

**Dr. Steven Merwin Kennedy**

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**Lab Section 01 (CRN 4347):** online asynchronous;

And, optional in-person Mondays 12:30 – 3:20 pm in 327 Caputo Hall.

Find your Learning Team name and optional in-person weeks at the top of your D2L gradebook.

Even Week Learning Teams meet for optional in-person labs on 8/31, 9/14, 9/28, 10/8, 10/26, & 11/9.

Odd Week Learning Teams meet for optional in-person labs on 9/7, 9/21, 10/5, 10/19, 11/2, & 11/16.

### **COURSE DESCRIPTION**

Skills and techniques relevant to the modern organic and organometallic synthesis research laboratory will be developed during the semester; these include: searching the chemical literature, multi-step synthesis planning, exploring reaction methods scope and limitations, reaction planning and set-up, reaction monitoring methods, chemical isolation, chemical purification, IR & NMR spectroscopic analysis of reaction products and mixtures.

### **COURSE LEARNING OBJECTIVES**

*Upon completion of Chemistry 391 you should be able to...*

1. Use SciFinder to search the chemical literature
2. Perform literature searches of a target organic molecule
3. Plan multi-step synthesis and individual reactions based on the literature
4. Explore or analyze—compare and contrast—reaction methods via green chemistry principles
5. Adapt procedures to different substrates, reaction size (scale), & commercially available supplies
6. Plan or set up chemical reactions safely and efficiently
7. Practice TLC, IR, and NMR analytical techniques
8. Write logical, organized, and detailed plans and proposals

### **COURSE ORGANIZATION**

Due to the ongoing COVID-19 pandemic, this course will be provided fully online with the option of some in-person laboratory work, as long as it adheres to the Millersville University health and safety guidelines (<https://www.millersville.edu/fall2020/index.php>). Required readings and videos, preparation for any in-person laboratory meetings, literature searches, data analysis, and writing plans and proposals will all require time. Any in-person laboratory meetings will be used primarily for wet chemistry and analysis.

**REQUIRED** daily online access to our Chemistry 391 D2L course website and various other websites, your Millersville email account, SciFinder and Request-it via the Millersville Library. Highly Recommended: a modern (published after 2015) sophomore-level organic chemistry textbook; this will help you to plan a multi-step synthesis and to propose reasonable reaction mechanisms using curved-arrow notation.

### **LABORATORY SAFETY** (for any in-person experiments)

Be prepared to complete focused and efficient work during any in-person laboratory time. Being prepared for laboratory is the best way to stay safe. Most of the compounds that we (as chemists) work with have some level of toxicity. All things are toxic, and many of the chemicals that we will work with in CHEM 391 are very toxic. General safety guidelines will be presented throughout this laboratory course and should be followed at all times. Specific safety precautions for each experiment will be covered before each in-person lab. Failure to follow safety guidelines is grounds for dismissal from a laboratory session and a grade of zero on the experiment. Additional laboratory guidelines including notebook guidelines and report instructions are covered in the weekly handouts.

| Week | Date    | Topics & due dates & <i>optional in-person lab technique</i> **                            |
|------|---------|--|
| 1    | 24-AUG  | Syllabus, SciFinder, Request-It, Chemical Ordering, & Safety via Zoom                      |
| 2    | 31-AUG  | Assignment of target molecules (TM) and read classic article, <i>TLC practice</i>          |
| 3    | 7-SEPT  | Literature review of TM; <b>draft bibliography due 18-SEPT</b> ; <i>TLC practice</i>       |
| 4    | 14-SEPT | Retrosynthetic analysis & forward synthesis planning; <i>IR practice</i>                   |
| 5    | 21-SEPT | Retrosynthetic analysis & forward synthesis planning; <i>IR practice</i>                   |
| 6    | 28-SEPT | <b>Synthesis plan overview draft due 2-OCT</b> ; <i><sup>1</sup>HNMR practice</i>          |
| 7    | 5-OCT   | Green chemistry and synthesis; <i><sup>1</sup>HNMR practice</i>                            |
| 8    | 12-OCT  | Reaction planning, chemical ordering, and notebook prep; <i><sup>13</sup>CNMR practice</i> |
| 9    | 19-OCT  | <b>Revised synthesis plan due 23-OCT</b> ; <i><sup>13</sup>CNMR practice</i>               |
| 10   | 26-OCT  | <b>First reaction plan (notebook &amp; budget due 30-OCT)</b> ; <i>imine formation</i>     |
| 11   | 2-NOV   | Research proposal; <i>imine formation</i>  |
| 12   | 9-NOV   | Research proposal; <i>2D NMR</i>   |
| 13   | 16-NOV  | <b>Second reaction plan (notebook &amp; budget due 20-NOV)</b> ; <i>2D NMR</i>             |
| 15   | 30-NOV  | <b>Research proposal (draft due 4-DEC &amp; final proposal due 11-DEC)</b>                 |

\*\*Note: asynchronous online lab technique assignment options will be provided in D2L

#### COURSE EVALUATION OVERVIEW

|  |                   |
|--|-------------------|
| TLC (weeks 2 or 3)                           | 5 %               |
| Draft bibliography (due by 18-SEPT)          | 5 %               |
| IR (weeks 4 or 5)                            | 5 %               |
| Synthesis plan overview draft (due by 2-OCT) | 5 %               |
| <sup>1</sup> HNMR (weeks 6 or 7)             | 10 %              |
| <sup>13</sup> CNMR (weeks 8 or 9)            | 10 %              |
| Revised synthesis plan (due by 23-OCT)       | 10 %              |
| First reaction plan (due by 30-OCT)          | 10 %              |
| Imine formation (weeks 10 or 11)             | 5 %               |
| 2D NMR (weeks 12 or 13)                      | 5 %               |
| Second reaction plan (due by 20-NOV)         | 10 %              |
| Research proposal draft (due by 4-DEC)       | 10 %              |
| Final research proposal (due by 11-DEC)      | 10 %              |
|  | $\Sigma = 100 \%$ |

**Academic Honesty & Dishonesty:** plagiarism is the deliberate or even accidental representation of another's work as your own without proper reference. You should be familiar with the University policy on academic honesty and dishonesty as outlined in the Student Handbook and Academic Honesty and Dishonesty brochure: <http://www.millersville.edu/english/for-faculty/academic-integrity/violations.php>.

#### Title Nine (IX) Statement:

Millersville University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. For more information on Title IX: <http://www.millersville.edu/titleix/title-ix-policies-and-procedures.php>