

# Undergraduate Research in Chemistry



Undergraduate chemistry majors are encouraged to participate in undergraduate research. There are several mechanisms for doing research. Students most often earn course credit (CHEM 397 or CHEM 398) for their efforts, but in select cases (mostly in the summer) can earn a salary.

## The value of undergraduate research in Chemistry

If there is a single action students can undertake to maximize their success in applying to Chemistry graduate programs, it is doing undergraduate research. Not only do you receive advanced training on first class research grade equipment, you also build confidence and learn to think independently, make new friends and experience a bit of life as a graduate student, and most importantly, build a relationship with a Professor that will lead to a letter of recommendation that becomes a cornerstone of your graduate school application. Even if you do not decide to pursue the PhD in Chemistry, nearly all programs will be interested in seeing a strong letter of recommendation that can describe your problem solving ability and other qualities.

This guide is intended to help interested students in (a) understanding the differences between the two research courses (b) how these are related to the SAGES Capstone experience and (c) how these are also related to graduation with honors.



## Introduction to UG research in Chemistry

Undergraduate chemistry majors are encouraged to participate in **CHEM 397** or **CHEM 398**. These two courses are similar to one another. The course descriptions are as follows:

**CHEM 397. Undergraduate Research (1-6)** Independent project within a research group in the chemistry department or, by approval, within a research group in another Case department. Arrangements should be made by consultation with the faculty member selected. Open to all chemistry majors and other qualified students. Satisfies the research requirement for Honors in Chemistry.\* A written report is required each semester.  
Prereq: Consent of department.

**CHEM 398. Undergraduate Research/Senior Capstone Project (3-6)** Independent project within a research group in the chemistry department or, by approval, within a research group in another CWRU department. Arrangements should be made by consultation with the faculty member selected and the Senior Capstone Committee of the chemistry department. Open to all chemistry majors and other qualified students. Satisfies the research requirement for Honors in Chemistry.\* A written report and public oral presentation is required. (Approved Sages Capstone)

*[\*when in total of 6 credits, or used in combination with CHEM 397/8 for a total of 6 credits]*

Prior to full implementation of SAGES, all BS Chemistry majors were required to fulfill 3 credits of CHEM 397. This requirement was instituted in order to fulfill the American Chemical Society's requirement for minimum number of *LABORATORY* hours needed for certification of our BS in Chemistry degree at CWRU. During the transitional period of time when SAGES was optional, BS Chemistry majors were required to take either 3 credits of CHEM 397 or CHEM 398.

Since all students now entering CWRU are in the SAGES program, and are required to fulfill the Capstone Experience, it might seem that all BS (and most BA) majors in Chemistry would only take CHEM 398. There are a couple of caveats to this line of thinking. First, each student's SAGES Capstone Experience does not have to be done within their own major. For example, a student majoring in both Biology and Chemistry may fulfill the SAGES requirement by taking only a single Capstone Experience course in Biology. In such a case, BS Chemistry majors would thus be required to take at least 3 credits of CHEM 397. Second, the department now allows students to undertake library research projects as CHEM 398 experiences. Students opting for non-laboratory CHEM 398 will thus be required to take 3 credits of CHEM 397 to gain the 3 credits of *LABORATORY* experience.

## Counting Credits as Electives

CHEM 397 or CHEM 398 credits above and beyond those required for earning the BS degree in Chemistry can be counted as either **Chemistry Electives** or **Technical Electives**.

**Chemistry Electives:** Only 3 additional credit hours of CHEM 397 or CHEM 398 may be applied as a Chemistry Elective. Six additional credit hours of CHEM 397 or CHEM 398 may be taken as Technical Electives. (Further additional credit hours of CHEM 397 may be taken as Open Electives).

**Technical Electives** may be chosen more widely from any of the natural sciences, math, or engineering courses and may include introductory level courses, i.e., 100, 200 level courses, in technical disciplines other than chemistry.

In summary, no more than 9 credit total hours of combined CHEM 397 and CHEM 398 can be applied to your degree!

