

## CHEM298 : Undergraduate Research in Chemistry

### General Information

Author:	<ul style="list-style-type: none"><li>Corey Jamieson</li></ul>
Course Code (CB01) :	CHEM298
Course Title (CB02) :	Undergraduate Research in Chemistry
Department:	CHEM
Proposal Start:	Fall 2025
TOP Code (CB03) :	(1905.00) Chemistry, General
CIP Code:	(40.0501) Chemistry, General.
SAM Code (CB09) :	Non-Occupational
Distance Education Approved:	No
Will this course be taught asynchronously?:	No
Course Control Number (CB00) :	CCC000567171
Curriculum Committee Approval Date:	04/23/2025
Board of Trustees Approval Date:	Pending
Last Cyclical Review Date:	10/01/2020
Course Description and Course Note:	CHEM 298 introduces students to a research laboratory setting. Students gain experience in performing group projects, setting research goals, and searching the literature for background information. Students design a target molecule, propose its potential applications, and develop reliable synthetic pathways for preparation and isolation of organic compounds. Students present a research goal and justify the cost, synthetic utility, and pedagogic use of the research outcomes for development of the chemistry department. One of the goals of this class is the long-term development of multistep synthetic procedures to be adopted in future curricula.
Justification:	Content Change
Academic Career:	<ul style="list-style-type: none"><li>Credit</li></ul>
Mode of Delivery:	<ul style="list-style-type: none"><li>In-Person</li></ul>
Author:	No value
Course Family:	No value

### Academic Senate Discipline

Primary Discipline:	<ul style="list-style-type: none"><li>Chemistry</li></ul>
Alternate Discipline:	No value
Alternate Discipline:	No value

## Course Development

### Basic Skill Status (CB08)

Course is not a basic skills course.

Allow Students to Gain Credit by Exam/Challenge

### Course Special Class Status (CB13)

Course is not a special class.

### Pre-Collegiate Level (CB21)

Not applicable.

### Grading Basis

- Grade Only

### Course Support Course Status (CB26)

Course is not a support course

## General Education and C-ID

### General Education Status (CB25)

Not Applicable

### Transferability

Transferable to CSU only

### Transferability Status

Approved

## Units and Hours

### Summary

<b>Minimum Credit Units (CB07)</b>	3
<b>Maximum Credit Units (CB06)</b>	3
<b>Total Course In-Class (Contact) Hours</b>	126
<b>Total Course Out-of-Class Hours</b>	36
<b>Total Student Learning Hours</b>	162

### Credit / Non-Credit Options

#### Course Type (CB04)

Credit - Degree Applicable

#### Noncredit Course Category (CB22)

Credit Course.

#### Noncredit Special Characteristics

No Value

#### Course Classification Code (CB11)

Credit Course.

Variable Credit Course

#### Funding Agency Category (CB23)

Not Applicable.

Cooperative Work Experience Education

Status (CB10)

### Weekly Student Hours

	In Class	Out of Class
Lecture Hours	1	2
Laboratory Hours	6	0
Studio Hours	0	0

### Course Student Hours

<b>Course Duration (Weeks)</b>	18
<b>Hours per unit divisor</b>	0
<b>Course In-Class (Contact) Hours</b>	
Lecture	18

Laboratory	108
Studio	0
<b>Total</b>	126

**Course Out-of-Class Hours**

Lecture	36
Laboratory	0
Studio	0
<b>Total</b>	36

**Time Commitment Notes for Students**

No value

**Units and Hours - Weekly Specialty Hours**

Activity Name	Type	In Class	Out of Class
No Value	No Value	No Value	No Value

**Prerequisites, Corequisites, Recommended Corequisites, and Recommended Preparation**

**Prerequisite**

CHEM105 - Organic Chemistry A

**Objectives**

- keep accurate laboratory records;
- be prepared for pre-professional examinations that include organic chemistry, i.e. MCAT, DAT, pharmacy and dental hygiene aptitude examinations;
- read and evaluate scientific material of significance to them as citizens.

