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497- 499 courses
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Undergraduate Research and Honors Projects

I. Chemistry degree undergraduate research courses

I.A. Available research courses for Department of Chemistry degrees:

Undergraduate research is offered through several courses in the Departments of Chemistry, Polymer Science or Biology as listed in the table below.

Department	Undergrad research		Honors projects	
	Course #	Credits per semester	Course #	Credits per semester
Chemistry (3150)	499	1-2	497	2
Polymer Science (9871)	499	1-3	497	1-3
Biology (3100)	497, 498	1-2	499	1-3
See the restrictions below on research in other Departments.				



These courses may be used as elective credit toward BS or BA in Chemistry and BS in Biochemistry degrees. Students taking the BS with Polymer Option degree or the 3-2 BS in Natural Science/MS in Polymer Science are required to do research in the Department of Polymer Science. Consult your degree contract to find out which of the above courses are accepted for elective credit or are required for the degree you have chosen. Degree contracts are posted at:

<http://www.uakron.edu/chemistry/undergraduate.dot>.

However, **only** if you have a signed Biochemistry degree contract that lists 3100:497 or 3100:499 as elective courses, will you be allowed to do undergrad research or an Honors project in the Department of Biology. Research or Honors Projects in Biology is not being allowed for new contracts.

I.B. Permission to take research courses:

All of the courses in the above table must be taken with permission of the Department from which they originate. Additional permissions are required (see the last two bullets in this section) if you are an Honors student or a Biochemistry major who is doing research in the Biology Department.

-  All projects in the Department of Polymer Science contain significant chemistry content. Therefore, no special permission from the Department of Chemistry is needed to take the 9871:497 and 9871:499 courses. However, such students are required to meet Department of Chemistry report writing standards and must turn in a graded report to the Department of Chemistry office. See below and the separate handout that describes how to write a report to meet ACS standards.
-  Biochemistry majors who **have a signed contract for the Biochemistry degree that lists the 3100:497-499 as elective courses** may do research in the Department of Biology *but only with Department of Chemistry permission*. For the research to count toward the Biochemistry degree, the project must have **significant** chemistry content. In order to obtain such permission, you must submit a 1-2 page proposal of your project to Prof. Taschner. It is expected that these proposals will have at least one literature reference to a major review in the field of the proposed research. Such students also are required to meet

Chemistry Department report writing standards and must turn in a graded report to the Department of Chemistry office. See below and the separate handout that describes how to write a report to meet ACS standards.

- Honors Biochemistry majors who are doing research in the Department of Biology must include at least one faculty member from the Department of Chemistry whose research involves biochemistry (Calvo, Leeper, Paruchuri, Shriver, Smith or Ziegler) as one of their readers.
- Honors students must submit a proposal to take the Honors versions of the research courses. The Honors research proposal and due dates for its submission are given at: <http://www.uakron.edu/honors/curriculum/honors-research-project-curriculum.dot>. It is expected that these proposals will have at least one reference to a major review in the field of the proposed research.

I.C. When to take the courses: Except for the restrictions on Honors courses mentioned above, the courses in the Department of Chemistry (3150:497 and 499) may be taken at any time during your degree program, at least in principle (see below). Please check with the Departments of Polymer Science or Biology to determine whether there are any restrictions on when you may take their courses.

I.D. The number of credits: To get a good research experience it is usually best to sign up for at least two semesters of research. A significant part of the first semester may involve training in research techniques and therefore, actual research is more likely to be done during the second semester. The Honors College requires that their students take at least two credits of one of the Honors project courses. In addition, If you are an Honors student, the final Honors project is due early, at the end of the last semester of the project.

II. How to sign up for undergraduate research or Honors projects

II.A. Find a research advisor

You must find your own *research* advisor. This person does not have to be the same as your *academic* or Honors chemistry advisor. (Note that Honors students may have another advisor in the Honors College and non-Honors students may have an additional advisor in University College.) The following web sites provide information on the research interests of each faculty member in the Departments of Chemistry, Polymer Science, and Biology.

- Chemistry: <http://www.uakron.edu/chemistry/faculty-staff.dot>
- Polymer Science: <http://www2.uakron.edu/cpspe/faculty.asp>
- Biology: <http://www.uakron.edu/biology/faculty-staff/> (only if you have a signed contract that allows research in the Biology Department)
- Chemistry and Polymer Science: Such information is also available at the *Directory of Graduate Research*, <http://dgr.rints.com/>, which is free from UA computers or via UA VPN. Click on “Institutional searches” and then enter “University of Akron”.)

