I. Introduction

Welcome to the Joy Lab!

The purpose of this manual is to give new lab members a resource for information about standard group policies and procedures, as well as instructional information on operation of the most critical lab instrumentation. This document will both answer questions and provide an understanding for expectation for all lab members in a way that I hope is clear, reasonable and avoids ambiguity. This is also a work in progress; additional information will be added as the group develops. If you think that information needs to be added, please let me know.

It is expected that all persons joining the group will CAREFULLY read this document before they begin work in the lab and refer back to it over the course of their time in the lab, as necessary.

No document is perfect, or all-inclusive. If there are mistakes or omissions, please let me know. Moreover, if policies become outdated due to changes in the lab setting or equipment, they should be updated. However, changes to policies outlined in this manual need to be approved by Dr. Joy prior to their implementation.

Finally, if there are questions that are left unanswered (as there will be) or disagreements over the contents of this manual, please, by all means, talk to me about it. Nothing can waste more time or lead to more resentment that assuming you know someone's opinion or thoughts. If you want to talk about something, let's talk. That is one of the things I am here for.

A. Scientific Integrity and Ethics

Our laboratory has a zero tolerance policy for plagiarism, falsified data, or cheating. (A commonly overlooked example of unethical behavior in science is not attributing an idea to its rightful source. Use "we" as often as possible when speaking about work. Avoid minimizing other's contributions.)

B. Expectations

Scientific research and study require a strong work ethic, which means spending much time and effort reading and working in the lab or at the computer. As you proceed through your career you will find that most good scientists are diligent workers with tenacity, fortitude, curiosity, and common sense. Some people have a bit of luck thrown to them, but they have prepared themselves for luck by becoming knowledgeable and observant. It is called "serendipity."

Set work hours are not enforced for Graduate Students. Part of the maturation process is learning how much time you need to spend on a project to get it accomplished. All lab members will be evaluated based on research productivity. If the quantity and quality of research you are producing is sufficient, no one will question the hours you are working. It has been my experience that counting hours leads to poor performance. Obviously, more time spent in lab will lead to a greater likelihood of success. The average week for a graduate student involves 6 days of work, but the beauty of our work is that it can be performed at any time of day and there are many opportunities for increasing productivity and getting the most out of your time.

Remember, you are learning. Only time, dedication, and motivation will get you to the point of being productive in an 8-10 hour day.

C. Project Management

A successful research experience (Ph.D., or other) is measured by your progress toward becoming an independent scientist. To do this, one must practice more than just proper laboratory techniques. After discussing your work with me, you should be taking the following steps to practice management of your project.

Every Month:

- Set/evaluate goals for the next **one**, **three,** and **six** months.
- Plan and prioritize experiments necessary for the paper(s) you are working towards. What control reactions will you run? What is the best method of analysis? What characterization will be required for publication?
- Sketch-out/Update a table of desired data needed to complete your proposed work.

Every week:

- Spend a few hours planning your goals/experiments for the week.
- Force yourself to learn something new (a mechanism, background, a reaction).

Each day:

- Read the literature related to your project/experiments.
- Read a paper **not** related to your project.
- If you have some time at the end of the day, but not enough to set up a crucial experiment, set the experiment up in your notebook and find all of the reagents.
- Evaluate needed characterization and control experiments. Check to be sure you have the equipment/chemicals needed for upcoming steps. End your day by compiling a "to do" list for the following day.

D. Safety

Safety is the utmost importance in the Joy group. Every precaution needs to be taken to ensure that you and your co-workers are safe at all times in the lab. This means that if an experiment cannot be performed in a way that is safe, it should not be done. No exceptions. Specific safety rules for the lab follow, but please be aware that safety will be taken very seriously. Gross lapses in safety protocol, even after a single instance, will constitute grounds for immediate dismissal from the laboratory. Repeat minor violation may also result in a researcher being asked to leave the group. This is not an option that will be exercised lightly, but is necessary for the protection of all persons working in the lab.

You are required to complete Environmental and Occupational Health and Safety (EOHS) safety training prior to working in the lab.

Use common sense. Not all situations can be spelled out in detail. Use sense when setting up experiments. If you are unsure about how to do something safely, seek help from Dr. Joy or an experienced group member, or someone in the department with expertise in an area (as needed).

Safety glasses are required for all persons in the lab. This includes visitors, salespeople, workmen or service contractors, as well as all lab personnel. No exceptions. Even things that seem pretty common and safe (e.g., using the rotovap) involve placing glassware under reduced pressure, which can lead to implosions.

The use of gloves is required when handling chemicals. Throw away (in chemical waste) dirty, contaminated or used gloves. Do not handle door knobs leading out the lab with gloves. Do not wear gloves or your lab coat at your desk or in the group room. This is not tolerated in industrial settings and is not safe for your colleagues.

No food or drink is allowed inside the lab.

Labcoats are required for anyone conducting experiments, working at a fume hood, or in contact with chemicals. Labcoats will be provided for lab personnel.

