CHE 502 Syllabus (2017)

Advanced Organic Synthesis: Strategies and Tactics in Organic Synthesis

Visit UBLearns for announcements and class documents.

Classes: MWF, 9 AM – 9:50 PM
Place: 103 Talbert, North Campus

Instructors: Dr. Sherry R. Chemler, Dr. Mike Detty
SRC Office hours: NSC618, Fridays, 1-3 PM or by appointment.
MD Office hours (Jan/Feb only): by appointment
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Books (none required): Look on UB learns for many handouts.
Some chapters of Advanced Organic Chemistry by Lewis, will be covered (most will have this book from CHE501)
Some chapters from Classics in Total Synthesis I –Nicolaou and Sorensen will be covered. Modern Organic Synthesis Lecture Notes, Boger also recommended but not required (try Amazon if you want to purchase any of these) and for references to look up. Some chapters and notes will be provided on UBLearns.

Grading: Tests [3 tests, total of 600 pts (test 1--180; test 2—180 pts; test 3--240)], 3 Graded Homeworks (50 pts each), 1 Quiz (50 pts), 1 Final Project (100 pts presentation; 100 pts proposal). The class is graded on a curve and the average is set around B+. Further point breakdown is below.

Resources: the library and its staff, electronic journals (library website), science citation index, Scifinder, the professor.

Upon request, Ben Wagner, Science librarian, can teach you Scifinder, EndNote, Web of Science, electronic journals, etc.

Schedule (adjusted as needed based on time limitations)

DATE	TOPIC	Assignment
1/30	Syllabus/Intro—Chemler Semisynth: Taxol, Artemisinin; Biosynthesis: Vit D, Lanasterol, Progesterone	Read Chap 15 in Lewis Read Baran, JOC, 2010, 75, 4657
2/1	Heterocyclic Chromophores and their Intermediates--Detty	
2/3	Heterocyclic Chromophores	

2/6	Your project, protecting groups-Chemler	and more chap 15 Lewis
2/8	Heterocyclic Chromophores	Sign up for presentation date this week (email Dr. Chemler)
2/10	Heterocyclic Chromophores	
2/13	Heterocyclic Chromophores	
2/15	Heterocyclic Chromophores	
2/17	Problem-solving	HW 1 due
2/20	Synthesis concepts	HW returned, key provided
2/22	Test 1	Test 1
2/24	Nitrogen heterocycles	Reserpine, Strychnine
2/27		Manzamine
3/1		
3/3		
3/6	Carbocycles	Cortistatin A
3/8		
3/10		HW 2 due
3/13		HW returned, key provided
3/15	Test 2	
3/17	Polypropionate macrocycles	erythronolide
3/27		1-page project summary due (25 pts)
3/29		zincophorin
3/31		
4/3	Use of radicals in synthesis	
4/5		
4/7		Homework 3 due
4/10	Problem solving	HW returned, key provided
4/12	Test 3	
4/14	Test 3	
4/17	Asym. Oxidations and Reductions in Target-Oriented-Synthesis	Chap 21 in Lewis
4/19		
4/21	Present 1	
4/24	Present 2	
4/26	Present 3	
4/28	Present 4	
5/1	Present 5	
5/3	Present 6	
5/5	Present 7	
5/8	Present 8	
5/10	Present 9	
5/12	Quiz on presentations	

5/17	**Final Project Due**	

CHE502 Assignments

Academic Integrity
All tests are individual. Homeworks are individual. Your presentations should be your work alone. You may consult the professor and others with questions related to your homework and presentations after you have given effort and attempts on your own, but do not ask for the answers. You are training to be professional scientists, the integrity standards are very high. You may consult UB's Undergraduate Academic Integrity Policy or the Graduate Academic Integrity Policy.

Learning outcomes
Problem-solving is emphasized: synthesis and reaction mechanism. You will become more knowledgeable on a range of organic reactions and the factors that control reactivity and selectivity. You will have better ability to design the synthesis of a target molecule from simpler (e.g. commercially available) materials. You will become proficient in learning material from the original source (research articles published in scientific journals). You will become more proficient at use of science library resources. The methods and strategies used in the de nouvo synthesis of complex natural products and drugs will become more apparent to you.

Assessment
Participation and reaction mechanism (arrow-pushing) will be assessed during in class problems. Students will be called on to go to the board, the class can help solve the problem with this person as needed (you can earn points at the board or at your seat).

Reactions, Mechanisms and Synthesis Strategy will be tested with Homework, as well as ability to use the literature/library resources.

Your general understanding of the material (including strategy, mechanism and reactions) and presentation ability will be tested with synthesis presentation papers.

Tests cover material covered in class, homework or questions that are reasonably worked out given the covered material. This means deep understanding rather than memorization is essential.

Total class points: 1000

Project (200 pts total):
1. Select a natural product target or drug that has some biological activity (anti-cancer, antibiotic, other). Target must have at least one stereocenter. Present a 1-page summary

of your target (reference, biological activity, key structural features, compound class, 20 pts). It's a good idea to get the target OK's ahead of time.
Find a target: go to journals like Natural Product Reports, Journal of Natural Products or other journal.

2. Present your target to the class (powerpoint presentation, schedule your with Dr. Chemler). Present previous total synthesis(s) of this compound or a similar compound.* Analyze the published syntheses for strengths and weaknesses. Email this presentation to Dr. Chemler on or before its due date. (90 pts) You may discuss your presentation with Dr. Chemler to make sure your presentation is clear.

3. Propose your own synthesis route to this molecule or similar (hand in on final exam day, 90 pts). A good approach applies newer, more concise or stereoselective synthetic methods. Be creative, take risks, propose exciting but well-reasoned new reactions or approaches. Do NOT copy the previous routes too much, you want to propose an improvement (90 pts). How to improve: reduce steps, make more selective, reduce waste, make analogs more easily.

*Note the relationship between your synthesis of a target (due on final exam date) and a molecule synthesized in the literature (classroom presentation) is flexible/can be loose. Try to pick published syntheses <20 steps and possibly exciting/impressive synthesis.

Grading of Presentation:
Clarity of presentation: (you are teaching the class)
•Use Powerpoint on your own laptop, or save as both powerpoint/pdf for my laptop or use overheads. Chalktalk for short syntheses or answering mechanism questions/presenting mechanism is fine too, but you must still hand in a written presentation (can be handwritten). Must hand in a copy of your presentation at least 1 day prior to presentation so class will have it to follow your talk.
•Purpose of the synthesis
•Retrosynthesis, presentation of overall strategy
•Clearly drawn structures, written presentation
•Clearly explain how each reactant is converted to each product
•If one major isomer/enantiomer is formed in a key step, try to explain why major is formed (is there a model in the paper or any of its references to explain formation of major isomer?)
•Conclusions: synthesis of accomplishments, summary of instructive synthesis points.
•Your ability to answer questions in class or after.

Proposal:
Why is your method better than previously reported routes?
How will your method be selective for the regioisomer/diastereomer/enantiomer you need? Provide conformational drawings for stereocenters. Give retrosynthetic analysis and forward synthesis including each step and rationale for selectivity. Provide key references for important reactions and concepts.