General Laboratory Safety at Liu Lab at UW (must read and follow)

Version 1.0 (Juewen Liu, October 5, 2013)

You are required to read and follow this document before you can work in the Liu Lab. This document is designed to outline laboratory safety in general and specific to the Liu Lab, and to make you aware of hazards and hazardous materials you may encounter during your time in the lab.

1. Before working in the lab you must:

A. Complete online safety trainings following the instructions and links in the following page

https://uwaterloo.ca/chemistry/meeting-minutes-and-important-information/safety-information

B. Meet with the lab coordinator to review the safety concerns in this lab.

C. Finish reading this document and sign on the New member check-in form.

2. Location of safety items.

a). First aid kits are located in QNC 5508 by the door.

b). A fire extinguisher is nearby the sink in each lab.

c). An emergency shower/eyewash station is located in the hallway between the labs.

3. Things you need to know

a). Safety is the number one priority of the Liu lab. Try to protect yourself from exposure to harmful chemicals and radiation using gloves, lab coats, goggles, and performing harmful reactions in the fume hoods. Plan your experiments well and get organized. This is important not only for safety but also for increasing your productivity.

b). Label all the tubes and bottles that you use for contain solutions or buffers. You need to write the chemical composition, concentration and date for the labels.

c). The laboratory has a **zero tolerance** policy on cheating, plagiarism, and falsification or fabrication of data. Individuals found to be in violation of this policy will forfeit their position in the lab and subject to disciplinary actions according to the University of Waterloo's guidelines.

d). Safety glasses are worn in the Laboratories.

e). Gloves must be worn when performing experiments, but must be taken off if you are outside of the labs (i.e. hallways, offices).

f). Drinks and food are not permitted in any of the labs, this includes water bottles. All food and drink must be left outside the lab.

g). A strict closed-toed shoe policy is in effect in the Liu lab. You cannot be in the lab if you are wearing open-toed shoes.

h). You need to be trained by an experienced user prior to using any of the instruments. If you encounter a problem while working with a piece of equipment, find a lab member who knows how to use that instrument.

i). Please clean up the lab bench and make sure all the un-used instruments are turned off at the end of each day. In case there is chemical spill, clean up right away (If you are not sure how to handle the spill, ask others for help or refer to http://web.princeton.edu/sites/ehs/emergency/spills.htm - kit).

j). If you are the last one of the day in the lab, make sure that the UV-vis lamp and fluorometer lamps are turned off and all the hotplates are turned off (unless the reaction is intended to leave on overnight with a note).

k). Whenever no one is in the lab and you are leaving (even for only a very short time), make sure that the door is locked.

4. Possible safety concerns from chemicals.

a). Aqua regia. We use strong acids for a few applications. The 3:1 mixture of concentrated HCl:HNO_3 (called aqua regia) is used for cleaning glass container and quartz cuvettes. The freshly prepared aqua regia has a beautiful orange color but is extremely dangerous. It can quickly dissolve gold and oxide many materials. It also generates a lot of HCl and nitric acid vapors. Overtime, the color is faded away to become light yellow, but still very dangerous.

- Always work in a fume hood; ware gloves; ware goggles; put on your lab coat.
- Make sure that the lab is not crowded that the time of working and no one can accidently hit you.
- Do not dump any acids to the sink; re-use the acids and when it cannot be re-used any more, dump into the chemical waste jar for acids.
- Do not use a micro-pipettor to take the acids; use glass pipettor for this purpose.
- Aqua regia is used daily by some lab members and they are stored in the fume hood.

b). Piranha solution. This is also a mixture, containing 5:1 H_2SO_4:H_2O_2. So, it is strongly acidic and oxidizing. The use of piranha solution is restricted to the cleaning of gold electrode and is only used occasionally by a few lab members. Similar precautions and attentions to the aqua regia solutions are required.

c). NaOH solution. A bottle of 12 M NaOH solution is maintained in a fume hood to clean glass vials. This solution is very viscous and corrosive. Do not mix it with strong acid and re-use the solution by dumping it back to the original bottle. The same safety procedures are needed.

d). Acrylamide. Acrylamide is a neurotoxin and our lab uses acrylamide on a daily basis to prepare polyacrylamide gels. The toxicity is significantly reduced when it is polymerized. Always ware gloves and lab coat when preparing for gels.

e) Ethidium bromide. Ethidium bromide is a well-known carcinogen and is highly toxic. We use ethidium bromide in staining DNA. Note that in general molecules binding to DNA are carcinogens.