**OR**

**Prerequisite**

CHEM106 - Organic Chemistry B

**Objectives**

- generate reasonable linear and convergent synthesis pathways for target organic compounds of interest;
- perform organic chemical reactions semi-independently in an organic chemistry laboratory setting, monitor the progress of reactions, and interpret the experimental results;

## Entry Standards

Entry Standards

Description

No value

No value

## Course Limitations

Cross Listed or Equivalent Course

Description

No value

No value

## Requisite Validation

**Upload Statistical Validation and/or other documents (if necessary)**

No Value

## Specifications

Methods of Instruction

Methods of Instruction

Lecture

Methods of Instruction

Laboratory

Methods of Instruction

Discussion

Methods of Instruction

Multimedia

Methods of Instruction

Independent Study

Methods of Instruction

Collaborative Learning

<b>Methods of Instruction</b>	Demonstrations			
<b>Methods of Instruction</b>	Field Activities (Trips)			
<b>Methods of Instruction</b>	Guest Speakers			
<b>Methods of Instruction</b>	Presentations			
<b>Out of Class Assignments</b> <ul style="list-style-type: none"> <li>• Written manuscript to present the synthetic problem</li> <li>• Poster preparation for a local conference, symposium, or seminar</li> <li>• Technical paper (e.g. design report detailing the project)</li> <li>• Technical poster (e.g. large-format poster detailing the project)</li> <li>• Group projects (e.g. design, synthesis, purification, characterization, and documentation of target molecule)</li> <li>• Analysis (e.g. development of appropriate purification techniques, application of spectral data to confirm the structure)</li> <li>• Project proposals (e.g. a proposal of project costs, budgets, chemical inventory, and instrumentation)</li> </ul>				
<b>Methods of Evaluation</b>	<b>Rationale</b>			
Exam/Quiz/Test	Final examination of 2.5 hours that contains multiple-choice questions			
Presentation (group or individual)	Weekly oral reports of experimental data			
Report	Reports on relevant literature			
Presentation (group or individual)	Instructor evaluation of in-class presentations			
Activity (answering journal prompt, group activity)	Effective participation in team assignments			
<b>Textbook Rationale</b> No Value				
<b>Textbooks</b>				
<b>Author</b>	<b>Title</b>	<b>Publisher</b>	<b>Date</b>	<b>ISBN</b>
Klein, David	Organic Chemistry	Wiley John and Sons Inc	2014	978-1-118-79571-2
Pavia, Donald L., et. al.	Introduction to Spectroscopy	Cengage Learning	2015	9781285460123

Lehman, John W.	Operational Organic Chemistry: A Problem-Solving Approach to the Laboratory Course	: Pearson Prentice Hall	2009	978-0-13600092-1
Grossman, Robert	The Art of Writing Reasonable Reaction Mechanisms	Springer	2003	978-0-38721545-7
<b>Other Instructional Materials (i.e. OER, handouts)</b>				
No Value				

## Learning Outcomes

### Course Objectives

Communicate effectively in an interdisciplinary, team-based environment.

Interface with interdisciplinary sub-teams with varying specialties.

Develop innovative design concepts to solve a problem or task.

Propose a target molecule with potential applicability in material science or the pharmaceutical field.

Prepare and present a target molecule design proposal to an audience of peers, professors, and industry professionals.

Propose and present a synthetic design approach to an audience of peers, professors, and industry professionals.

Simulate the structural features of the proposed molecule's performance with computer software before proceeding with actual synthesis.

Evaluate, analyze, and critique designs of peers and apply those insights to the preparation of his or her own target molecule.

Read and analyze peer-reviewed literature and supplemental information.

Utilize proper laboratory safety protocols.

Design a feasible total synthesis scheme to execute preparation of the target molecule.

Demonstrate an understanding of the design process, inter-team communications, proper documentation, and modification processes.

## SLOs

Utilize advanced organic synthetic lab techniques.

Expected Outcome Performance: 70.0

*ILOs* Analyze and solve problems using critical, logical, and creative thinking; ask questions, pursue a line of inquiry, and derive conclusions; cultivate  
*Core* creativity that leads to innovative ideas.  
*ILOs*

Design and propose synthetic pathways for preparation of small organic molecules.