Wear appropriate clothing. Closed toe, close top shoes are required in the lab. Sandals, flip-flops and other like-footwear are not allowed, as they do not protect your feet against spilled chemicals and dropped glassware. Long pants are required for those conducting experiments; shorts, skirts, etc do not provide protection for your legs. Clothing made exclusively of polyester, rayon, or other highly flammable materials is strictly forbidden – recently a student died at UCLA after spilling a small amount of a pyrophoric material on her polyester sweater. Cotton, denim and other natural fiber materials provide better fire resistance. These rules may seem stringent, but they are for your own protection.

Do not work when highly fatigued or exhausted. The chances for mistakes increase greatly when you are sleep deprived; the risks to you and others are too great.

If the ventilation system shuts down, or there is a power failure, DO NOT WORK IN LAB.

Nitric acid needs to be used with extreme care. Nitric acid is a strong oxidizer, when mixed with organics it can (will) explode. DO NOT PUT NITRIC ACID WASTE IN ORGANIC WASTE CONTAINERS. NITRIC ACID NEEDS ITS OWN WASTE CONTAINER.

Read all containers as you handle them – become familiar with common statements about chemicals and the correct procedure for handling classes of chemicals. A quick glance at any chemical container will help you prepare for what may happen. MSDS sheets are available through our inventory and at http://hazard.com/msds/

Rehearse the actual experiment in your head. Train yourself to ask questions about when things may go wrong for the reaction. Developing an intuitive sense for foreseeing events during the experiment creates a safe environment and leads to more successful reaction outcomes.

Clean up your glassware and hood at the end of each day. Clean workstations improve safety and the quality of science.

Know where the fire extinguishers and lab showers are! Do not risk yourself attempting to put out a fire that you are not sure that you can extinguish. Know what kind of fire extinguishers can be used for various fires.

Extinguisher Type	*Weight/Size*	*Classification*
ABC Dry Chemical	2-1/2, 5 or 10 lb	(A) Ordinary combustibles (Paper products); (B) flammable liquids (gasoline); (C) electrical equipment/appliances
C02 Carbon Dioxide	5, 10, 15 or 30 lb	(B) Flammable liquids (Gasoline); (C) electrical equipment (appliances, computers)
Metal-X Dry Powder	30 lb	(D) flammable metals (lithium, magnesium)
Water H_20	10 lb	(A) Ordinary combustibles (paper products, discarded smoking materials), wood products (mulch)

Do NOT use Water extinguishers on energized electrical equipment!

Know where the chemical spill kits are, but only use them if it is appropriate and safe to do so. For large or highly toxic spills, call EOHS at (330) 972-6866 for non-emergencies or 330-972-7123 for emergencies, or 2911 (UA Police).

Know where the eyewash and lab showers are, know how to use them! Secondary containers are required for all chemicals and chemical waste.

Use proper care when dealing with sharps. Do not leave exposed sharps out in the lab. They should be disposed off immediately in the sharps container. Do not put them into the regular trash bin or leave them in your work area.

Run experiments on the smallest scale possible to obtain needed data. Required scale will depend on the nature of the reaction and how much material, if any, is needed. In general, running reaction on the smallest possible scale is safest. If something goes wrong, a smaller scale means less chance for injury. If it the first time you are doing this reaction, do not run it on a large scale. You may not foresee all the problems that you may encounter during the reaction and purification steps.

Only order the smallest amount of chemical needed. Large bottles may seem cheaper, but only if the whole volume will be used. Buying in bulk and then using only a small amount creates storage, safety and disposal hazards.

All reagents must be dated when opened. Some reagents decomposed over time, for example ethers can form explosive peroxides over time. Date all chemicals when they are opened, and do not store ethers for more than 6 months after opening.

Solvents must be stored in flammable cabinets. Never place solvent bottles on the floor. Do not leave solvent bottles on the bench. Keep the floors free of anything other than lab stools, vacuum pumps, and the LN_2 dewar.

Liquid nitrogen needs to be used with great care. Liquid nitrogen is very effective for cooling vacuum traps, but if not used properly can condense liquid oxygen. Liquid oxygen (which is blue in color) can flash boil, leading to explosions.

Heatguns cause fires if misused. Many serious lab fires have been started by solvent vapors from recrystallizations getting pulled into heatguns. DO NOT USE HEATGUNS TO RECRYSTALLIZE WITHOUT THE USE OF A REFLUX CONDENSER IN PLACE.

All chemical containers must be labeled at ALL times and must be closed when not in use. Commercial reagents should have a label when shipped, please make sure that this remains legible. If not, please remark bottle before it can no longer be identified. Chemical waste must be stored in proper bottles, MUST be labeled at all times, and KEPT CLOSED when not in use. This is a safety issue and a regulatory issue (EPA and OSHA fines are >>$1000/PER BOTTLE for open and unlabelled waste!!!)

Chemical Waste bottles and containers must be closed at all times. See above. No exceptions.

If you are the last person out of the lab at night, before leaving lab make sure to sign the "End of Day Checklist" posted on the lab doors ensuring that:

- √ All N_2 Bubblers have a flow rate of 1 bubble per second or less
- √ All of the labs hood sashes are totally closed
- √ All rotovaps are turned off
- √ All water lines are secured with wires
- √ All faucets are turned off (except for reaction in progress)
- √ All lights are turned off

√ All doors are locked (including instrument and computer rooms)