Syllabus: Organic Chemistry II Laboratory (Chem 2545), 2 Credits (Chemistry Majors)

*Spring Semester, 2015, Instructor: Dr. Robert M. Carlson, Office (Chemistry 325), Phone: 726-7231; Email: rcarlson@d.umn.edu, Office Hours W 2:00 – 3:00 pm, other times by appointment*

**Course description:** Chem 2545 is the required laboratory portion of the second semester of organic chemistry that is designed primarily for chemistry majors. The laboratory emphasizes the use of modern techniques in organic structure determination (NMR, MS, GCMS, IR, Polarimetry), the characteristic reaction chemistry of alcohols, carbonyl compounds, amines and compounds of biological importance (amino acids and carbohydrates) and the use of “microwave-enhanced” organic synthesis. An introduction to literature searching and graphical tools (e.g., SciFinder Scholar and ChemDraw) will be presented and illustrations developed. The work will be performed in groups (see details below) and the results presented to the class (e.g., using PowerPoint) and to the Teaching Assistants. Written reports will be submitted as email attachments. A short review paper (8-10 pages) on common “Organic Chemistry Name Reactions”, “concepts”, “experimental techniques” or contemporary organic chemical topics will be developed with the assistance of the senior instructor.

**Teaching Assistants:**

- **Section 1 (MW 3-5 pm)**, Mr. Lucas Solano, Graduate Teaching Assistant [solan043@d.umn.edu](mailto:solan043@d.umn.edu) and Mr. Dillon Lundstrom ([lunds097@d.umn.edu](mailto:lunds097@d.umn.edu)), Undergraduate Teaching Assistant.

- **Section 2 (TTh 12-2 pm)** Mr. Khiem Nguyen (Graduate Teaching Assistant [chaun@005@d.umn.edu](mailto:chaun@005@d.umn.edu)), and Mr. Jon Fuchs ([fuchs080@d.umn.edu](mailto:fuchs080@d.umn.edu)), Undergraduate Teaching Assistant.

- **Section 3 (TTh 3-5 pm)**, Mr. Lucas Solano, Graduate Teaching Assistant ([solan043@d.umn.edu](mailto:solan043@d.umn.edu)) and Mr. Kevin Hughes ([hughe387@d.umn.edu](mailto:hughe387@d.umn.edu)) Undergraduate Teaching Assistant.

**Laboratory Materials**:  
- Safety Goggles, Bound Laboratory Book

**Week**  
*Note: Unless indicated, the identified experiments are performed “Microscale”.*

1. **a. Check-in.** Course overview, including research paper/SciFinder searching, oral presentations and submission of lab reports as an email attachment to your teaching assistant. There will also be a short presentation on the “essentials” of NMR, including the “handout” and discussion of the NMR experiment.  
   **b. Continue with IR/NMR (Chapters 11/12), plus “in-class” NMR problems.**

2. **a. Discussion of Mass spectrometry/UV (Chapters 13/14), b. Oxidation of cyclohexanol (Chapter 22 a. . Sodium borohydride reduction of 2-methylcyclohexanone (Chapter 26).**

3. **a. Qualitative Analysis and use of Thin-Layer Chromatography (determination of unknown structure of aldehydes/ketones, Chapter 36) ....GCMS analysis ...and preparation of a derivative);  
   **b. b Qualitative Analysis(continued) b. “Hydride Chemistry” (Handout, Mystery Experiment #1)**

4. **“Fischer esterification of unknown acid” (NMR/GCMS, Chapter 40**)  
A sample of an “unknown” acid will be esterified by the Fischer procedure (Chapter 40, Section 4). The resulting butyl ester will then be isolated and analyzed by NMR (spectra obtained by the teaching assistants) and GCMS to identify the starting “unknown” acid.  
*Submission of an outline for the Research Paper.