Expected Outcome Performance: 70.0

*ILOs* Analyze and solve problems using critical, logical, and creative thinking; ask questions, pursue a line of inquiry, and derive conclusions; cultivate  
*Core* creativity that leads to innovative ideas.  
*ILOs*

Synthesize, isolate, and purify proposed compounds.

Expected Outcome Performance: 70.0

*ILOs* Analyze and solve problems using critical, logical, and creative thinking; ask questions, pursue a line of inquiry, and derive conclusions; cultivate  
*Core* creativity that leads to innovative ideas.  
*ILOs*

Demonstrate depth of knowledge in a course, discipline, or vocation by applying practical knowledge, skills, abilities, theories, or methodologies to solve unique problems.

Apply knowledge of computer simulation techniques to evaluate the effectiveness of design.

Expected Outcome Performance: 70.0

*ILOs* Analyze and solve problems using critical, logical, and creative thinking; ask questions, pursue a line of inquiry, and derive conclusions; cultivate  
*Core* creativity that leads to innovative ideas.  
*ILOs*

## Additional SLO Information

**Does this proposal include revisions that might improve student attainment of course learning outcomes?**

No

**Is this proposal submitted in response to learning outcomes assessment data?**

No

**If yes was selected in either of the above questions for learning outcomes, explain and attach evidence of discussions about learning outcomes.**

No Value

**SLO Evidence**

No Value

## Course Content

### Lecture Content

#### Preliminary Design Proposal (6 Hours)

- Project outline and idea exchange
- Applicability and assessment of need in material science or pharmaceutical applications
- Definition of synthetic requirements
- Inventory of materials and equipment
- Budget development
- Task list and timeline of project completion
- Target molecule preparation plan
- Development of synthetic design
- Presentation of design and methodology (synthetic design review)

#### Prototype and Feasibility Assessment (6 Hours)

- Computer-aided design such as molecular modeling using Spartan and ChemDoodle software.
- Evaluation of computer-simulated models in terms of proposed applicability of target molecules
- Laboratory safety and equipment usage
- Synthetic model development
- Design of starting materials
- Iterative modification of synthetic procedures
- Feasibility assessment of preliminary outcomes
- Proposal of divergent and convergent integrated synthesis
- Reading, analyzing, and summarizing technical literature
- Team definition and cross-team communication for synthesis of comparable targets

#### Final Design Proposal (6 Hours)

- Detailed synthesis plans and experimental procedures
- Analysis and summary of total synthesis plans and literature
- Synthetic outcomes and evaluation of experimental data
- Presentation of detailed synthetic design and product characterization

**Total Hours - 18**

### Laboratory/Studio Content

#### Preliminary Design Proposal (40 Hours)

- Project outline and idea exchange
- Applicability and assessment of need in material science or pharmaceutical applications
- Definition of synthetic requirements
- Inventory of materials and equipment
- Budget development
- Task list and timeline of project completion
- Target molecule preparation plan
- Development of synthetic design
- Presentation of design and methodology (synthetic design review)

#### Prototype and Feasibility Assessment (60 Hours)

- Computer-aided design such as molecular modeling using Spartan and ChemDoodle software.
- Evaluation of computer-simulated models in terms of proposed applicability of target molecules
- Laboratory safety and equipment usage
- Synthetic model development
- Design of starting materials
- Iterative modification of synthetic procedures
- Feasibility assessment of preliminary outcomes
- Proposal of divergent and convergent integrated synthesis
- Reading, analyzing, and summarizing technical literature
- Team definition and cross-team communication for synthesis of comparable targets

#### Final Design Proposal (8 Hours)

- Detailed synthesis plans and experimental procedures
- Analysis and summary of total synthesis plans and literature

- Synthetic outcomes and evaluation of experimental data
- Presentation of detailed synthetic design and product characterization

**Total Hours - 108**

## **Additional Information**

### **Repeatability**

Not Repeatable

### **Justification (if repeatable was chosen above)**

No Value

### **Is it possible this course will have a material fee?**

Yes

### **I have contacted my library liaison (<https://campusguides.glendale.edu/faculty/liaisons>):**

No

### **What term(s) will this course be offered?**

Summer/Winter

### **Will any additional resources be needed for this course? (Click all that apply)**

- No

### **If additional resources are needed, add a brief description and cost in the box provided.**

No Value