## Selecting a research advisor

Students should consult with faculty members in the department and select one under whose guidance the student undertakes a specific research project. This gives students the opportunity to join a research group and to work with faculty, graduate students, and research associates. Many such research projects have resulted in papers published in scientific journals and coauthored by undergraduate students. Descriptions of current research projects of the Chemistry faculty may be viewed at: <http://www.cwru.edu/artsci/chem/> by clicking on Faculty and selecting an individual faculty page.

## Rules for UG Research

The rules governing this program are as follows:

1. CHEM 397 and CHEM 398 are normally taken by a student under the supervision of a Chemistry faculty member (including those with a joint appointment in Chemistry). Students who want to carry out CHEM 397 or CHEM 398 research with a faculty mentor not listed above (i.e., not within the Chemistry Department or its secondary faculty) must submit a petition to the Undergraduate Committee for approval of the proposed project. The proposed project must be primarily chemically-based in order to be approved. In addition, the student must identify a faculty member within Chemistry to act as the sponsor for the proposed research. Often this person will be collaborating with the faculty member outside the Chemistry department.
2. Registration for CHEM 397 or CHEM 398 also requires a permit (available in Clapp Hall 212C), signed by the research mentor, specifying the name of the research mentor and the number of credit hours agreed upon. This form should be signed by a Chemistry faculty sponsor if the mentor is outside the department. The "contract" lists expectations for each particular course.
3. At the end of each semester that CHEM 397 or CHEM 398 is carried out, the student must submit to the research adviser a comprehensive report of the work accomplished. A copy of the report must also be submitted to the Chair of the Undergraduate Committee. No grade for CHEM 397 will be issued without the comprehensive report. CHEM 398 carries the extra requirement of a public oral presentation(s) of the research accomplished (see attached expectations and checklist guides for each course).
4. A maximum of 3 credit hours of CHEM 397 or 398 may be taken as Chemistry Electives. A maximum of 6 credit hours of CHEM 397 or 398 may be taken as Technical Electives. Additional credit hours of CHEM 397 may be taken as Open Electives.

# Undergraduate Honors Program in Chemistry

Chemistry majors who have excellent academic records are invited at the end of their junior year to participate in the Honors Chemistry Program. To graduate with "Honors in Chemistry" a student must satisfy the following requirements:

**I. Academic Excellence:** Academic excellence must be demonstrated in both chemistry and overall undergraduate course work. This is measured by a combined grade point average of 3.5 in Chemistry, Physics, and Mathematics and an overall grade point average of 3.2.

**II. Undergraduate Research:** A minimum of 6 semester hours of laboratory research involving chemistry must be completed. The research requirements can be satisfied by:

**A.** Research conducted in the Chemistry Department as CHEM 397 or CHEM 398.

**B.** Research done under another course number. Such research must be approved by the Undergraduate Committee of the Chemistry Department with respect to its chemical content. Conditional approval should be sought prior to initiation of the work.

**III. Approval of a Senior Thesis:** A thesis on the completed research in CHEM 397 or CHEM 398 must be approved. All theses will be submitted to the Chemistry Undergraduate Committee along with a recommendation letter from the thesis adviser. The Chemistry Undergraduate Committee will judge each thesis with respect to the level of research, the quality of the manuscript and the chemical content. Special notice should be taken that research done outside of the Chemistry Department will not be judged appropriate for Honors in Chemistry unless its subject matter is primarily chemical. The deadline for submitting a thesis is the last day of classes.

