project. The dissertation committee needs to be finalized by the fall semester of the second year.

4.3. Qualifying Exam

A qualifying exam is required for PhD candidacy. In the fall semester of the second year, students must decide on the members on their thesis committee and coordinate with medicinal chemistry program members to arrange for the qualifying exam. The deadline for the qualifying exam is August of the second year. For a qualifying exam, students will give a presentation on their thesis project, which should include background, goals, and any preliminary results if available. Preliminary results are useful, however, not required. All didactic course work must be complete in order to pass your qualifying exam (excludes Independent Research Proposal and Seminar in Medicinal Chemistry). Overall, the committee will evaluate five areas:

1. The student's ability to understand in a broad context their area of research.
2. Their ability to plan and execute rationally designed experiments.
3. Their effort (not results) in the laboratory up until this point.
4. Their proposal for future work on their project.
5. Their performance in coursework.

Students are expected to deliver a one-hour presentation covering the background, experiment design, research output, conclusion, and perspectives. Committee members will raise questions during or after the presentation. Students will receive pass, fail, or conditional pass upon voting from the dissertation committee members. Students who fail the qualifying exam will be advised to graduate with a master's degree. If you are successful with the qualifying exam, your committee members will then sign paperwork which you will need to submit to the School of Graduate Studies, and you will be formally admitted into candidacy for a Ph.D. degree. In the event of a conditional pass your committee will provide you with a set of requirements that you must meet to pass your qualifying exam. You will then have four to six months to reattempt your qualifying exam in which the only outcomes are pass or fail. Students who fail in the second attempt will be dismissed from the graduate program and be advised to graduate with a MSc degree should he/she meets the requirements of MSc degree.

4.4. Ph.D. Thesis Committee Meeting

You must arrange at least one meeting with your thesis committee to review the scope of the project you are working on, your results up to the present time, and your plans for future experiments by year 4 (before the end of the Spring semester or in Summer). This meeting gives the other members of your committee an opportunity to learn about your project, make sure that it is broad enough in scope for a Ph.D. dissertation, and to offer suggestions for improving the project. It also ensures that there are no unpleasant surprises when you defend your dissertation.

4.5. Yearly Independent Development Plan

You must submit the independent development plan every year. Your advisor will review the plan and provide you with a grade of Satisfactory or Unsatisfactory with feedback. An Unsatisfactory grade means the student is not in good standing in the graduate program. A warning letter from the graduate program will be issued by the graduate director, Dr Jun Wang. A list of expected actions will be recommended in the warning letter. Students receiving two consecutive Unsatisfactory grades will be recommended for dismissal from the graduate program. The students can appeal the decision to the executive committee. In such case, the students need to prepare a written summary of the thesis project and give a presentation to the executive committee. The executive committee will vote to decide dismissal or grant an extension to meet the requirements.

4.6. Teaching Assistant Re-appointment

Students in the PhD graduate program seeking to apply teaching assistantships within or outside the medicinal chemistry department need to be in good standing in the graduate program to qualify. The student's advisor needs to provide written verification to the graduate program director Dr. Jun Wang that the student is in good standing. Dr. Wang will not sign the re-appointment letter without the advisor's verification.

4.7. Ph.D. Dissertation and Thesis Defense

As your research project nears its end, you will begin writing your dissertation. This is an iterative process between you and your advisor, with your advisor offering corrections and suggestions for improving the written document. The School of Graduate Studies – New Brunswick requires that you strictly adhere to their guidelines when preparing your thesis or dissertation. A style guide can be found online at https://grad.rutgers.edu/academics/graduation/electronic-thesis-and-dissertation-style-guide. This guide gives detailed information about the order and physical layout of pages in the written document, margins, type of paper required, etc.

While the School of Graduate Studies - New Brunswick does not specify any criteria for the characterization of new compounds, this is central to medicinal chemistry and this program requires that all new compounds be adequately characterized. This means that you should include tabulated ^{1}H and ^{13}C-NMR spectra for all new compounds and mass spectra). For optically active compounds the specific rotation should be reported. Other data can be reported as necessary. In general, criteria for characterization should conform to that specified in the American Chemical Society Guidelines for Authors (https://researcher-resources.acs.org/publish/author_guidelines?coden=jmcmar#data_requirements). For all compounds the color and physical form (solid, liquid, oil, etc) should be specified. The mass (or volume) and the number of moles (mmol or μmol) of all reactants and reagents and the mass and percent yield of all products should be reported.

When a suitable document has been completed, you will schedule a date for your defense and submit copies to each member of your committee (allow them at least two weeks to read the dissertation). During the defense, the members of your committee will

ask questions about the work you performed. They may also ask questions relating more to your general background and preparation. Suggestions may also be made for ways to improve the written dissertation. It is wise to act on these suggestions and make the necessary corrections or additions to the thesis. When everyone is satisfied that you have met all the requirements for the Ph.D. degree in Medicinal Chemistry, they will sign the appropriate forms. You will then need to submit those forms as well as a final copy of your dissertation to the School of Graduate Studies as per their website requirements (https://grad.rutgers.edu/academics/graduation). All degrees and diplomas are conferred at the May commencement ceremony, but students who file their application and complete all degree requirements by the announced deadlines in October or January will have their diplomas dated accordingly.

