1. Course information:

Title: Asymmetric Synthesis

Course number: chem 494

3 credits

Prerequisites: Chem 322 and Chem 202 or equivalent, minimum grades of "C".

Location: Reichardt 165

Meeting time:

2. Instructor Information:

Professor Fenton Heirtzler
Office: 161
Office hours: 1:00 – 2:00 TR
Tel.: 474-5507
e-mail: frheirtzler@alaska.edu

3. Support services:

Office hours: 1:00 – 2:00 TR

4. Course readings/materials:

G. Proctor *'Asymmetric Synthesis'* 1996, Oxford Science Publications [QD262; 0536466] (highly recommended)
Reading assignments from the scientific literature.
Molecular models (recommended)

5. Course description:

Catalogue Description: Theory and practice in the synthesis of highly enantiomerically enriched organic compounds according to compound classes. Prerequisites: Chem 322 and Chem 202 or permission of instructor. 4 credits.

6. Course Goals:

To provide understanding of how enantiomerically enriched compounds can be synthesized using examples relating to metal chelation, steric effects, chiral reagents and chiral catalysts. To demonstrate to how the chirality of naturally occurring single-enantiomer compounds can be transmitted to non-chiral starting materials through reactivity. To show how the relative amounts of enantiomers in chirally enriched materials can be quantified using chemical and physical methods.

7. Student Learning Outcomes:

By the completion of this module, the students should be able to (a) show how the synthesis of absolutely chiral molecules belonging to specific compound classes can be achieved from achiral starting materials and chiral auxiliaries (b) have a grasp on the mechanisms leading to the preferred formation of a single enantiomer of a product molecule (c) have a good idea of the methods available for the quantification of enantiomerically enriched mixtures according to their compound class.

8. Instructional methods:

Instruction will be by lecture on either whiteboard or chalkboard. Students will be expected to competently record their own notes. This method insures that complicated topics will be correctly paced for the instructional environment.

Homework and test grades will be posted on Blackboard.

9. Course calendar:

Week #	Content
1	• Introduction, Significance of Asymmetric Organic Synthesis • Terminology - What is the chiral pool? • Quantification of Chiral Purity (optical rotation, NMR methods, GC/HPLC)
2	• Using Cram's Rule & Cram's Metal Chelation Rule to Understand diastereotopicity. • Chiral Auxiliaries for Nucleophillic Addition to Carbonyl Group
3	• Use of Chiral Auxiliaries to Control Hydride Addition to Carbonyl Group • Catalytic Reduction of Ketones • Homework assignment #1 due at end of week
4	• Catalytic Reduction of Ketones • Enantioselective hydroboration of alkenes
5	• Catalytic reduction of alkenes and imines
6	• Stereospecific Addition of Electrophiles to Enolates with Chiral Auxiliaries • Homework assignment #2 due at end of week
7	• Review/catch up
8	• Mid-term exam (in class) • Diastereoselective Aldol Reactions
9	• Enantioselective Hydrogenation of Carbon-Carbon Double Bonds
10	• Diastereoselective Aldol Reactions
11	• Enantioselective Hydrogenation of Carbon-Carbon Double Bonds • Cyclopropanation of Alkenes
12	• Sharpless Epoxidation of Allylic Alcohols • Homework assignment #3 due at end of week
13	• Jacobsen-Katsuki Epoxidation of *cis*-Alkenes • Sharpless Asymmetric Dihydroxylation of *trans*-Alkenes
14	• Asymmetric Diels-Alder Reactions

10. Course policies:

Students will be required to take their own lecture notes. Complete attendance at the lectures is essential to success in this course.

Articles from the recent scientific literature will be discussed in the class, and from this, a mark for class participation will be assigned over the entire term.

Make-up exams will be allowed for documented emergency medical circumstances. This does not include doctor appointments, sleeping late, and so forth.

Plagiarism in tests and exams will result in a mark of 'F' for the same test or exam.

11. Evaluation:

- 3 Homework assignments of equal value: 300 points total. The homework assignments will:
  a. Require predicting the structures of reaction products from reactions which are adapted from the contemporary scientific literature,
  b. Determine the ability of students to correctly describe reaction conditions leading to pre-determined target molecules and
  c. Test the students' knowledge of transition states leading to enantioselectively enhanced reaction products.
- Mid-term exam, held in class: 200 points
- Final exam: 400 points
- Classroom participation in reading assignments: 100 points. It is expected that the students will actively contribute to the discussion of the mechanisms of reactions in question, as well as the overall synthetic strategy employed in reading assignments from the contemporary literature.

Grades will be tabulated according to the following rubric: 900-1000 points – A; 800-899 points – B; 700-799 points – C; 600-699 points – D; 0 – 599 points – F

12. Disabilities Services:

The Office of Disability Services implements the Americans with Disabilities Act (ADA), and insures that UAF students have equal access to the campus and course materials. Students with documented disabilities who may need reasonable academic accommodations should discuss these with the instructor during the first two weeks of class. The instructor will work with the Office of Disabilities Services (*208 WHIT, 474-5655) to provide reasonable accommodation to students with disabilities. You will need to provide documentation of your disability to Disability Services.