



University of Colorado **Denver**



Safety in an Undergraduate/Graduate Laboratory, Working at the Interface of Biological Chemistry

Raising Safety in Research: Scaling Up Safety in Individual Research Projects

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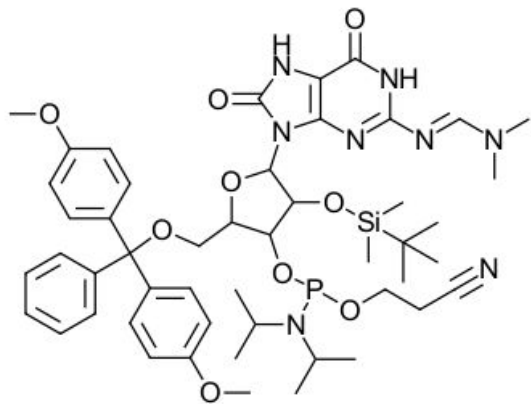
Department of Chemistry



Safety in perspective: Routine Activities in the Resendiz's Lab at CU Denver

Organic Synthesis

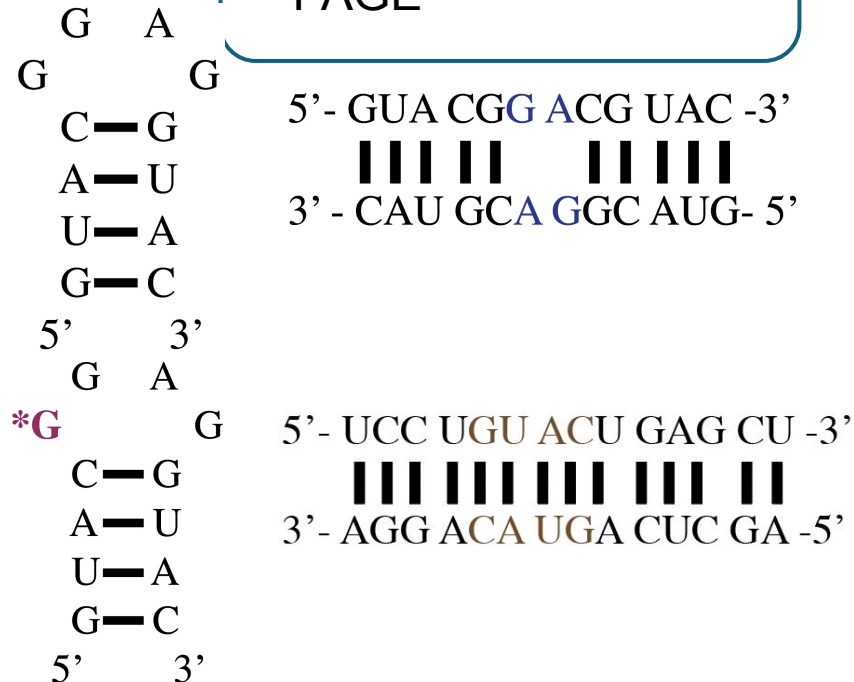
- Solvents, Reagents, Physical Hazards
- Flash column chromatography



(Protected phosphoramidite of 8-oxoG = *G)

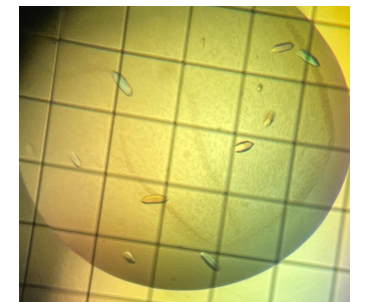
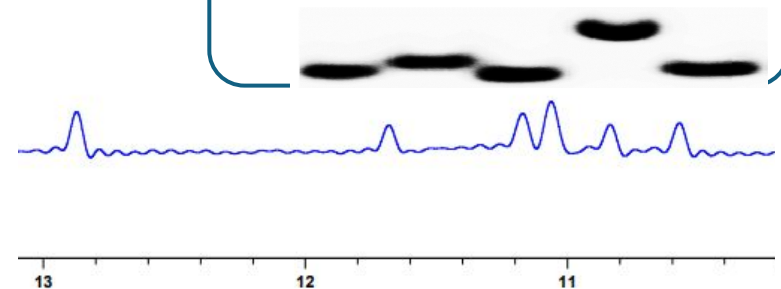
Solid Phase Synthesis

- Closed system
- Under argon atmosphere pressure
- Purification with PAGE



Biochemical/ Biophysical/ Structural Biology Studies

- Radiolabeling
- NMR
- X-ray Crystallography



Translation from Degree Coursework to a Research Laboratory

Coursework

Labs are run by teacher assistants (TAs) who most likely are ...

