Department of Chemistry: E331 CB, 335-1350, DEO Len MacGillivray
Instructor: Dr. Gregory K. Friestad -- E455 CB, 319-335-1364, gregory-friestad@uiowa.edu
Office Hours: E455 CB, Tues 11am–12pm, Wed 2–3pm, or by appointment
Scheduled Lectures: Tuesday/Thursday, 8:00–9:15am, online
Course Website: icon.uiowa.edu

Course Description and Goals

From UI Course Catalog: Survey of organic reactions used in contemporary organic synthesis; emphasis on C–C bond forming reactions, functional group interconversions, oxidations and reductions; mechanistic details of reaction types; innovations in catalytic and asymmetric organic reactions.

Successful completion of this course will ensure that students...
• Build a fundamental knowledge base of reactions for organic synthesis, and understand how they generate chemo-, regio-, and stereoselectivity.
• Demonstrate how to apply current reactions and methodology to design feasible synthetic plans for small organic target molecules such as chiral ligands, monomers for materials synthesis, drug candidates, and natural products.
• Develop literature research skills, critical thinking, and scientific communication skills via a written and oral presentation including peer review and revision.

Course Textbook and Materials
• Friestad, G. K. Advanced Organic Synthesis, 2011, PDF file (download from course website)
• journal articles and other documents to be distributed via course website

Course Outline
A. Stereochemistry, Conformation, Stereoelectronic Effects
B. Some Foundations for Thinking About Organic Synthesis: Writing Mechanisms, Retrosynthetic Analysis, Polarity Reversal (Umpolung), Protecting Groups
C. Preparative Methods in Organic Chemistry: A Retrosynthetic Perspective

Useful Reference Materials
Selected readings may be assigned from some of the resources listed below. Also, in your problem sets and projects, you may find it useful to consult these resources as needed.

Synthetic Strategy
Reactions and Selectivity
• Mundy, B. P.; Ellerd, M. G.; Favoloro, F. G. *Name Reactions and Reagents in Organic Synthesis*, 2nd edition, Wiley: New York, 2005. (accessible online through UI Library)
• *Reaxys*, online reaction database (previously known as Beilstein): https://www.reaxys.com

Stereochemistry

Applications to Target-Directed Syntheses
• Searchable databases of syntheses:
  Reich, H. J. https://organicchemistrydata.org/hansreich/resources/syntheses/
  Kan, T. http://w3pharm.u-shizuoka-ken.ac.jp/~yakuzo/pass-eng/pdf-eng.html

Calendar: Tentative Due Dates (changes will be announced on website and in class)
| Problem Set 1 | Conformation, Stereochemistry, Stereoelectronics | Due Feb 12 |
| Problem Set 2 | Synthetic Planning, Aromatic Compounds | Due Feb 26 |
| Problem Set 3 | Applications of Preparative Methods A | Due Mar 12 |
| Problem Set 4 | Applications of Preparative Methods B | Due Mar 26 |
| Final Project Report First Draft | | Due Apr 9 |
| Final Project Report Peer Review | | Due Apr 23 |
| Final Project Report Presentations (provide slides in advance) | | Apr 22–May 6 |
| Final Project Report Final Revised Draft | | Due May 13 |

Coursework Grading
| Problem Sets: 4 x 50 pts | 200 points |
| Student Topic Presentation: 50 pts | 50 points |
| Final Project Report | 200 points |
| Critique: 50 points | |
| Report Oral Presentation: 50 points | |
| Final Revised Report: 100 points | |
| Total | 450 points |

*Student Topic Presentations* will involve a brief presentation in class (10-15 minutes) about a synthesis-oriented topic from the current literature, selected in consultation with the instructor. The presentation should (a) address reasoning and justification for the work, (b) outline key points in the analysis of the problem or question, (c) highlight the most important results, and (d) discuss what the research projects add to the field of synthesis.
Class attendance and participation. It is important to keep up with the assigned reading and sample problems in this class, as we will be discussing these in class meetings. Although a specific point allocation is not assigned to attendance or participation, the instructor reserves the right to use these factors for determination of grades in borderline cases.

Academic honesty policies in this course. Although consulting books, journals, and the like is encouraged, database structure searching (Scifinder, Reaxys, etc) may NOT be used to find the original source and solutions for problems in the Problem Sets. Students may discuss Problem Sets with their classmates, but the work that is submitted for grading must be their own. Students may work together on preparing their Student Topic Presentations or Final Project Reports, and are encouraged to work together to discuss and practice their in-class presentations.

More About the Final Project Report

In this course, you will develop and apply some literature research skills by writing a report about a topic in synthesis. The report should explain the importance of the research area, the key challenges and problems that are current in the area, and provide several solutions to the problems from the current literature. Topics will be assigned early in the semester. There will be a peer review component, in which a classmate will review your first draft and provide constructive criticism.

First Draft: The first draft will not be graded. It is intended to allow you to have a round of peer review before your final draft. Thus, the content should be mostly complete, including references. A polished format is not required, but it must be legible. The first draft will be rejected if it is too incomplete, illegible, or otherwise not suitable for peer review. If your first draft is rejected and/or submitted late, your colleague will have less time to complete the critique. Although this component is not graded, you will lose 10 points on your overall course grade for each calendar day your first draft is overdue.

