

Chemistry 501: Chemistry of Heterocyclic Compounds
Fall 2020, Rutgers University, Newark
Syllabus
Lecture: Wednesday, 6:00-8:50 PM.

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All lectures will be available for download through Blackboard at the time of the regular lectures and available for the remainder of the semester.

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Office hours: By appointment.

Course Synopsis:

Note that due to COVID-19, the class will be given in a remote format. Fundamental principles and advanced topics in heterocyclic chemistry. Synthesis and reactivity of major classes of heterocyclic compounds are covered in detail, with emphasis on recent advances in synthesis and reaction development. Special attention is given to heterocycles of biological interest and the importance of heterocycles in pharmaceutical industry.

Required Text:

- *Heterocyclic Chemistry, 5th Ed.* Joule, J. A.; Mills, K.

Recommended Texts (Optional):

General organic chemistry textbooks

- *Strategic Applications of Named Reactions in Organic Synthesis.* Kurti, L.; Czako, B.
- *Advanced Organic Chemistry, Part B: Reactions and Synthesis.* Carey, F. A.; Sundberg, R. J.

General heterocyclic chemistry textbooks:

The following texts are available in Dana Library this semester:

- *Heterocyclic Chemistry in Drug Discovery.* Li, J. J. (available online through Rutgers Libraries)
- *Palladium in Heterocyclic Chemistry, 2nd Ed.* Li, J. J.; Gribble, G. W.
- *Fundamentals of Heterocyclic Chemistry: Importance in Nature and in the Synthesis of Pharmaceuticals.* Quin, L. D.; Tyrell, J. A.

- *The Chemistry of Heterocycles: Structures, Reactions, Synthesis, and Applications*, 2nd Ed. Eicher, T.; Hauptmann, S.

List of other resources in heterocyclic chemistry:

- *Heterocyclic Chemistry*. Gilchrist, T. L.
- *Name Reactions in Heterocyclic Chemistry*. Li, J. J.
- *Handbook of Heterocyclic Chemistry*, 3rd Ed. Katritzky, A. R.; Ramsden, C. A.; Joule, J. A.; Zhdankin, V. V.
- *Comprehensive Heterocyclic Chemistry*. Katritzky, A. R., Ed. Pergamon.
- *Advances in Heterocyclic Chemistry*. Katritzky, A. R., Ed. Elsevier.
- *Progress in Heterocyclic Chemistry*. Gribble, G. W.; Joule, J. A., Eds. Pergamon.

Grading:

Breakdown:

Assignment 1: 20%

Assignment 2: 20%

Assignment 3: 20%

Final project: 40%

Approximate Class Outline:

Week	Date	Lecture	Topic
1	Sep 2	Lecture 1	General reactivity
2	Sep 9	Lecture 2	5-Membered heterocycles, 1 heteroatom: Pyrroles/Furans/Thiophenes
3	Sep 16	Lecture 3	5-Membered heterocycles, 1 heteroatom: Pyrroles/Furans/Thiophenes
4	Sep 23	Lecture 4	Benzofused 5-membered heterocycles, 1 heteroatom: Indoles/Benzofurans/Benzothiophenes
5	Sep 30	Lecture 5	6-Membered heterocycles, 1 heteroatom: Pyridines
6	Oct 7	Lecture 6	6-Membered heterocycles, 1 heteroatom: Pyridines/Quinolines/Isoquinolines
7	Oct 14	Lecture 7	Assignment 1: Background and outline
8	Oct 21	Lecture 8	Case studies, Assignment 1 Due
9	Oct 28	Lecture 9	5-Membered heterocycles, 2 heteroatoms: 1,2-Azoles/1,3-Azoles
10	Nov 4	Lecture 10	5-Membered heterocycles, 2 heteroatoms: 1,2-Azoles/1,3-Azoles
11	Nov 11	Lecture 11	Case studies, Assignment 2 Due
12	Nov 18	Lecture 12	6-Membered heterocycles, 2 heteroatoms: Diazines, Pyrylium/Pyrones,
13	Nov 25		Thanksgiving Break
14	Dec 2	Lecture 13	Case studies, Assignment 3 Due
15	Dec 9	Lecture 14	Multicomponent and Pd-catalyzed reactions in heterocyclic chemistry, Case studies
Finals	Dec 16		Final Project Due

Exam:

There will be no exam in this class. The grading breakdown will be based on 3 written assignments and the final written project, covering assigned reading and literature discussed in class.

Assignments:

Each student will be asked to review a heterocyclic transformation or a heterocycle based on an original research paper from the current heterocyclic literature and prepare a 3-5 page long powerpoint presentation using *ACS settings format*. The presentation should cover: (i) the most important aspects (mechanism, scope); (ii) cited references and background; (iii) follow-up work from the assigned topic. **The presentation should be a critical summary of the assigned topic, and not simply a description of the lead paper.** The selection of papers, heterocycles and heterocyclic transformations will be given during the semester. Each presentation will be graded as 20% of the final grade. Grading will include content, presentation and clarity.

