

Summer 2025 Syllabus

Chemistry Research Academy

Monday, July 7 – Friday, July 25

Program Director:	Dr. Jenine Maeyer
Lead Instructors:	Mr. Jeremy Wolf Ms. Jacqueline Gartner,
Instructors:	Mr. Darcy Brewer, Dr. Zach Minken, Mr. Eual Phillips, and Mr. Michael
Lab Manager:	Romea Mr. Ryan Kubanoff

Course Schedule:

The Chemistry Research Academy will run **Monday – Friday from 9:00 am – 4:00* pm** with a 1-hour lunch break.

**Labs may run a bit later for some groups.*

Classroom: [Chemistry Building '73](#), **Rm 102 Lecture Hall**

Lab room: [Chemistry Building '58](#), first floor in the **General Chemistry Laboratory**

Course Format:

Course time will be split approximately evenly between the classroom and the laboratory. Classroom activities will include guest lectures from leading faculty in the department, library research, large- and small-group discussion, and collaborative activities dealing with the background material related to the topics being presented. Laboratory activities will include instruction on the use of various instruments and learning and practice of specific research skills within the presented topics. Students will also visit research labs and facilities in the department, and elsewhere on campus, as available. The following table provides a general outline of what will be accomplished throughout the 3-week program (though not necessarily in the order provided).

Chemistry Research Academy Focus Questions
What is "Research"?
Do real scientists use the same scientific methods as you learn in high school?
How do you find a topic that you want to research?
What is the role of scientific literature in research?
What types of instruments are used in chemistry research?
What are some areas of current research in chemistry?
How is a scientific experiment designed?
How much can you trust experimental results?

Topics

Background and fundamental topics we will review:

- Atomic Structure and Periodic Table
- Bonding: Structure and Properties
- Chemical Reaction Dynamics (kinetics, equilibrium, etc)
- Laboratory safety in a college lab
- How to access and use Penn's vast resources for library research

Topics we will learn/study, driven by current departmental research

Broadly, we will explore:

- how we know what we know about substances and reactions
- how scientists research things they cannot see
- how structures of substances lead to unique properties and functions

To explore these, we will learn about:

- Analytical techniques:
 - o Spectroscopy
 - o Polarimetry
 - o Chromatography (various types)
- Nanoparticles – synthesis, characterization and current/expected applications
- Transition metals and Rare Earths: coordination complexes and the role they play in many areas of research
- Organic chemistry: chirality, effects of intermolecular forces, chemistry in biology

Activities

Classroom time

- Active learning, with minimal lecture time
- Small-group discussions
- Interactive Chemistry Demonstrations
- Research lectures by Chemistry Department Professors and Students (including Q&A)
- Pre-Lab activities
- Collaborative analysis and evaluation of lab work

Laboratory time

- Introductory labs to learn about how different instruments work and are used.
- Guided- and open-inquiry laboratory experiences to explore chemistry topics from class and research lectures.

Program-long Research Project

- Details will be given in class. In this on-going activity, you will design a plan for doing an independent research or science fair project for after you leave the program.

Interacting with Penn Researchers

- Research lectures by Chemistry Department Professors and Student Research Groups, with time for Q&A and opportunities for individual follow-up.
- Laboratory Facility Tours in the Chemistry Department and in the wider Penn community.
- Journal Club and other special activities with Research Grad/Undergrad Students.

Field Trips

- We will visit the [Science History Institute](#) to explore how chemistry has advanced throughout history.
- The [Penn Museum](#)

Guest Lectures:

Research Talks or activities from the following speakers are planned for Summer 2025:

- [Dr. Eric Schelter](#) – Studying and Using the Rare Earth Elements
- [Dr. James Petersson](#) – Molecular probes for protein folding and interactions
- [Dr. Ivan Dmochowski](#) – How to Capture an Atom
- [Dr. Daniel Mindiola](#) – Metal Complexes and Catalysis
- [Dr. Karen Goldberg](#) - Energy Research, Inorganic, and Materials Chemistry
- [Dr. Dirk Trauner](#) - Chemical Biology and Chemical Catalysis
- [Dr. Shoji Hall](#) - Materials and catalysis

Required Course Material:

- **Laptop or Tablet:** Students are asked to bring a laptop or tablet if possible. We will be using an electronic lab notebook (see below) and online course materials. There are laptops available for students who do not have one to bring.
- **Lab Notebook:** We will be using electronic lab notebooks (ELNs) to record data and complete assignments. You will sign up through Canvas for an account with Lab Archives on the first day of the program.
- **Lab Handouts:** There is not a printed manual for this course. All course material and other handouts will be posted in your ELN or on Canvas.