Critique: You will each critically review another students’ first draft (randomly assigned) and provide constructive suggestions. Your grade for this critique will be assigned based on your ability to (a) validate that the literature covered is appropriate and properly cited, (b) identify any problems with the accuracy and presentation of the content, both text and graphics, and (c) suggest appropriate corrections. If your critique is submitted late, your colleague will have less time to make any corrections. You will lose 10 points for each calendar day your critique is overdue.

Final Draft: The final draft will be a formal typewritten document which should be presented with clear, concise text. Electronic structure drawing must be used, and references in ACS style are required.

Presentation: You will present your report to the class using appropriate media (such as digital overhead camera or computer presentation software), being prepared to answer questions which may arise during your discussion. Presentations will be limited to 10–15 minutes (exact time to be announced later). Each student will be assigned to introduce another students’ presentation, and the introducer will ask the first question during question and answer after the presentation.
Absences and Attendance
Students are responsible for attending class and for contributing to the learning environment of a course. Students are also responsible for knowing course absence policies, which vary by instructor. All absence policies, however, must uphold the UI policy related to student illness, mandatory religious obligations, including Holy Day obligations, unavoidable circumstances, and University authorized activities (https://clas.uiowa.edu/students/handbook/attendance-absences). Students may use the CLAS absence form to aid communication with the instructor who will decide if the absence is excused or unexcused; the form is located on ICON within the top banner under "Student Tools.”

Academic Integrity
All undergraduates enrolled in courses offered by CLAS have in essence agreed to the College's Code of Academic Honesty. Academic misconduct affects a student's related grade and is reported to the College which applies an additional sanction including suspension. Outcomes about misconduct are communicated through UI email (https://clas.uiowa.edu/students/handbook/academic-fraud-honor-code).

Accommodations for Disabilities
UI is committed to an educational experience that is accessible to all students. A student may request academic accommodations for a disability (such as a mental health, attention, learning, vision, and a physical or health-related condition) by registering with Student Disability Services (SDS). The student is then responsible for discussing specific accommodations with the instructor. More information is at https://sds.studentlife.uiowa.edu/.

Administrative Home of the Course
The College of Liberal Arts and Sciences (CLAS) is the administrative home of this course and governs its add/drop deadlines, the second-grade-only option, and related policies. Other UI colleges may have different policies for courses offered by that college. CLAS policies may be found here: https://clas.uiowa.edu/students/handbook.

Classroom Expectations
Students are expected to comply with University policies regarding appropriate classroom behavior as outlined in the Code of Student Life (https://dos.uiowa.edu/policies/code-of-student-life/). This includes related UI policies and procedures that all students have agreed to regarding the COVID-19 pandemic. Particularly, each student must wear a face mask when in a UI building, including a classroom. The density of seats in classrooms has been reduced, and in some instances, this will allow 6 feet or more of distance while other cases, it may be less. Regardless, wearing a face mask and maintaining as much distance as is possible are vital to slowing the spread of COVID-19. In the event that a student disrupts the classroom environment through the failure to comply with a reasonable directive of an instructor or of the University, the instructor has the authority to ask that the student to leave the space immediately for the remainder of the class period. Additionally, the instructor is asked to report the incident to the UI Office of Student Accountability, with the possibility of additional follow-up with the student. Students who need temporary alternative learning arrangements (TALA) for a future semester related to COVID-19 should visit this website for more information: https://coronavirus.uiowa.edu/temporary-alternative-learning-arrangements-tala.

Class Recordings: Privacy and Sharing
Some sessions of a course could be recorded or live-streamed. Such a recording or streaming will only be available to students registered for the course. These recordings are the intellectual property of the faculty, and they may not be shared or reproduced without the explicit written consent of the faculty member. Students may not share these sessions with those who are not enrolled in the course; likewise, students may not upload recordings to any other online environment. Doing so is a breach of the Code of Student Conduct and in some cases is a violation of the Federal Education Rights and Privacy Act (FERPA).
Communication and the Required Use of UI Email
Students are responsible for official correspondences sent to the UI email address (uiowa.edu) and must use this address for all communication within or with UI (Operations Manual, III.15.2).

Complaints
Students with a complaint about an academic issue should first visit with the instructor or course supervisor and then with the Chair of the department or program offering the course; students may next bring the issue to the College of Liberal Arts and Sciences. See this page for more information: https://clas.uiowa.edu/students/handbook/student-rights-responsibilities.

Final Examination Policies
The final exam schedule is announced around the fifth week of classes; students are responsible for knowing the date, time, and place of a final exam. Students should not make travel plans until knowing this information. No exams of any kind are allowed the week before finals with a few exceptions made for particular types of courses such as labs or off-cycle courses: https://registrar.uiowa.edu/final-examination-scheduling-policies.

Nondiscrimination in the Classroom
The University of Iowa is committed to making the classroom a respectful and inclusive space for people of all gender, sexual, racial, religious, and other identities. Toward this goal, students are invited in MyUI to optionally share the names and pronouns they would like their instructors and advisors to use to address them. The University of Iowa prohibits discrimination and harassment against individuals on the basis of race, class, gender, sexual orientation, national origin, and other identity categories set forth in the University’s Human Rights policy. For more information, contact the Office of Equal Opportunity and Diversity (https://diversity.uiowa.edu/eod; +1 319 335-0705 or (diversity.uiowa.edu)

Sexual Harassment
Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff. All members of the UI community must uphold the UI mission and contribute to a safe environment that enhances learning. Incidents of sexual harassment must be reported immediately. For assistance, please see https://osmrc.uiowa.edu/.