- Undergraduate students
- Different field of interest
 - Computational vs benchwork
 - Dry vs Wet
- No research experience
- Insufficient technique exposure

Research

Labs are run by a Principal Investigator (PI)

- Close 1 on 1 training
- Similar field of interest
- Trained students assisting one another
- More technique exposure
- Time management and seriousness play big roles in safety/success

Student Engagement: Safety in Synthesis Beyond Initial Training

Handling Unsafe Chemicals

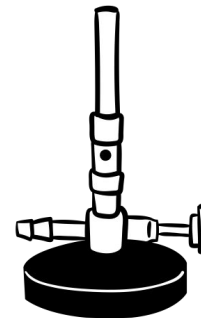
- Silica dust only handled inside the hood
 - If impossible, always wear an appropriate face mask

Physical Hazard: Heat

- Handling flame-dried glassware
- Bunsen burner placement

Physical Hazard: Pressure

- Hydrogenolysis: use shield
- Flash column explosion
 - Lack of pressure relief/air backflow
- Heated ammonia/volatile compounds
 - Case study: Stir rod hitting pressurized RBF overnight led to explosion

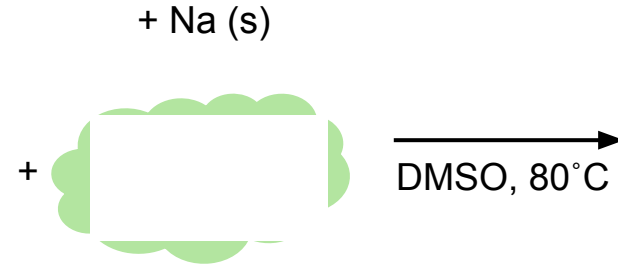


Gloves, lab coat and **safety goggles ALWAYS.**

Student Engagement Continued...

- Case Study: Benzyl Mercaptan Stinkup

- Technique + Care = Mitigation
- Mitigation \neq Elimination
- Communicate, raise awareness



- Solid Phase Synthesis + Purification of RNA/DNA:

- Future procedural changes may be required
 - Substitute **dichloromethane** as solvent
- Polyacrylamide is needed for purification
- Deprotecting agents include HF

Unexpected Risks:

- During glass cleanup
- Prioritize safety over glassware



The Process of Radiation Training at CU Denver

General Radiation
Safety Training
with EH&S

Located at Anschutz
Medical Campus (30
minutes drive)

Laboratory
Personnel
Radiation Training
(with PI)

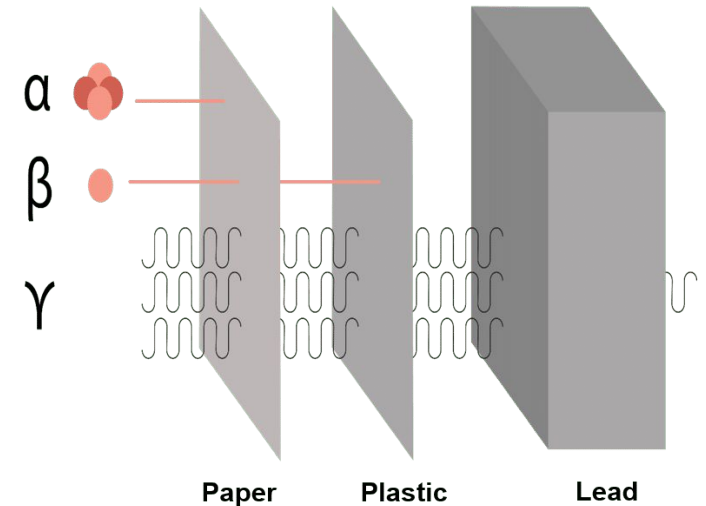
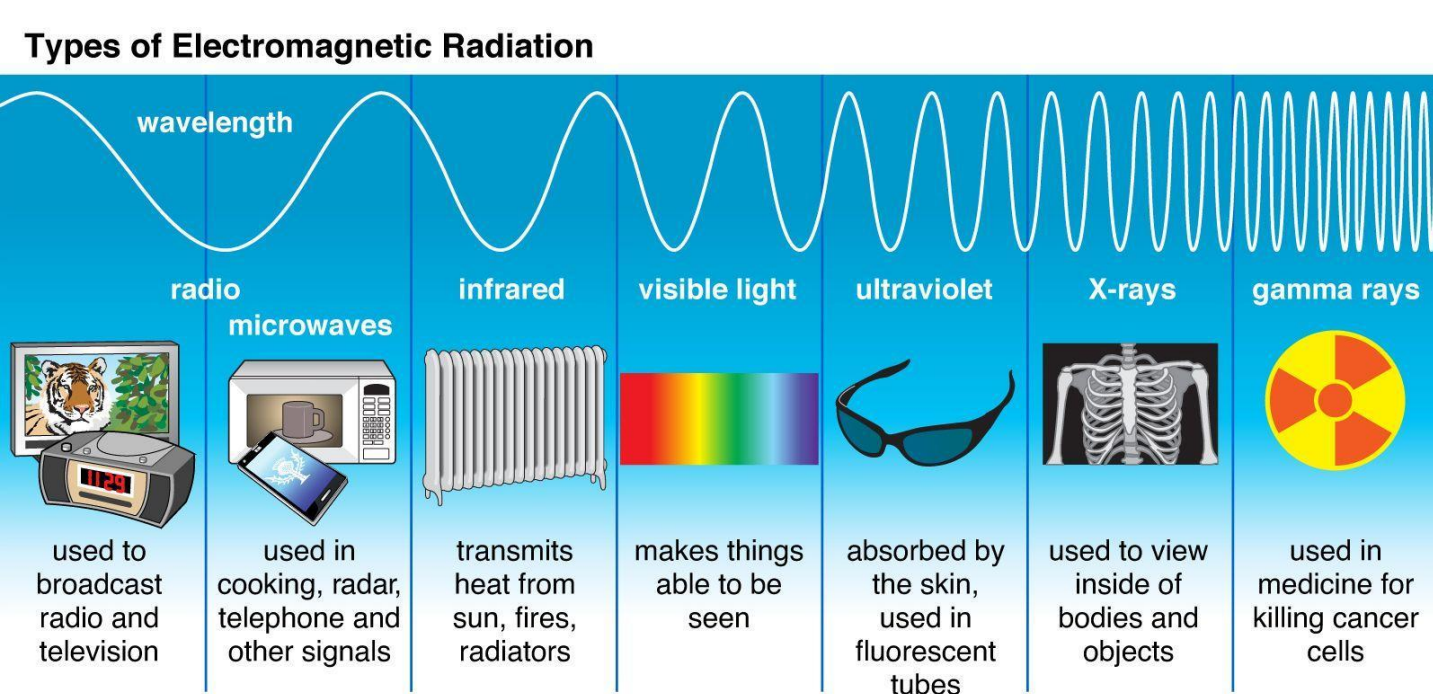
Everyone who handles
radiation requires training
Adhere to the protocol