5. **Enzymatic Reactions: A Chiral Alcohol from a Ketone (Chapter 65) … Handout Note: 2 x Microscale.**

Determination of the Optical Purity of Amino Acids, Use of the Polarimeter.
8.  PowerPoint*/ChemDraw*, oral group presentations to the class (continued)

**Spring break (March 16-20, 2015)**

10. “Mystery Experiments” (“Reaction of Salicyaldehyde with Diethyl Malonate” and “Reaction of Acetophenone with Chlorox” (Handout),
11. Natural Products: a. Synthesis of Camphor from Camphene (Chapter 66) Note: 3 x Microscale b. Carbohydrates (Chapter 63),
14. a. Final development of oral presentations. b. Oral presentations to senior organic chemistry faculty...
15. Check-out

*Free Download of software from UMD-ITSS to personal computer should be considered.

**Reports should be submitted to the teaching assistants as an email “attachment”. You should anticipate that laboratory make-up opportunities will not be possible because of limited space availability.

**Organic Chemistry 2545 Laboratory Work Groups**

The tasks for the semester in Organic Chemistry 2545 will be a combination of individual and group activities. It will be the responsibility of each group (2-3 members) to carry out the assigned set of experiments in the most efficient manner possible, while making sure that every member of the group stays informed as to the status of the work. A portion of an individual’s grade for the semester will be based on how well the “group” performs.

This approach most clearly represents the actual situation that will be encountered in both academic and industrial research. Success in these situations will often depend as much on communication, time management and leadership skills as the accomplishments within the research or development effort itself.

**Software introduction:**

It is assumed that most every student has encountered the use of PowerPoint presentation software and has this application on their personal computer. As for SciFinder Scholar (Chemical Abstracts Service) literature search software and ChemDraw (ChemOffice, CambridgeSoft) structural drawing software, these software packages are paid for by UMD and offered, without charge, to students. The teaching assistants can help obtain these materials.
Laboratory Reports:

Clear, concise laboratory reports should be prepared using Word and ChemDraw and submitted as an email attachment to the Graduate Laboratory Assistant. Reports prepared by an individual within a group for a specific experiment should be reviewed by other members the group before submission.

Oral presentations:

Each student will have 8 minutes to make an oral “PowerPoint” presentation to the class, with 3 minutes allocated for questions after the presentation. (Note: the entire PowerPoint presentation package should be submitted to a Teaching Assistant for evaluation). The topic for oral presentation will be identified by the Teaching Assistant preceding the actual classroom presentation. All members of the “group” should be available to support the member making the oral presentation in answering questions from the audience. The first oral presentation during the week before spring semester break will be to the Teaching Assistants. The second oral presentation at the end of the semester will be to both the Teaching Assistants and to Senior Faculty members.

Approximate Grading Total: 325 points

- Individual and group experiments: approximately 200 points (10-20 points/experiment)
- Quiz (midterm “Practicum” 20 points), Paper (30 pts), Final Oral Presentation (10 pts)
- Instructor evaluation: 30 points (effectiveness of the group, laboratory skills and safety, etc.)

Schedule Summary for The Development of The “Topical Paper”

- Week 1: Identification of “Topic” and overview of the writing process.
- Week 5: Friday, 4 pm. Deadline for submission of Draft outline of paper (including some suggested primary references.
- Week 7: Friday, 4 pm. Deadline for submission of First Draft of the paper (including a “graphical abstract” where appropriate.
- Week 12: Friday, 4 pm. Deadline for submission of Final Draft of the paper.
- Week 13: Grading of Papers

The Senior Instructor will be available for assistance with “The Paper”. The goal is the development of a quality product that could be used as a model for subsequent writing exercises. Grade--satisfactory or “Incomplete”.

Access for Students with Disabilities:

Individuals who have any disability or physical condition (such as pregnancy, allergy, etc.), either permanent or temporary, which might affect their ability to perform in this class, are encouraged to inform the instructor at the start of the semester. It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities that may affect their ability to participate in course activities or to meet course requirements. Adaptations of methods, materials or testing may be made as required to provide for equitable participation. This publication/material is available in alternative formats to individuals with disabilities upon request. Please contact Penny Cragun, Disability Services and Resources, 726-8727

Note: The class will follow the UMD policies (Student Conduct Code, Teaching and Learning, Academic Integrity, Final Exams, Excused Absence, Appropriate Use of ClassNotes). See...http://www.d.umn.edu/vcaa/SyllabusStatements.html

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