

**C. Eugene Bennett Department of Chemistry
West Virginia University**

Chemistry 497: Undergraduate Research Registration Information

To register for the Chemistry 497: Undergraduate Research course in the Department of Chemistry, the following process must be completed prior to each semester during which you plan to conduct research.

- Make necessary contact and arrangements with the Chemistry faculty member who will serve as your research mentor. In rare cases, faculty members outside the Chemistry Department may serve as research mentor for the Chemistry 497 course.
- Read the “Safety Rules and Regulations for Undergraduate Students in Research Laboratories in the Chemistry Research Laboratory Building (CRL) (revised Jan 2017)” and complete the associated safety waiver and contact lens sheets. Submit the completed safety forms to Barbara Foster, Safety Director (217 Clark Hall).
- Complete the attached “Undergraduate Research Approval Sheet” (note that Chemistry 498 – Honors Thesis, has additional requirements). Submit the completed approval sheet to the Chemistry 497 course instructor. Email the course instructor to let the instructor know that you have submitted your approval sheet.
- Once the instructor has received your approval sheet, the instructor will verify your information and issue an electronic permit override so that you can enroll in the Chemistry 497 class. The instructor will email you after issuance of the override. Because Chemistry 497 is a variable credit course, you will enroll for the specific number of credit hours that you indicated on the approval sheet. Keep in mind that for each Chemistry 497 credit hour, you are required to spend a minimum of 3-4 hours per week researching your project.

Notes

- All students must have a 3.0 GPA or higher to participate in Chemistry 497 research.
- A written research report describing your activities is required at the end of each semester, as part of your Chemistry 497 course grade and for Chemistry Department records. Details and instructions on the writing of the research report will be provided.
- Only the Chemistry 497 course instructor may issue a permit for the research course.

Chemistry 497
Undergraduate Research Approval Sheet

Student Name: _____ Student ID No.: _____

Student Major: _____ Student email: _____

Overall College GPA: _____ Date: _____

Chemistry College GPA: _____ Date: _____

Semester: Fall Spring Summer I Summer II Year: _____
 (circle semester)

497 Credit Hours: _____
(for each 497 credit, student must research a minimum of 3-4 hours/week × 15 weeks = 45-60 hours)

Expected Hours Per Week in Lab: _____ (based on above credit hours)

Topic of Research Project: _____

Student Signature: _____ Date: _____

Research Mentor Print Name: _____

Research Advisor Signature: _____ Date: _____

Departmental Approval: _____ Date: _____

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Additional Information (Required if Student is Completing an Honors Thesis)

Honors Advisory Committee: _____

_____ (Committee Chair)

Honors Thesis Approved by Committee on: _____ (date)

Advisory Committee Signatures: _____

_____ (Committee Chair)

**C. Eugene Bennett Department of Chemistry
West Virginia University
Eberly College of Arts and Sciences**

**Safety Rules and Regulations
for Undergraduate Students in
Research Laboratories in the
Chemistry Research Laboratory Building (CRL)**

Revised January 2017

I certify that I have read and that I understand the *Safety Rules and Regulations for Undergraduate Students in Research Laboratories*. In consideration of being permitted to participate in a research laboratory in the Chemistry Research Laboratory Building, I will follow these rules and regulations.

PRINTED NAME

Date

SIGNATURE

Date

EMAIL ADDRESS _____

CELL PHONE NUMBER _____

EMERGENCY CONTACT NAME

EMERGENCY CONTACT
TELEPHONE NUMBER

I will make every effort to assist this student in complying with all of the safety rules and regulations of the Bennett Department of Chemistry at West Virginia University.

RESEARCH ADVISOR

Date

Return signed form to Barbara L. Foster, Safety Director

**C. Eugene Bennett Department of Chemistry
West Virginia University
Eberly College of Arts and Sciences**

**Safety Rules and Regulations for Undergraduate Students
in Research Laboratories
in the Chemistry Research Laboratory Building (CRL)**

**Effective May 1996
Revised January 2000, January 2011, January 2017**

These safety rules must be obeyed by all undergraduate students at all times in the research laboratories. Undergraduate students who violate these safety rules will be subject to dismissal from the research laboratory. These safety rules are meant to assist clear thinking, reasonable judgment, and the exercise of foresight in the design and implementation of any experiment. It is essential that you read this material in order to understand what is expected of you while you work in a research laboratory. Everyone is responsible for safe laboratory practices and is expected to exercise all due caution and prudence when working in research laboratories.