4.8. Transferring Credit from another Institution

Students that have taken graduate courses at another U.S. institution or foreign institution may complete an application to have some of those credits transferred to Rutgers. The student must consult with his/her advisor about which courses might be transferred. The student must then obtain the necessary application from Hui Pung and get it signed by the Graduate Director, who must approve the list of courses to be transferred. Only graduate level courses related to the Medicinal Chemistry curriculum completed at an accredited university with a grade of B or better may be transferred at the discretion of the Graduate Director. The student must complete the application and submit a transcript along with the Application for Transfer of Credit to the Office of the Dean of the School of Graduate Studies - New Brunswick, 25 Bishop Place, New Brunswick, NJ. No student may transfer any credits until 12 credits of graduate level course work have been completed at Rutgers with a grade of B or better. For Ph.D. students, no more than 9 credits may be transferred. M.S. students may transfer no more than 6 credits of course work. Credit is not given for courses taken more than six years prior to the application for transfer of credits.

4.9. Recommended Timeline for Ph.D. in Medicinal Chemistry

Students admitted in odd years:

Semester/Year	Course	Credits	Total
Year 1 Fall	• Med Chem Research Principles • Molecular Biology and Biochemistry • Elective 1 (suggested: Advanced Organic) • Rotations (required for Ph.D.)	12	12
Year 1 Spring	• Modern Synthetic Organic Chemistry • Interpretation of Organic Spectra • Principles of Drug Design	9	21
Year 2 Fall	• Elective 2 (can take in Spring if necessary)	3	24
Year 2 Spring	• Qualifying Exam	-	24
Year 3 Spring	• Seminar 1	1	25
Year 4	• Independent Research Proposal	3	28
Year 5	• Seminar 2 • Thesis	1	29

Students admitted in even years:

Semester/Year	Course	Credits	Total
Year 1 Fall	• Molecular Biology and Biochemistry • Elective 1 (suggested: Advanced Organic) • Elective 2 (can take in Spring Year 1 if necessary) • Rotations (required for Ph.D.)	12	12
Year 1 Spring	• Modern Synthetic Organic Chemistry • Interpretation of Organic Spectra	6	18
Year 2 Fall	• Med Chem Research Principles	3	21
Year 2 Spring	• Principles of Drug Design • Qualifying Exam	3	24
Year 3 Spring	• Seminar 1	1	25
Year 4	• Independent Research Proposal	3	28
Year 5	• Seminar 2 • Thesis	1	29

5. PharmD/PhD dual degree program in Medicinal Chemistry

The Ernest Mario School of Pharmacy has established a joint PharmD/PhD program to meet the needs of interests of highly motivated PharmD students. The program enables students to complete both degrees in approximately nine years by beginning their PhD coursework and research while still enrolled in the PharmD program. Our graduate program joined the dual degree program starting in 2014.

The dual degree PharmD/PhD can arrange to take graduate level courses in their PharmD professional years, and matriculate into the Graduate Program in Medicinal Chemistry at the end of their 2nd professional year in the PharmD program. These students will continue to finish their PharmD degree and graduate with their classmates at the end of their P4 year while their course work during the P3 and P4 year will be tailored to meet the requirements for the Ph.D. degree in Medicinal Chemistry (see the Recommended Timeline for PharmD/PhD in Medicinal Chemistry). Qualifying examinations will take place by August of their full first year after receiving their PharmD degree (end of year 1 in Ph.D.) program.

5.1. PhD Curriculum in Medicinal Chemistry for PharmD/PhD Dual Degree Students

Required Core Courses for Ph.D. (17 credits)

- Medicinal Chemistry: Research Techniques and Principles (16:663:501) (3 credits, offered once every two years) – Fall
- Principles of Drug Design (16:663:502) (3 credits, offered once every two years) – Spring
- Interpretation of Organic Spectra (3 credits) (16:160:515) – Spring
- Modern Synthetic Organic Chemistry (3 credits) (16:160:503) – Spring
- Independent Research Proposal (3 credits) (16:663:540)
  Independent Exam Research Proposal must be your own ideas and not directly related to your thesis project. It is to be written using the National Institutes of Health (NIH) R21 grant style consisting of one-page Specific Aims and six-page Research Proposal. When complete (your advisor cannot edit it for you), schedule a meeting of the dissertation committee and submit copies of the written document to each member (allow at least two weeks for them to read the proposal). At the scheduled meeting, you will present your proposal to the committee (PowerPoint)..
- Seminar in Medicinal Chemistry, two (2 credits) (16:663:601 or 602)

Electives: 6 Credits from the approved list or courses approved by the advisor.

Lab Rotation (3 credits) (16.663.508)

Research in Medicinal Chemistry (16:663:701,702) (46 research credits).

