

## Course Syllabus – CHEM 611

### Course Information

Course Number: CHEM 611 WI25

Course Name: Total Synthesis of Natural Products

Term: WI 2025

Start Date: 01/07/2025

End Date: 03/28/2025

Credits: 3.0

### Meeting Days / Times

Tuesdays and Thursdays, 9:00-10:30am PT / 12:00-1:30pm ET  
(See Calendar in Canvas for the most up-to-date schedule.)

### Location

CA: Keck Auditorium (Beckman Building)  
FL: B387

### Course Managers

| Role            | Last Name | First Name | Email Address                                                        |
|-----------------|-----------|------------|----------------------------------------------------------------------|
| Course Director | Shenvi    | Ryan       | <a href="mailto:rshenvi@scripps.edu">rshenvi@scripps.edu</a>         |
| TA              | Rodriguez | Anthony    | <a href="mailto:anrodriguez@scripps.edu">anrodriguez@scripps.edu</a> |

### Course Description

This course covers the reactions, strategies, and tactics needed to tackle the molecular complexity posed by the structures of complex natural products. Building upon reactions learned in previous course, additional examples of modern methods for bond-forming reactions will be presented, as will the tools necessary to logically analyze and build complex molecular targets. The interplay between reaction and strategy development, using natural products as sources of inspiration for the development of novel chemistry, will also serve as a major organizing theme for the course.

### Program Learning Outcomes

By the end of the program, students will have accomplished these objectives:

PLO1: Original Research – graduate students are expected to develop the skills critical for generating high-quality research output. This would include absorbing, recalling, and contextualizing scientific knowledge, evaluating scientific information and data, creating testable hypotheses and investigating hypotheses, mastering scientific tools and techniques, displaying ethical behavior, and receiving and giving feedback.

PLO2: Communication – graduate students are expected to demonstrate the oral, written, and media skills to effectively communicate the impact of a study or a body of work to the greater scientific community and to the public at large using a number of methods.

PLO3: Critical Thinking – graduate students are expected to develop a self-directed process to analyze information, form opinions or judgments, and use this process to improve the quality of their scientific thoughts, navigate problems, and make informed decisions.

PLO4: Intellectual Curiosity – graduate students are expected to acquire the capacity to build their intellectual curiosity and demonstrate problem solving approaches that serve their professional growth and ability to impact a field.

PLO5: Career and Professional Development – graduate students are expected to develop a variety of transferable skillsets throughout their graduate experience, including management and leadership, inclusiveness, resilience, scientific rigor, collaboration, accountability, time management, teamwork, networking, and career planning.

### **Course Learning Outcomes**

Upon completion of this course students will be able to:

CLO1: Read and understand complex molecule synthesis papers in the literature.

CLO2: Design multistep syntheses through the principles of retrosynthetic analysis.

CLO3: Possess enhanced understanding of organic reactions and reactivity.

CLO4: Write and evaluate proposals in total synthesis.

CLO5: Have strengthened analytical skills.

### **Background Preparation (Prerequisites)**

CHEM 410 Modern Organic Synthesis

### **Course Materials**

Required: Kurti, L. & Czako, B. (2005). *Strategic Applications of Named Reactions in Organic Synthesis*. ISBN: 978-0124297852.

Required: Corey, E. & Cheng, X. (2009). *The Logic of Chemical Synthesis*. ISBN: 978-0471115946.

Useful to Consult: Nicolaou, K. & Montagnon, T. (2008). *Molecules that Changed the World*. ISBN: 978-3527309832.

Useful to Consult: Kocienski, P. (2005). *Protecting Groups* (3rd Edition). ISBN: 978-1588903761.

Useful to Consult: Wuts, P. & Greene, T. (2006). *Greene's Protective Groups in Organic Synthesis* (4th Edition). ISBN: 978-0471697541.

### **Attendance Statement**

Students are expected to attend all classes. Students who are unable to attend class must seek permission for an excused absence from the course director or teaching assistant. If a student has to miss a class, they should arrange to get notes from a fellow student and is strongly encouraged to meet with the teaching assistant to obtain the missed material. Missed exams will not be available for re-taking.

### **Scientific and Professional Ethics**

The work you do in this course must be your own. Feel free to build on, react to, criticize, and analyze the ideas of others but, when you do, make it known whose ideas you are working with. You must explicitly acknowledge when your work builds on someone else's ideas, including ideas of classmates,

professors, and authors you read. If you ever have questions about drawing the line between others' work and your own, ask the course professor who will give you clear guidance. Exams must be completed independently. Any collaboration on answers to exams, unless expressly permitted, may result in an automatic failing grade and possible expulsion from the Graduate Program.

### Technology Requirements and Support

For issues related to Canvas, please contact the Graduate Office by email at: [gradprgm@scripps.edu](mailto:gradprgm@scripps.edu) or by phone at: 858-784-8469.