**Telephones have been installed in all laboratories in the CRL. An emergency telephone is located near the water fountain on each floor in the CRL.
Emergency 9.911
Public Safety Office 304.293.3136**

Undergraduate research students must be supervised by the faculty member or a designated surrogate during the normal work day (8:15A.M.- 4:45 P.M.). During all other hours the faculty member must be present in the laboratory or the immediate vicinity when the student is working in the laboratory.

I. Guidelines for Personal Apparel and Personal Protective Equipment in the Laboratory

- A. All undergraduate students must wear approved chemical splash goggles (over regular eyeglasses) and approved laboratory aprons or cotton lab coats (not lab jackets) at all times in the laboratory. All persons who work with lasers must wear additional suitable protective eye wear that conforms to ANSI Z87.1, "Occupational and Educational Personal Eye and Face Protection Devices."



Chemical splash goggles protect the face and the eyes in the event of a chemical splash or exposure and must be worn by all undergraduate students in the laboratory.



Safety glasses do not protect the face and the eyes in the event of a chemical splash or exposure and are not approved for use by undergraduate students in the laboratory.

- B. The use of contact lenses in the laboratory is strongly discouraged. In the event of a chemical splash or vapor release, contact lenses can increase the degree of injury to the eye and may prevent prompt first-aid and eye-flushing procedures. All undergraduate students who plan to wear contact lenses in the laboratory must sign a statement (page 8 of this document) that states that they will accept responsibility for any injury caused by their wearing of contact lenses in the laboratory.
- C. Students should wear cotton clothing that provides protection from chemical spills. Clothing which completely covers the legs must be worn at all times in the laboratory. Shorts and skirts that do not completely cover the leg are inappropriate apparel in the laboratory and are not permitted.
- D. To avoid exposure to hazardous materials, open-backed shirts, bare midriff shirts, or shirts which expose areas of the torso are not permitted.
- E. Wear shoes which completely cover the feet. Sandals, perforated shoes, open-toed shoes, open-backed shoes, or high-heeled shoes are not permitted in the laboratory.
- F. For your safety, hair longer than shoulder length and loose sleeves must be confined when working in the laboratory.
- G. Wear the disposable gloves that are provided in each laboratory when working with hazardous chemicals. Inspect the gloves for defects before wearing. Be sure to notify your Research Advisor before undertaking any experimental work if you have an allergy to latex. Always remove gloves before exiting the laboratory. Upon removal, discard the disposable gloves in the wastebasket.
- H. You are advised to avoid wearing synthetic fingernails in the chemistry laboratory. Synthetic fingernails can be damaged by solvents and are made of extremely flammable polymers which can burn to completion and are not easily extinguished.
- I. For your protection, jewelry should not be worn in the laboratory. Dangling jewelry can become entangled in equipment and can conduct electricity. Chemicals can seep under

the jewelry and cause injuries to the skin. Chemicals can ruin jewelry and change its composition.

II. Procedures to Avoid Exposure to Hazardous Materials in the Laboratory

Laboratory workers should always READ and HEED the label and the Material Safety Data Sheet (MSDS) before using a chemical for the first time. MSDS can be found at <http://hazard.com/msds/index.php>

- A. Minimize all chemical exposure. Avoid ingestion, injection, inhalation, eye contact, and skin contact with all hazardous materials in the laboratory.
- B. No chemical should ever be tasted. Do not pipet by mouth in the laboratory; use a pipet aid.
- C. When you are instructed to smell a chemical, you should gently waft the vapors toward your nose using your gloved hand or a folded sheet of paper. Do not place the container directly under your nose and inhale the vapors.
- D. Experiments involving odorous, lachrymatory, vesicant, toxic, corrosive, or otherwise obnoxious substances must be carried out in a hood under draft and not on the bench top. When using a chemical fume hood, the sash opening should be kept at a minimum to protect the user and to ensure the efficiency of the operation. Keep your head and body outside of the hood face. All chemicals and equipment should be placed at least six inches from the hood face to ensure proper airflow.
- E. Eating, drinking, smoking, chewing gum, applying cosmetics, and using smokeless tobacco products are prohibited in the laboratory. Beverage containers, cups, bottled water, and food containers are not permitted in the laboratory. Never use laboratory glassware for eating or drinking purposes. Do not store food and/or drink in laboratory refrigerators.
- F. Always remove gloves and thoroughly wash your hands before exiting the laboratory. Dispose of gloves in the designated wastebasket. Do not reuse gloves.
- G. Notify your Research Advisor if you spill any chemicals. Clean up chemical spills (including water) immediately. Do not leave spilled chemicals on the bench top or floor.
- H. Notify the Research Advisor about any sensitivities that you may have to particular chemicals before undertaking any experimental work in the laboratory.
- I. If a chemical spills onto the skin, immediately flush the affected area with water and notify the Research Advisor and the Prep Room laboratory staff, Room 304 Clark Hall. Complete an Accident Report Form (page 9 of this document) and submit it to the Safety Director.