5.2. Suggested timeline for PharmD/Ph.D. Students:

Semester/Year	Course	Credits	Total
P1-P2	• Med Chem Research Principles (Spring) • Principles of Drug Design (Spring) • Rotations	9	9
P3-P4	• Modern Synthetic Organic Chemistry (Spring) • Elective 1 (suggested: Advanced Organic, Fall) • Interpretation of Organic Spectra (Spring)	9	18
Year 1 Fall	• Elective 2	3	21
Year 1 Spring	• Qualifying Exam	0	21
Year 2 Fall		0	21
Year 2 Spring	• Seminar 1	1	22
Year 3 Spring	• Independent Research Proposal	3	25
Year 4	• Seminar 2 • Thesis	1	26

6. Electives

The following is a list of electives that have previously been taken by students in the program (as of 2024). Students are encouraged to take electives that align with the graduate project. Advanced Organic Chemistry I is a recommended elective, although it is not required. Electives not listed below must be approved in writing from the PI and Director of Graduate Studies. Please send a copy of the syllabus and a short paragraph as to why the course will be useful for your Ph.D. to the Director of Graduate Studies. Courses offered at Rutgers can be found at: https://classes.rutgers.edu/soc/#home

Course Number	Department	Course	Semester
16:160:511	Chemistry	Advanced Organic Chemistry I	Fall
16:160:575	Chemistry	Principles of Organometallic Chemistry	Spring
16:160:571	Chemistry	Advanced Inorganic Chemistry	Fall
16:115:503**:**	Biochemistry	Biochemistry	Spring and Fall
16:115:512:	Biochemistry	Molecular Biology and Biochemistry II	Spring
16:663:506:	Med Chem	Heterocycles in Medicinal Chemistry	Spring
16:160:550	Chemistry	Computational Chemistry	Spring
16.160:582	Chemistry	Chemical Biology	Spring
16:718:680	Pharmacology	Cellular and Molecular Pharmacology	Fall
16:718:560	Pharmacology	Communicating Science	Fall
16:761:610		Aspects in Aging	Spring
16:718:600	Pharmacology	Cancer Pharmacology	Spring
16:160:580	Chemistry	Structural Biophysics	Fall

7. Miscellaneous Information

7.1. Special Issues for International Students

Rutgers Global is available to answer all questions relating to policies, laws, and procedures relating to international students. Please visit their web site at:

https://global.rutgers.edu/. Students that have been awarded a Teaching Assistantship will be required to take an English Language Examination. Based upon the results of that test you will either be cleared for full duties as a TA, restricted to non-instructional duties, or required to take an English Language course (grade does not affect your GPA). It is important for non-English speaking students that you practice your English language skills as much as possible.

7.2. Financial Support

Outside of external fellowships there are two main mechanisms for financial support of graduate students, teaching assistantships and graduate assistantships. There is no separate application process for this support. In some cases, entering students are supported as teaching assistants (TAs). Such support is offered for up to two years to students with Department of Medicinal Chemistry faculty advisors. At that point if their advisor has money from a research grant, the student is typically supported as a graduate assistant (GA). Money for TA positions is given to the department from the university. A TA position includes a stipend, full tuition remission and fees, and health benefits. The Medicinal Chemistry Department has a limited number of TA positions that it can offer. Those positions are awarded on a first come, first serve basis. Other departments, including Life Science and Chemistry, often have unfilled TA positions. In the past several students in the Medicinal Chemistry graduate program have been supported as TAs from these other departments. Since these other departments often do not know until the start of classes whether everyone that was offered a TA position will actually attend Rutgers, those positions often become available at or near the start of the semester. In some cases, students that do not get a TA in the Fall semester, may obtain a position at the start of the Spring semester.

Students are encouraged to make use of the GradFund (Office of Graduate Student External Grants and Fellowships) website (https://gradfund.rutgers.edu). Its mission is to assist graduate students throughout the process of identifying and applying for external fellowships and grants. GradFund offers individual meetings to discuss funding opportunities with graduate students as well as workshops, presentations and mentoring programs. Students may also want to look at the Office of Financial Aid website (https://financialaid.rutgers.edu) as well as the School of Graduate Studies website for additional funding opportunities.

If you obtain a TA in Medicinal Chemistry your duties will typically include helping to proctor examinations, grading exams and quizzes, and conducting small group weekly (usually < 10 students) recitation sessions. If your TA is from Life Science or Chemistry, you will typically be supervising a laboratory session and grading papers. Your TA duties cannot require working more than 15 hours per week. Students that are supported as GAs are expected to work in the laboratory on their research projects.

If you are supported as a TA or a GA, you are expected to be conscientious about performing your duties. Teaching Assistants who do not show up when expected for recitation sessions or for proctoring exams, or that do not do their share of grading exams and quizzes will not be renewed for a second year. Along the same lines, a GA

that spends only minimal time in the lab and does not give good effort will find their advisor less likely to renew their support for subsequent years.