**NOTE:** Students with appropriate GPAs and who have had a LABORATORY-based CHEM 398 and CHEM 397 credits may be considered for honors by a thesis that is a comprehensive report from 6 credits of these activities. *Students are not automatically eligible-they must apply to graduate with honors.*

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**Case Western Reserve University**  
**Department of Chemistry**

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**REGISTRATION PERMIT FOR CHEM 397 UNDERGRADUATE RESEARCH**

Name of Student: \_\_\_\_\_ Semester: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Topic: \_\_\_\_\_

Research Mentor (print): \_\_\_\_\_ No. of hours of CHEM 397 this semester: \_\_\_\_\_

(signature): \_\_\_\_\_

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Is the project supervisor within the Chemistry Department or Secondary Faculty? \_\_\_\_\_

**If NO, please get signature of Undergraduate Committee for approval of CHEM 397 performed outside Chemistry Department. In addition, a one-page description of the research project emphasizing the CHEMISTRY component should be sent to the Undergraduate Committee for approval. A faculty member within the Chemistry Department should also be identified as a sponsor.**

\_\_\_\_\_  
Undergraduate Committee Representative Signature

\_\_\_\_\_  
Chemistry Sponsor Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

Please return this form to Zedeara Pratt in 204 Clapp Hall.

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**Case Western Reserve University**  
**Department of Chemistry**

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**EXPECTATIONS & CHECKLIST  
FOR CHEM 397 UNDERGRADUATE RESEARCH**

*This form must be signed AND attached to the final report.  
Failure to return this form may result in a grade of "I" being assigned.*

Name of Student: \_\_\_\_\_ Semester: \_\_\_\_\_

Successful completion of a CHEM 397 requires a final written report, and at least 3 hours of research effort/week for each credit hour earned.

Date	Report Type(s)*

\*Final and any interim reports

I approve the final report by the student.

Research Mentor: \_\_\_\_\_ Date \_\_\_\_\_

I also approve the attached final report (for work performed for non-Chemistry/associated secondary) faculty

Chemistry Sponsor: \_\_\_\_\_ Date \_\_\_\_\_

Final Approval:  
Undergraduate Committee Representative Signature \_\_\_\_\_

Please return this form to Zedeara Pratt in 204 Clapp Hall.

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**Case Western Reserve University**  
**Department of Chemistry**

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**REGISTRATION PERMIT FOR CHEM 398 SENIOR CAPSTONE PROJECT**

Name of Student: \_\_\_\_\_ Semester: \_\_\_\_\_

E-mail Address: \_\_\_\_\_

Topic: \_\_\_\_\_

Research Mentor (print): \_\_\_\_\_ No. of hours of CHEM 398 this semester: \_\_\_\_\_

(signature): \_\_\_\_\_

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Is the project supervisor within the Chemistry Department or Secondary Faculty? \_\_\_\_\_

**If NO, please get signature of Undergraduate Committee for approval of CHEM 398 performed outside Chemistry Department. In addition, a one-page description of the research project emphasizing the CHEMISTRY component should be sent to the Undergraduate Committee for approval. A faculty member within the Chemistry Department should also be identified as a sponsor.**

\_\_\_\_\_  
Undergraduate Committee Representative Signature

\_\_\_\_\_  
Chemistry Sponsor Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Date

Please return this form to Zedeara Pratt in 204 Clapp Hall.

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**Case Western Reserve University**  
**Department of Chemistry**

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**EXPECTATIONS & CHECKLIST FOR CHEM 398 SENIOR CAPSTONE PROJECT**

*This form must be signed AND attached to final report.  
Failure to return this form may result in a grade of "I" being assigned.*

Name of Student: \_\_\_\_\_ Semester: \_\_\_\_\_

Successful completion of a Capstone Experience requires oral presentations, written report(s), and at least 3 hours of research effort/week for each credit hour earned.

Date	Presentations*	Length (Time)	Approval by Research Mentor (please initial)
Date	Written Reports**	Approval by Research Mentor (please sign)	

\* G = Group Meeting, P = Poster Presentation (such as Research Showcase, Chemistry Pizza Poster Party, etc.), OP = Oral Presentation (such as Meeting in Miniature, local ACS meeting, etc.).

\*\*Final and interim reports

I also approve the above checklist (for work performed for non-Chemistry/associated secondary faculty and the attached final report

Chemistry Sponsor: \_\_\_\_\_ Date \_\_\_\_\_

Final Approval:  
Undergraduate Committee Representative Signature \_\_\_\_\_

Please return this form to Zedeara Pratt in 204 Clapp Hall.