III. General Guidelines for Laboratory Procedures

- A. Any personal injury or accident that may occur in the laboratory must be reported to the Prep Room laboratory staff in Room 304 Clark Hall and the Research Advisor in charge, or, if he or she is not immediately available, to some other faculty member and the Safety Director. The research advisor receiving such information must submit an Accident Report Form to the Safety Director within 24 hours.
- B. When the fire alarm sounds you must evacuate the building immediately. Extinguish all flames and turn off all equipment, as appropriate, before exiting.
- C. Unauthorized experimentation and work in the laboratory are forbidden.
- D. Unauthorized personnel are not permitted in a laboratory.
- E. Excessive noise and boisterous conduct are forbidden. Radios must not be audible from outside the immediate laboratory or office and use must be discontinued if potentially hazardous situations exist or if the sound level disturbs coworkers.
- F. No laboratory work involving any hazard may be carried out unless responsible assistance is available nearby in the event of an accident. Responsible assistance is interpreted to mean Department of Chemistry graduate students, postdoctoral research associates, and Research Advisors.
- G. Vocal warning should be given to those working nearby in case of fire, explosion, spillage of dangerous chemicals, release of toxic fumes, etc. The information should be reported to the research advisor in charge and any other person who might be affected by such an occurrence. Written notification of the use of a fire extinguisher should be made to the Safety Director as soon as possible (within 24 hours).
- H. Each undergraduate student must know the location and proper use of fire extinguishers, safety showers, eyewash stations, fire blankets, and first aid kits that are available in that section of the building in which he or she is working. Your Research Advisor will instruct you in the proper usage of the emergency equipment.
- I. All water, gas, air, electrical, and other service connections must be made in a safe and secure manner. All worn, frayed, or damaged cords and plugs on all electrical equipment must be replaced by satisfactory cords and plugs. Electrical components, power cords, etc., should be kept off of the floor in case of flooding. All tubing for water must be securely fastened.
- J. Hoses for a water condenser or other cooling unit must be in good condition (not cracked or brittle) and must be clamped or wired to the condenser or cooling unit. The drain-end of the hose must be secured in the drain to ensure that the end does not come out of the drain. The attachment of an inverted funnel to the drain-end of the hose works very well to keep the hose end in the drain. When operating a condenser, use water only when it is needed and use only the necessary flow-rate; usually this is a slow flow-rate. If it is necessary to provide cooling water to an apparatus overnight or longer (e.g., heating a solution at reflux), be sure all connections are made correctly and have your apparatus checked by your Research Advisor before you leave it.
- K. Solid materials (paper, matches, towels, broken glass, stoppers, rubber tubing, etc.) must be kept out of the sinks at all times to minimize the danger of plugging drains.
- L. Reactions that are chemically or mechanically hazardous must not be left unattended. If a room contains a special hazard, a sign designating the presence and nature of the hazard must be posted on the door.
- M. Good housekeeping is essential. Aisles, emergency exits, and breakout panels must be unobstructed. Hoods must be available for work. Benchtops must be kept as free from unnecessary apparatus as possible. Clean up chemical spills (including water) immediately. Do not leave spilled chemicals on the benchtop or floor. Keep glassware clean. Chemicals, including those in a refrigerator, must be in labeled containers. Coats, bags, and other personal items should be stored in the proper areas in the laboratory room; not on the benchtops or in the aisles. Sinks should not be filled with dirty glassware.
- N. Clear visibility from corridors into laboratories must be maintained. Only