- Always use a fume hood when working with ethidium bromide.
- Do not directly discard ethidium bromide containing waste in the sink or in the trash. There are designated solid and liquid waste contains for ethidium bromide.
- If you suspect that your glove is contaminated by ethidium bromide, change to another pair.

f) Heavy metals. The Liu lab uses many different types of heavy metal salts and a few common ones include lead, mercury, arsenic, cadmium and cobalt. These metals are known to be highly toxic. Therefore, care needs to be taken when dealing with them.

- Try not to make the solution from the metal powders by yourself. Always check with Dr. Liu or other lab members to see if stock solutions are already prepared.
- For some metal salts, they need to be dissolved in nitric acids instead of directly into water (e.g. lead acetate, mercury perchlorate).
- Do not dump the heavy metal waste into the sink and there is a designated heavy metal waste container.
- Always ware gloves, goggles and lab coat when dealing with concentrated heavy metal salts.

g) Agarose gel. Although agarose gel itself does not bare the same level of toxicity as the previously mentioned chemicals, it might cause burning of your skin. Since we heat up the agarose solution using a microwave, it is possible that the solution is over heated and might spill upon taking out. Be extremely careful in heating agarose and do not heat for too long. Check the standard protocols when carrying out this operation.

h) Organic solvents. There are a few organic solvents in the lab for various applications. One example is to dissolve phospholipids using chloroform. In general, organic solvent exposure is a safety concern, especially for long-term exposure. All the solvents are in the solvent cabinets. Always use a fume hood when handling the solvents and ware gloves, lab coat and goggles.

g) Other chemicals and MSDS. In general, all the chemicals are toxic to some extent. So the Liu lab requires its members to be very careful and professional in the lab. Always ware protection equipment. Since even when you are not doing experiments, accidents from others might still affect you when you are around. The material safety data sheet (MSDS) for each chemical can be found on-line at https://www.sigmaaldrich.com/canada-english.html. Hardcopies of commonly used ones are also available in the lab. Consult with these materials for new and existing chemicals.

5. Possible safety concerns from equipments.

a). Centrifuges. We have many centrifuges in the lab, from ultracentrifuge running at 120,000 rpm to mini-centrifuge running at 6,000 rpm. The most commonly used one runs at 15,000 rpm. The most important rule is to make sure that your samples are balanced, regardless of the speed of the centrifugation. Especially for the ultracentrifuge, it is important to use the analytical balance to confirm the mass of each centrifugation tube.

Use only the designated tubes for each centrifuge. For the ultracentrifuge, push down the bottom on the rotor cap to lock the rotor. Do not operate the ultracentrifuge if you have not been trained on the equipment by a senior member of the lab.

The Eppendorf centrifuges can take a few different types of tubes. If spinning at greater than 6,000 rpm, only use the 1.5 mL tubes. The 0.6 mL tube can only be used at below 6,000 rpm.

b). Raman spectrometer. There is a near IR laser in our Raman spectrometer. Since it is invisible to the human eye, we need to be very careful about it. Always ware the IR laser protecting goggle. There are two other lasers in the lab (472 nm and 808 nm). Ware appropriate eye protection goggle when using each one of them.

c). UV lamps. There are a few UV lamps in the lab to excite various fluorophores. These are typically used in a dark room. Ware the UV protection goggle when using these lamps and avoid direct eye or skin contact with the UV light. Do not forget to turn off the lamps when you finish your experiment.

d). Hot plates. There are a few hot plates in the lab. Pay close attention to the hot plates when using them and make sure you turn them off immediate after you finish your experiment. Also be careful not to be burned by it. Do not walk away when heating your sample (you might forget and melt your plastic tubes and cause fire hazards).

e). Glassware. Glassware are a potential source of hazard when it is broken. Always ware goggles to protect your eyes and lab coat and gloves when handling glassware.

f). Gel electrophoresis. There is a high voltage power supply for gel electrophoresis. Do not touch the related parts during the run in case of electric shock.

g). Milli-Q water station. Do not walk away when filling Milli-Q water tanks in case of flooding.

Overall, please use common sense in the lab. Please ask other students or Dr. Liu if you are not sure about how to handle a chemical or equipment.

6. Summary. Use common sense and be considerate of not only yourself but also your co-workers. Enjoy a safe lab environment.