The research descriptions should help narrow down your choices to one or two faculty members. Don't hesitate to ask a faculty member for an appointment, even if you don't know her/him. Faculty members expect students to initiate such conversations. Some things to discuss are:

- The nature of the research project you will be assigned. Most undergraduates don't know enough chemistry to develop their own research project and to conduct the research safely.
- Different projects require different skill sets, so you should inquire whether your current skills are acceptable for a particular project.
- When signing up for a course that has a variable number of credits, you should ask your potential advisor what his/her expectations are for the number of credits you plan to take. A rough guide is that the total amount of time you put into a two credit Advanced Laboratory or the Biochemistry Laboratory courses, *both inside and outside the lab*, should be similar to the amount of time you spend on two credits of research.
- Also inquire whether your advisor wants you to write more reports than the minimum number described in section on grading (see III.B.).

II.B. Register for the course

You cannot register directly into any research or Honors project course in the Departments of Chemistry, Polymer Science or Biology.

- For research in the Department of Chemistry, ask your *research* advisor to contact the staff in the Chemistry office. The staff will register you for 3150:497 or 3150:499.
- Consult the Departments of Polymer Science and Biology for directions on how to sign up for their research courses.

II.C. Additional considerations for Honors students

For the purposes of the Department of Chemistry, Honors students may combine work done in non-Honors research courses with work done in the Honors courses for their Honors Project report. If you are doing research in the Departments of Polymer Science or Biology, check whether this is allowed with these departments. An advantage of taking Chem 499 over Chem 497 is that the former may be taken for one or two credits and it does not require approval from the Honors College.

III. How are grades assigned for undergraduate research?

III.A. Your performance in research.

Your research advisor and any graduate students or postdocs in the research group will note your attendance, effort, attitude, etc. *Undergraduates must be supervised when they are working on their research project.* If you disobey this rule, you will not be allowed to continue your research project.

III.B. One or more reports on your research

You will write one or more thorough reports on your research according to the timeline described below. This is usually the most important part of the grade.

- Specific directions to writing reports are given in a separate handout entitled *Research Reports*. The handout is posted on the Springboard site (<https://springboard.uakron.edu/>) and at <http://www.uakron.edu/chemistry/undergraduate.dot>. *Do not submit a report for grading without having followed the directions in the handout.*
- As a minimum, you are required to turn in a report at the 1) end of each year, 2) at the end of your last semester of research and 3) if you switch research advisor. If, for example, your research takes place during the fall, spring and

summer, then you would receive IP (in progress) grades for the fall and spring semesters. After you turn in your report at the end of the summer, the IP grades would be changed to letter grades. *Please remind your research advisor and the staff in the Department of Chemistry that you have IP grades that need to be changed to a letter grade.* Otherwise, there could be a delay in obtaining your degree if there are IP grades in your transcript after the date you wish to graduate.

- Your research advisor has the right to request more reports than the minimum described above.
- If you are a non-Honors student, you should plan on completing the first draft of the report *at least one week before the end of the semester.* Your advisor will work with you to help you revise the report to bring it up to the required level. It is not unusual to have two draft reports before writing the final version. Honors students must follow a different timeline (see section III.C below).
- It is expected that your paper will not be plagiarized.
- A copy of all your *graded* reports should be given to the Department of Chemistry main office (KNCL 103), even if you are doing research in the Departments of Polymer Science or Biology.
- Even though a report is not always required of 3100:497 and 3100:498 students, students taking these courses toward a Department of Chemistry degree are subject to follow the report writing requirements in this handout. In such a case, turn in your report(s) to Prof. Calvo.

III.C Additional grading considerations for Honors students in the Honors Project courses

Honors students have to attach a special cover sheet to their report and their report must be read and accepted by their committee members (readers). The additional requirements are listed at the following web site:

<http://www.uakron.edu/honors/curriculum/honors-research-project-curriculum.dot>.

- Honors students are expected to abide by the Honors Project due dates given at the web site above. The due date for the first draft is usually during the 13th week of a 16-week semester. Therefore, Honors students should be more prompt in submitting their first draft to their research advisor than non-Honors students.
- The research advisor is the expert in the field of study and is most qualified to review the Project and determine whether it is flawed. **AFTER** the advisor has signed (or is willing to sign) the cover sheet, then you can submit it to the rest of your committee (readers and Honors advisor).
- The committee members sign the sheet once they have accepted the Honors project. Give all members of your committee sufficient time to read and critique your project. In principle, *any* committee member has the right to require that you rewrite your report, if it is deficient. (The Honors Chemistry Advisor, Prof. Tessier, has done this *many* times.) Ask your research advisor to do a thorough job with the editing so that this does not happen to you, especially if you plan to graduate that semester.
- If you obtain extensions from the Honors College on the due date of your project, be sure to *ask all* your committee members, by phone or Email, whether

the change fits *their* schedules. *You must respect* the right of the committee members to plan their end-of-semester activities. If the new due date conflicts with a committee member's schedule, you may have to replace that member with another.

- ☉ If you have taken a mix of Chem 497 and 499 to do the Honor's project, then IP grades for both of these courses will be converted to a real grade (A, B, C, etc) once you complete the project.