Safety:

Everyone is responsible for safe practices in the laboratory. Most of the main points are below, but you should never hesitate to ask a question of your instructor, lab staff, or Dr. Maeyer. Every student must digitally sign the safety agreement before performing any lab work.

1. Lab Attire

- No open-toed shoes are permitted in any labs. Shoes must cover the entire foot.
- Clothing that completely covers the legs and ankles must be worn at all times, including long pants and socks. No shorts, *capris*, *leggings*, or *tights* are permitted in any labs.
- *Shirts with sleeves* are required. Tops such as tank tops or clothing with exposed shoulders or backs are not permitted.
- Arriving to lab in inappropriate attire will result in a loss of points. You will not be permitted to begin the experiment until the appropriate clothing is worn.

2. Personal Protective Equipment (PPE)

- *Safety goggles* and an *apron* are provided for each student.
- Safety goggles are to be worn AT ALL TIMES while in the lab room, whether or not experiments are currently being performed. This includes during pre-lab presentations and when typing up or organizing data after experimental work. If you are in the lab room, you are to have safety glasses on.
- An apron or other approved lab coat must be worn while performing experimental work and cleaning up your station. You don't need to wear the apron during the pre-lab presentation or while doing your data work up if all chemicals have been cleaned up.
- Instructors and/or lab handouts will instruct students during the experiment about specialized PPE, including the use of gloves.
- When arriving to lab, putting on your safety goggles is the FIRST thing that you do. You must put your safety goggles on before putting on your apron. This protects your eyes from any chemicals that may be present on the apron.
- Violations of PPE requirements are taken seriously. A verbal reminder will be issued on the first violation. All other violations will result in removal from the lab.

3. Electronics and Personal Items

- Only items needed for lab are permitted in the lab room. All other belongings (bags, coats, etc) should be left in the day-use lockers provided in the hallway.
- Students are provided with a combination lock for the day use lockers.
- Cell phones are NOT permitted in the lab. Cell phones are easily contaminated and as such are to be left outside of the lab in lockers provided for day use.
- Students will need to bring a laptop or tablet to access the lab documents. Stands are provided and should be used to raise approved electronics off of the lab bench. No gloves are to be used while typing on electronics, and any suspected chemical contamination should be brought to the attention of the lab manager or instructor immediately.

4. Behavior

- No food or drink is permitted in the lab.
- Disruptive or destructive behavior will not be tolerated.

5. Emergencies & Incident Reporting

- Inform your instructor immediately of any injury or exposure. In the case of chemical contact, cut, or puncture, flush the affected area for 15 minutes with soap and water. If splashed in eyes, use emergency eyewash. Hold both eyes open and flush for 15 minutes.
- Students must immediately inform a Lab Instructor of any emergency.
- Students must follow the emergency response procedures stated in the Emergency Response instructions poster, which is posted in the lab.

6. Chemical Spills & Waste Disposal

- Only water down the drain. All other chemicals and materials should be disposed of properly. When in doubt, ask.
- There are cardboard boxes for all broken glass waste. Only chemical-free clean glass can be placed in these boxes.
- Waste areas for liquid and solid chemical waste are in each lab room. Please refer to the label on the container and instructions in the lab handout for details. Specific waste disposal instructions are included in each experimental procedure.
- If there is a small spill on the lab bench, inform your TA and clean it up. Acids and bases will need to be neutralized. Once all chemicals are disposed of properly, the area can be rinsed with water.
- For large spills, please keep clear of the area and inform the instructor immediately.

7. Additional Resources:

- [ACS College Lab Safety Video Series](#)
- [ACS Guide to Safety in Academic Labs](#)