- authorized warning signs and directories are permitted on the glass of the laboratory doors; no posters, etc. are permitted. Specific exceptions will be made where a dark room is required or protection from lasers is needed.
- O. In the event of a mercury spill, contact the Research Advisor and notify the Prep Room laboratory staff in Room 304 Clark Hall.
 - P. As a reminder of University policy, smoking is prohibited in all Chemistry facilities.
 - Q. Research Advisors who supervise work involving microwave generators or X-ray generators must periodically check for leakage and make appropriate correction if there is leakage.
 - R. Special equipment utilizing high voltage components, radiation devices (i.e., X-ray generators or electron capture detectors), intense ultraviolet sources, high pressure components, and other such equipment must incorporate commonly accepted safety features. Suitable warnings must be posted on entry doors.
 - S. All hazardous chemicals not packaged for shipping must be transported within the buildings in suitable "safety carriers" (such as a rubber pail with a handle or a chemical cart).
 - T. Equipment operated by a motor-driven belt (such as a vacuum pump) must be protected by a suitable belt shield or guard.
 - U. When heating or carrying out a reaction in a test tube or flask, never point the apparatus toward your co-workers or yourself.
 - V. In all experiments, including distillations, in which explosions, implosions, or violent reaction is possible, the operator and neighbors should be protected by safety shields (in addition to chemical splash goggles).
 - W. When diluting concentrated acids always pour the acid slowly into the water with stirring; **NEVER ADD WATER TO CONCENTRATED ACIDS** because of the danger of splattering.

IV. Laboratory Glassware

- A. Tubing ends must be fire-polished or ground smooth. Towels or gloves must be used to protect the hands when inserting glass tubing into corks or stoppers. Lubricants such as soapy water, mineral oil, or glycerol may be useful.
- B. Do not attempt to dry glassware by inserting a towel wrapped around a glass rod. Do not use cracked glassware. Flasks and other glassware that will be used for vacuum distillation must be inspected carefully before use.
- C. Apparatus intended for use at atmospheric pressure must not be used under vacuum. Erlenmeyer flasks larger than 25 mL must not be used as receivers for vacuum distillations.
- D. Glass tubes must extend well through rubber stoppers so that closure of the tubes does not occur if the rubber stoppers swell.
- E. Heavy pieces of apparatus must be supported with clamps suitably protected with pads and also with bottom support such as tripods or rings.
- F. Vacuum desiccators that are not in a protective cage and Dewar flasks without a metal case must be completely wrapped with electrical or duct tape.
- G. Broken glass should be disposed of in containers (available in the Stockroom, Room 308 Clark Hall) specifically designed for that purpose, not in the normal trash containers. Contact the laboratory staff in Room 304 Clark Hall to remove broken glass containers when they are full.
- H. Reagent bottles may be cleaned and submitted to the laboratory staff in Room 304 Clark Hall for re-use.

V. Special Hazards in the Laboratory

A. Flammable Liquids

- All flammable liquids are to be stored in approved safety cabinets. **EVERYONE IS URGED TO MINIMIZE THE TOTAL VOLUME OF FLAMMABLE LIQUIDS STORED IN A LABORATORY.** All flammable solvents from bulk (large metal containers) should be dispensed into department-approved safety cans. Flammable liquids that have been directly purchased from a vendor and not stored in a department-approved safety can should be stored in the safest possible manner and in the smallest quantity appropriate for the intended use. Experience has established that the most serious laboratory fires have involved large volumes of flammable solvents in a laboratory.
- Do not heat flammable liquids in a domestic-grade microwave oven.
- Very volatile flammable substances must not be heated in open containers near a flame or laboratory equipment where the flammable substance may ignite. Before very volatile substances are heated, the area must be carefully inspected for the presence of open flames, hotplates, potential electric sparks, etc. If in doubt about the flammability of a substance, consult your Research Advisor.
- Flammable substances boiling below ca. 150°C at atmospheric pressure must be distilled only with the aid of a suitable heating bath or mantle and the receiver must be so vented that uncondensed vapors are led into a suitable trap.
- The concentration of non-aqueous solutions should be done by distillation, NOT by evaporation or vaporization into the laboratory atmosphere. Most organic solvents are highly toxic. A rotary evaporator should not be used to remove toxic/flammable solvents unless they are condensed.