### Course Grading

Grading is in accordance with the academic policies of the Skaggs Graduate School. The breakdown of grading is as follows:

- Midterm Exam: 35%
- Final Exam: 35%
- Proposal: 25%
- Video Presentation: 5%

| Letter Grade | Percent | GPA  | Description                                                                                                                                                                                                                         |
|--------------|---------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A            | 93-100  | 4.00 | Outstanding achievement. Student performance demonstrates full command of the course subject matter and evinces a high level of originality and/or creativity that far surpasses course expectations.                               |
| A-           | 90-92   | 3.67 | Excellent achievement. Student performance demonstrates thorough knowledge of the course subject matter and exceeds course expectations by completing all requirements in a superior manner.                                        |
| B+           | 87-89   | 3.33 | Very good work. Student performance demonstrates above-average comprehension of the course subject matter and exceeds course expectations on all tasks as defined in the course syllabus. There is notable insight and originality. |
| B            | 83-86   | 3.00 | Satisfactory work. Student performance meets designated course expectations and demonstrates understanding of the course subject matter at an acceptable level.                                                                     |
| B-           | 80-82   | 2.67 | Marginal work. Student performance demonstrates incomplete understanding of course subject matter. There is limited perception and originality.                                                                                     |
| C+           | 77-79   | 2.33 | Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course subject matter. There is severely limited or no perception or originality. Course will not count toward degree.             |
| C            | 73-76   | 2.00 | Unsatisfactory work. Student performance demonstrates incomplete and inadequate understanding of course subject matter. There is severely limited or no perception or originality. Course will not count toward degree.             |

|   |        |      |                                                                                                                                                                                                                                          |
|---|--------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P | 73-100 | 0.00 | Satisfactory work. Student performance demonstrated complete and adequate understanding of course subject matter. Course will count toward degree.                                                                                       |
| F | 0-72   | 0.00 | Unacceptable work/Failure. Student performance is unacceptably low level of knowledge and understanding of course subject matter. Course will not count toward degree. Student may continue in program only with permission of the Dean. |
| I |        | 0.00 | Incomplete is assigned when work is of passing quality but is incomplete for a pre-approved reason. Once an incomplete grade is assigned, it remains on student's permanent record until a grade is awarded.                             |
| W |        | 0.00 | Withdrew from the course with Dean's permission beyond the second week of the term.                                                                                                                                                      |

- All courses will be recorded and maintained in the student's permanent academic record; only courses that apply towards the degree will appear on the academic transcript. Non-credit or audited courses will not appear on the transcript.
- 4 core courses taken for a letter grade (pass = B- or higher for a core course)
- 2 elective courses taken pass/fail (pass = A, B, C for an elective)

### Course Summary

| Date             | Details                                                  |
|------------------|----------------------------------------------------------|
| Tue Jan 7, 2025  | Introduction and Retrosynthetic Analysis (Shenvi)        |
| Thu Jan 9, 2025  | Logic (Shenvi)                                           |
| Tue Jan 14, 2025 | Biosynthesis and Biomimicry (Shenvi)                     |
| Thu Jan 16, 2025 | Putting It All Together: Vigulariol (Shenvi)             |
| Mon Jan 20, 2025 | No Class (Martin Luther King Jr. Day)                    |
| Tue Jan 21, 2025 | Vigulariol Part 2 (Shenvi)                               |
| Thu Jan 23, 2025 | Cyclopropanes (Shenvi)                                   |
| Tue Jan 28, 2025 | Cyclobutanes (Shenvi)                                    |
| Thu Jan 30, 2025 | Cyclopentanes (Shenvi)                                   |
|                  | Molecule Selection for Proposal Project                  |
| Tue Feb 11, 2025 | Midterm Exam                                             |
| Thu Feb 13, 2025 | Medium rings (Shenvi)                                    |
| Mon Feb 17, 2025 | No Class (President's Day)                               |
| Tue Feb 18, 2025 | Spiro Rings (Shenvi)                                     |
| Thu Feb 20, 2025 | Fused Rings (Shenvi)                                     |
| Tue Feb 25, 2025 | Bridging rings (Shenvi) / Video Presentation             |
| Thu Feb 27, 2025 | Bridging Rings Pt. 2 (Shenvi)                            |
| Tue Mar 4, 2025  | Attached rings (Shenvi)                                  |
| Thu Mar 6, 2025  | Stereochemically complex linear systems, Part 1 (Shenvi) |
| Tue Mar 11, 2025 | Stereochemically complex linear systems, Part 2 (Shenvi) |
| Thu Mar 13, 2025 | Polyaromatic systems (Shenvi) / Proposal                 |
| Tue Mar 18, 2025 | TBA (Seiple)                                             |
| Thu Mar 20, 2025 | Final Exam                                               |