Technique
Improvements
(Individually)

Radiation Safety Training

Ionizing Radiation: Combination of elemental particles or photons that has sufficient kinetic energy to cause ionization in the medium through which it passes.

Use ALARA (As Low As Reasonably Achievable)



Houri, J. *What stops gamma radiation - gamma radiation shielding.* StemRad.

<https://stemrad.com/protection-from-radiation/> (accessed 2024-09-24)

Working with Radiation

Resendiz's Lab is the only lab in the Chemistry Department at CU Denver get certified/trained in radiation.

EH&S is required to be contacted to stop by the Denver campus (spillage, radiation waste clearance, check-up)

1-2 times training with PI is necessary before leaving students to perform the task alone.

- Students must take great notes during the process to improve their techniques.

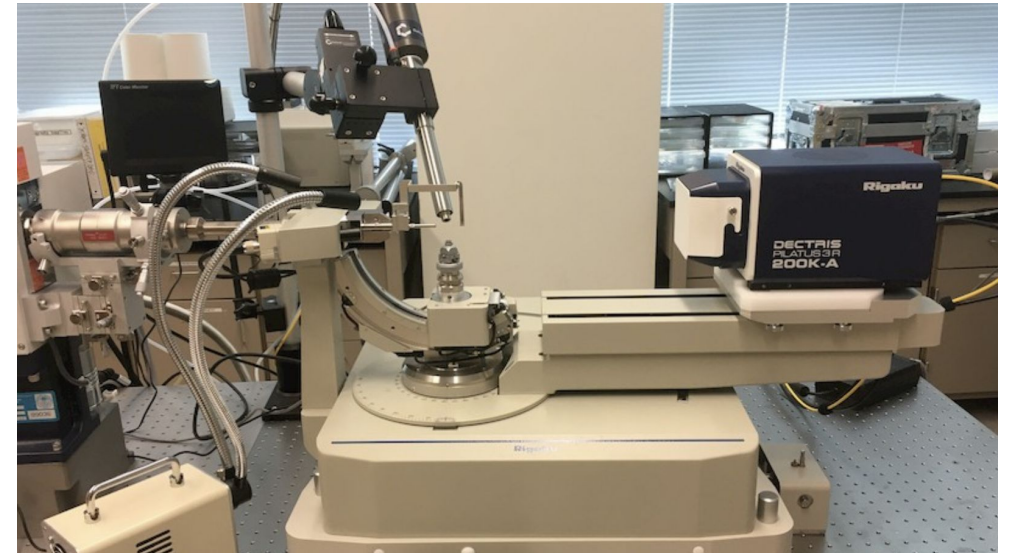
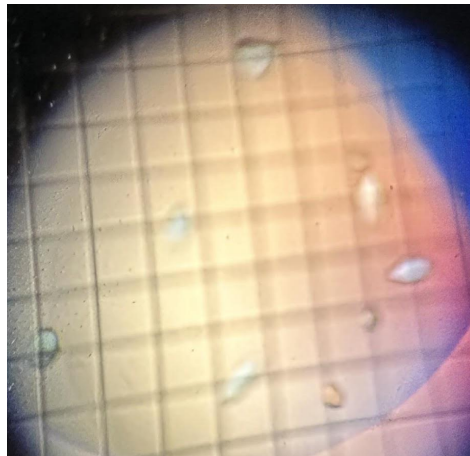
Ask trained/authorized personnel for help when necessary to prevent mishaps