B. Gases and Toxic Fumes

- All cylinders containing gases under pressures of more than 100 lbs/sq. in. and/or more than 36 inches in height must be handled or transported only on suitable trucks. **Such cylinders in use or in storage inside a laboratory must be secured by a cylinder strap or a chain positioned approximately 1/3 of the way down the cylinder. Compressed gases must be transported with the safety cap covering the valve (i.e., no regulators).**

**The regulator must be removed and replaced
with a safety cap prior to transport
of a gas cylinder.**

- Cylinders containing poisonous, corrosive, or flammable gases must not be opened by any operator who has not used them previously without permission and instruction from the Research Advisor in charge or other proper authority. Furthermore, such cylinders may be opened only when properly connected to apparatus contained in a hood under draft. Adequate traps must be placed between the cylinders and other apparatus.
- Experiments involving odorous, lachrymatory, vesicant, toxic, corrosive, or otherwise

obnoxious substances must be carried out in a hood under draft and not on the bench top. Provisions should be made to absorb corrosive, toxic, and obnoxious fumes. Obnoxious and dangerous gases must not be released into the laboratory.

- Reactions or operations involving high or low pressure - especially those using or generating hazardous or explosive gases - must be properly contained and/or vented.
- Gas valves must be kept closed except when a burner is in use.

C. Active Metals and Pyrophoric Substances

- Metallic sodium and potassium, lithium aluminum hydride, sodium borohydride and pyrophoric substances of all kinds must be stored under an inert liquid or in a dry box or desiccator under nitrogen or argon as may be proper for the particular case. In general, all such substances must be stored separately (i.e., not in the same container) and must be kept out of contact with air and moisture.

VI. Waste Chemical Disposal

Do not dispose of waste chemicals in the sink drains or in the wastebasket. It is the policy of the Eberly College of Arts and Sciences that no chemicals or solutions are poured down the drains or placed in the general wastebaskets in the laboratory.

Waste chemicals must be collected in appropriate containers, properly labeled, and must be stored in the assigned location within the laboratory. The laboratory worker who is in charge of the chemical waste disposal for the research laboratory must complete the online waste pick up forms, located on the WVU Environmental Health and Safety home page, to arrange for a chemical waste pickup, when necessary.

<http://ehs.wvu.edu/>

- Waste chemicals should be stored in the smallest container possible (i.e., not 500 mL in a 2L bottle). The container should be reasonably full (but with 1-2 inches of headspace) prior to pickup. Waste liquids and solids should be treated and stored (i.e., temperature conditions, labeling, and packaging) as new material is stored. All chemical waste must be collected in appropriate containers, properly labeled, and submitted with the proper paperwork to personnel from the Department of Environmental Health and Safety.

C. Eugene Bennett Department of Chemistry**USE OF CONTACT LENSES IN CHEMISTRY
RESEARCH LABORATORIES**

Chemical splash goggles with shielded vents must be worn at all times in the research laboratories. Such safety goggles prevent liquids or solid particles from being splashed or sprayed into the eyes and they reduce contact with laboratory vapors. Gases and vapors can concentrate under contact lenses and cause permanent eye damage. It has been shown that soft contact lenses can pose an even greater risk of vapor absorption and possible eye damage than hard contact lenses. In addition to the possible vapor and gas hazards, contact lenses may trap foreign matter in the eye and produce abrasion of the cornea. Contact lens wearers are advised to remove their contact lenses and replace them with conventional eyeglasses before coming to the chemistry laboratory when possible to avoid the possibility of the aforementioned hazards as well as any unforeseen problems which might occur as a result of wearing contact lenses. The exceptions to this general rule include persons who cannot wear corrective glasses for medical reasons or persons for whom contact lenses are medically required for therapeutic reasons.

RELEASE IN FULL OF ALL CLAIMS

I have read and understand the information set out above pertaining to the potential risks of wearing contact lenses in the chemistry laboratory.

In consideration of being permitted to conduct research in a chemistry laboratory, I agree to wear safety goggles at **ALL** times in the laboratory and to notify my Research Advisor that I wear contact lenses in the laboratory.

I fully understand that I assume **FULL RESPONSIBILITY** for any injury which might occur as a result of or connected in any way to the fact that I wear contact lenses in the chemistry laboratory.

PRINTED NAME _____

STUDENT SIGNATURE: _____ **DATE:** _____

WITNESS SIGNATURE: _____ **DATE:** _____