III.D. Additional considerations for students doing research or Honors projects outside the Department of Chemistry

Though you are doing research outside the Department of Chemistry, your degree and any ACS certification is controlled by the Department of Chemistry. For this reason, *in addition to* submitting your report to the outside department, a *graded copy* of your report must be turned into the Department of Chemistry. For accreditation purposes, ACS mandates that we keep such reports on file for several years.

III.E. Other research-related activities

Your research advisor may also encourage you to attend group meetings or present your research at a group meeting or at a conference as a talk or poster presentation. If your work is at a very high level, you could get a publication on your work. Though these activities are not required, it is highly recommended that you take advantage of such opportunities. Your research advisor will look favorably on your willingness to develop your oral communication skills. Make sure to report such activities on your resume and in graduate school applications.

IV. Ethics in chemistry and academic honesty

IV.A. General ethics

All students at the University of Akron are expected to follow the Code of Conduct (<http://www.uakron.edu/sja/code-of-conduct.dot>). Of particular note are #1 (plagiarism) and #14 in the "Definitions of Misconduct". The latter indicates that "Unauthorized use of keys or entry into University facilities" is considered misconduct! **You must be supervised when working in the laboratory.** Otherwise your presence in the laboratory is considered unauthorized.

A professional chemist should conduct him/herself in an ethical manner and such behavior is expected of all research students. Fraud, plagiarism, falsification, fabrication, bias, selective deletion of undesirable data, conflict of interest, lack of acknowledgement, disrespect, dishonesty, mistreatment of laboratory animals, and lack of concern for the environment or for safety are some of the unethical behaviors that occur in the field of chemistry. The ACS Chemist's Code of Conduct (see web site below) defines ethical behavior. A number of web sites discuss ethics and provide guidance in how to act in various situations. "Green chemistry" is the term used for chemistry that is done with concern for the environment.

- ☉ ACS Ethical and Professional Guidelines
http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_TRAN_SITIONMAIN&node_id=1095&use_sec=false&sec_url_var=region1
- ☉ Case studies on ethics in chemistry: <http://chemcases.com/>
- ☉ "On Being a Scientist" 3rd ed. – a 2009 report by the Committee on Science Engineering and Public Policy representing the National Academy of Sciences,

the National Academy of Engineering and the Institute of Medicine

http://books.nap.edu/catalog.php?record_id=12192&utm_medium=email&utm_source=National%20Academies%20Press&utm_campaign=New+from+NAP+3.31.09&utm_content=Customer&utm_term=

- UA Department of Environmental Health and Safety:
<http://www.healthandsafety.uakron.edu/>
- ACS safety including free downloads of safety booklets:
http://portal.acs.org/portal/acs/corg/content?nfpb=true&pageLabel=PP_SUPEARTICLE&node_id=2230&use_sec=false&sec_url_var=region1&uuid=073f33c6-e547-481a-9442-6d88ad214f5a
http://portal.acs.org/portal/acs/corg/content?nfpb=true&pageLabel=PP_ARTICLEMAIN&node_id=195&content_id=CTP_006749&use_sec=true&sec_url_var=region1&uuid=52623be6-e15b-4735-bd06-e0e276457e5e
http://www.dchas.org/index.php?option=com_weblinks&view=category&id=3&Itemid=6
- MSDS (Material Safety Data Sheets) sources (See also chemical company web sites): <http://ull.chemistry.uakron.edu/erd/>, <http://www.ilpi.com/msds/index.html>, and <http://hazard.com/msds/>
- Chemistry and Engineering News safety letters (published by ACS):
<http://pubs.acs.org/cen/safety/index.html>
- NIOSH (National Institute for Occupational Safety and Health) Pocket Guide to Chemical Hazards: <http://www.cdc.gov/niosh/npg/>
- ACS Green Chemistry Institute:
http://portal.acs.org/portal/acs/corg/content?nfpb=true&pageLabel=PP_SUPEARTICLE&node_id=1415&use_sec=false&sec_url_var=region1

IV.B. Plagiarism

Plagiarism is a particularly important ethical concern in Chem 499 or 497 because a written report comprises a large part of the grading. This ethical concern is discussed in the handout entitled *Research Reports*.

V. Career and professional school information

Prof. Tessier can lend you a copy of the ACS book *Careers for Chemists*. The research experience can help you decide the field of chemistry in which you would like to find permanent employment or may inspire you to attend graduate school. Information on chemistry careers and graduate schools can be obtained at the following web sites.

- ACS career resources information:
http://portal.acs.org/portal/acs/corg/content?nfpb=true&pageLabel=PP_CAREERS&node_id=87&use_sec=false&sec_url_var=region1
- Directory of Graduate Research (free from UA computers or via UA VPN):
<http://dgr.rints.com/>
- UA career services: <http://www3.uakron.edu/ascareer/> and <http://www.uakron.edu/career/>