Final Project:

Each student will be asked to review a heterocyclic transformation or a heterocycle based on an original research paper from the current heterocyclic literature and prepare a 3-page review article in *ACS communication format*. The review article should cover: (i) the most important aspects (mechanism, scope); (ii) cited references and background; (iii) follow-up work from the assigned topic. **The review should be a critical summary of the assigned topic, and not simply a description of the lead paper.** The selection of papers will be given after the midterm presentation. The review article should be formatted using standard ACS template (ChemDraw drawings, ACS settings). The review should be submitted in an electronic format (as a .pdf file) The project will be graded as 40% of the final grade. The final project is due at the time of the regular final exam. The reviews will be compiled and distributed to the class after the final exam. Grading will include content, presentation and clarity.

Learning Objectives:After completion of this course students should:

- be familiar with modern methods in heterocyclic chemistry with focus on the importance of heterocycles in biological systems and pharmaceutical industry
- be familiar with major classes of heterocyclic compounds and their chemical properties
- be able to predict reactivity of different classes of heterocycles
- be familiar with commonly used synthetic routes to heterocycles
- be able to plan synthetic routes to complex organic molecules containing heterocyclic motifs
- be familiar with the major advances and the current state-of-the-art methods in heterocyclic chemistry
- be familiar with major journals and publications in heterocyclic chemistry
- be familiar with general synthetic approaches used in drug discovery and synthetic routes to major drugs containing heterocyclic motifs
- be able to critically evaluate heterocyclic chemical literature, present seminars and short reviews in heterocyclic chemistry

Attendance Policy:

Please, review Rutgers University attendance policy, which can be found at <http://policies.rutgers.edu/view-policies/academic-%E2%80%93-section-10#2>

Academic Integrity Policy:

Please, review Rutgers University Academic Integrity Policy, which can be found at <http://academicintegrity.rutgers.edu/academic-integrity-policy>. This policy applies to all Schools and Colleges of Rutgers, the State University of New Jersey, including the Ernest Mario School of Pharmacy and the Rutgers College of Nursing.

Accommodation and Support Statement

Rutgers University Newark (RU-N) is committed to the creation of an inclusive and safe learning environment for all students and the University as a whole. RU-N has identified the following resources to further the mission of access and support:

For Individuals with Disabilities: The Office of Disability Services (ODS) is responsible for the determination of appropriate accommodations for students who encounter barriers due to disability. Once a student has completed the ODS process (registration, initial appointment, and submitted documentation) and reasonable accommodations are determined to be necessary and appropriate, a Letter of Accommodation (LOA) will be provided. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at ods.rutgers.edu. Contact ODS at (973)353-5375 or via email at ods@newark.rutgers.edu.

For Individuals who are Pregnant: The Office of Title IX and ADA Compliance is available to assist with any concerns or potential accommodations related to pregnancy. Students may contact the Office of Title IX and ADA Compliance at (973) 353-1906 or via email at TitleIX@newark.rutgers.edu.

For Absence Verification: The Office of the Dean of Students can provide assistance for absences related to religious observance, emergency or unavoidable conflict (e.g., illness, personal or family emergency, etc.). Students should refer to [University Policy 10.2.7](#) for information about expectations and responsibilities. The Office of the Dean of Students can be contacted by calling (973) 353-5063 or emailing deanofstudents@newark.rutgers.edu.

For Individuals with temporary conditions/injuries: The Office of the Dean of Students can assist students who are experiencing a temporary condition or injury (e.g., broken or sprained limbs, concussions, or recovery from surgery). Students experiencing a temporary condition or injury should submit a request using the following link: <https://temporaryconditions.rutgers.edu>.

For English as a Second Language (ESL): The Program in American Language Studies (PALS) can support students experiencing difficulty in courses due to English as a Second Language (ESL) and can be reached by emailing PALS@newark.rutgers.edu to discuss potential supports.

For Gender or Sex-Based Discrimination or Harassment: The Office of Title IX and ADA Compliance can assist students who are experiencing any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking. Students can report an incident to the Office of Title IX and ADA Compliance by calling (973) 353-1906 or emailing TitleIX@newark.rutgers.edu. Incidents may also be reported by using the following link: tinyurl.com/RUNReportingForm. For more information, students should refer to the University's Student Policy Prohibiting Sexual Harassment, Sexual Violence, Relationship Violence, Stalking and Related Misconduct located at <http://compliance.rutgers.edu/title-ix/about-title-ix/title-ix-policies/>.

For support related to interpersonal violence: The Office for Violence Prevention and Victim Assistance can provide any student with confidential support. The office is a **confidential resource** and does *not* have an obligation to report information to the University's Title IX Coordinator. Students can contact the office by calling (973) 353-1918 or emailing run.vpva@rutgers.edu. There is also a confidential text-based line available to students; students can text (973) 339-0734 for support.

For Crisis and Concerns: The Campus Awareness Response and Education (CARE) Team works with students in crisis to develop a support plan to address personal situations that might impact their academic performance. Students, faculty and staff may contact the CARE Team by using the following link: tinyurl.com/RUNCARE or emailing careteam@rutgers.edu.

For Stress, Worry, or Concerns about Well-being: The Counseling Center has confidential therapists available to support students. Students should reach out to the Counseling Center to schedule an appointment: counseling@newark.rutgers.edu or (973) 353-5805. If you are not quite ready to make an appointment with a therapist but are interested in self-help, check out *TAO at Rutgers-Newark* for an easy, web-based approach to self-care and support: <https://tinyurl.com/RUN-TAO>.

For emergencies, call 911 or contact Rutgers University Police Department (RUPD) by calling (973) 353-5111.