- Be mindful of surrounding areas
- Pipetting techniques
- Be meticulous and precise



X-Ray Crystallography: 1 on 1 Personnel Training at Anschutz Medical Campus

- Follow the protocol and only allow trained personnel into the room.
- Lock the room while an experiment is running.
- Always wear the dosimeter while using the X-ray crystallography generator
- Beware of the surrounding area and evacuate the area when the low-oxygen alarm goes off.



Anschutz Medical Campus- Structural Biology & Biophysics Core Facilities- X-Ray Crystallography Dr. John Hardin

Dosimeter



Radiation monitoring badges. Office of Environmental Health and Safety.
<https://ehs.princeton.edu/laboratory-research/radiation-safety/radiation-monitoring-badges> (accessed 2024-08-21).

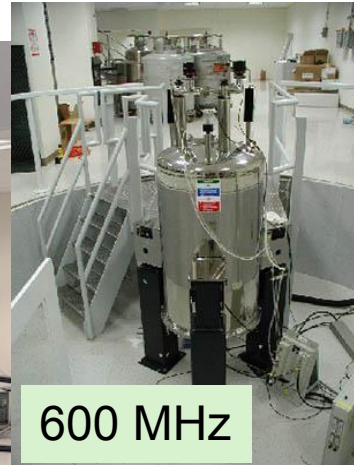
Using NMR at CU Denver & Anschutz Medical Campus

Nuclear Magnetic Resonance Spectroscopy: a powerful method that is commonly used to study chemical, physical, biological properties.

900 MHz



600 MHz



Warn Pacemaker Wearer

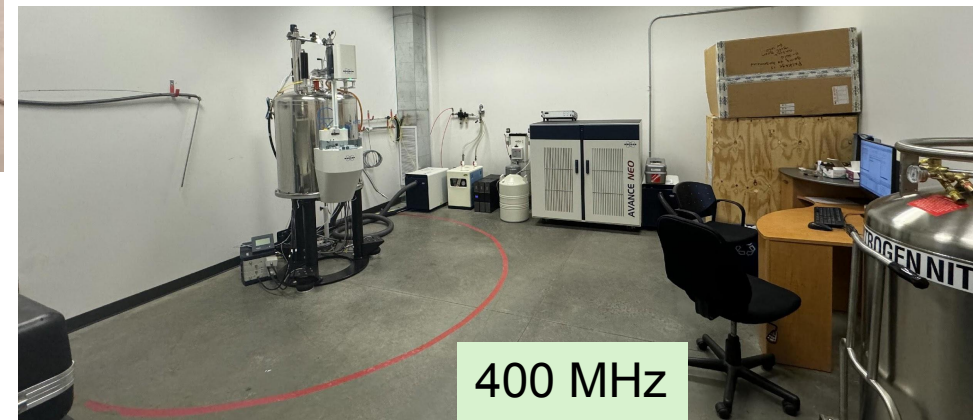
800 MHz



Anschutz Medical Campus- Structural Biology & Biophysics Core Facilities- NMR- Dr. David Jones

CU Denver- Department of Chemistry

400 MHz



DE&I in a Research Laboratory Setting



Keep in mind, individual safety is as important as lab safety

- Pacemaker users
- Pregnancy
- Mental Health
- Physical Disability/Handicaps

Different specialties in a lab

- Biology
- Biochemistry
- Biophysics
- Chemistry
- Engineering
- Pre-Med

Language barrier

- manual/procedure in different languages

Colorblind

Different pH measure tools

Education status

- **High school**
- Undergraduate
- Graduate

**Culture + Perspective =
Enhance Communication =
Positive Safe
Environment**

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Co-Sponsors:

- Nominal COMSCI: Committee on Science
- Cooperative MPPG: Multidisciplinary Program Planning Group
- Nominal CCS: Committee on Chemical Safety
- Division of Chemical Health and Safety

