LABORATORY RISK ASSESSMENT TOOL (Lab R.A.T.)

The Laboratory Risk Assessment Tool (Lab RAT) provides a framework for risk assessment complimenting the process researchers already use to answer scientific questions.

This tool provides a format for researchers to systematically identify and control hazards to reduce risk of injuries and incidents. Conduct a risk assessment prior to conducting an experiment for the first time and review the **Lab R.A.T. Guidelines** document for further details.

The risk assessment process involves rating the risk of the experiment from "low" to "unacceptable" risk. Consult with your PI/supervisor and EH&S if your risk rating is "high" or "unacceptable" to redesign the experiment and/or implement additional controls to reduce risk.

Procedure: Butterfly and Grasshopper Lab research		
PI / Lab Group: Buckley		
Department: Biology	**Building / Location: LSB4**	
Form Completed By: Buckley		**Start Date: 11/20/2024**

PHASE 1: EXPLORE

Identify your research question and approach. What question are you trying to answer? What are you trying to measure or learn? What is your hypothesis? What approach or method will you use to answer your question? Are there alternative approaches?

Research Question(s)
• How does local adaptation across a species' range influence responses to climate change? • How does thermoregulatory behavior alter the evolution of thermal tolerances and climate change impacts over the short and long term? • How does thermal exposure and sensitivity vary across the life cycle and what are the implications for demography and distributions? • What are the implications of developmental plasticity for phenology and demography in changing environments? • What are the relative impacts of acute (extremes) and chronic (means) climate conditions on demography and distributions? • How does climate variability influence plastic and evolutionary responses to climate change?
Approach(s) or Method
We integrate a diversity of field, laboratory, and quantitative approaches to investigate how organisms experience their environment. We develop mechanistic models linking phenotype to fitness as a function of environmental conditions. We look to natural history collections and field and lab resurveys to test our models. We turn to biologically-informed data science approaches to test generality. We seek a middle ground whereby models capture enough of the biology for accurate prediction but remain tractable.

Identify the general hazards (check all that apply). Perform background research to identify known risks of the reagents, reactions, or processes. Review protocols, Safety Data Sheets (SDSs), and safety information for hazardous chemicals, agents, or processes. Review accident histories within your laboratory/department.

Hazardous Agents

Physical Hazards of Chemicals

☐ Compressed gases
☐ Cryogens
☐ Explosives
x Flammables
☐ Organic peroxides
☐ Oxidizers
☐ Peroxide formers
☐ Pyrophorics
☐ Self-heating substances
☐ Self-reactive substances
☐ Substances which, in contact with water, emit flammable or toxic gases

Health Hazards of Chemicals

☐ Acute toxicity
☐ Carcinogens
x Eye damage/ irritation
☐ Germ cell mutagens
☐ Nanomaterials
☐ Reproductive toxins
☐ Respiratory or skin sensitization
☐ Simple asphyxiant
☐ Skin corrosion/ irritation
☐ Specific target organ toxicity
☐ Hazards not otherwise classified

Ionizing Radiation

☐ Irradiator
☐ Radionuclide
☐ Radionuclide sealed source
☐ X-ray machine

Non-Ionizing Radiation

☐ Lasers, Class 3 or 4
☐ Lasers, Class 2
☐ Magnetic fields (e.g., NMR, MRI)
☐ RF/microwaves
☐ UV lamps

Biohazards

☐ BSL-2 Biological agents
☐ BSL-3 Biological agents
☐ Human cells/blood/ BBP
☐ NHPs/cells/blood
☐ Non-exempt rDNA
☐ Animal work
☐ High risk animals (RC1)
☐ Other (list):

Hazardous Conditions or Processes

Reaction Hazards

☐ Explosive
☐ Exothermic, with potential for fire, excessive heat, or runaway reaction
☐ Endothermic, with potential for freezing solvents decreased solubility or heterogeneous mixtures
☐ Gases produced
☐ Hazardous reaction intermediates/products
☐ Hazardous side reactions

Hazardous Processes

☐ Generation of air contaminants (gases, aerosols, or particulates)
☐ Heating chemicals
☐ Large mass or volume
☐ Pressure > atmospheric
☐ Pressure < atmospheric
☐ Scale-up of reaction

Other Hazards

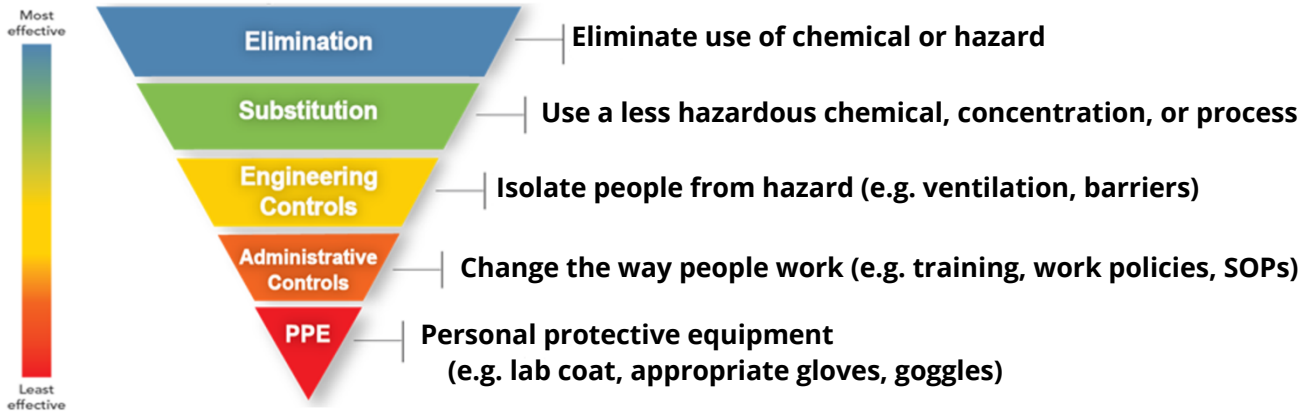
☐ Hand/power tools
☐ Moving equipment/parts
☐ Electrical
☐ Noise > 80 dBA
☐ Heat/hot surfaces
☐ Ergonomic hazards
☐ Needles/sharps
☐ Other (list):

PHASE 2: PLAN

Outline the Procedure. List the steps or tasks for your procedure and the hazard/potential consequences of each. Include set-up and clean-up steps or tasks. Define the hazard controls to minimize the risk of each step using the hierarchy of controls starting with the most effective (i.e., elimination, substitution, engineering controls, administrative controls, and personal protective equipment). List the hazard control measure you would use for each step or task (e.g., run at a micro scale, work in a fume hood, wear face shield and goggles).

Steps or Tasks	Hazard	Hazard Control Measure(s)
See standard operating procedures	Hazards are minimal	See standard operating procedures

HIERARCHY OF CONTROLS



1 For guidance on selection of Personal Protective Equipment (PPE), use EH&S PPE Hazard Assessment Tool.
2 For guidance on selection of chemical-resistant gloves, see EH&S Website.

A hierarchy of controls should be applied starting with the most effective controls (i.e., elimination and substitution) at the top of the graphic and moving down. While personal protective equipment (PPE) should always be used, it should be considered the last line of defense from potential hazards.

Select the appropriate PPE and safety supplies for the procedure (check all that apply).

Laboratory PPE/Safety Supplies

☒ Appropriate street clothing (long pants, closed shoes)
☐ Gloves; indicate type: _____
☐ Safety glasses
☐ Safety goggles
☐ Face shield and googles
☐ Lab coat
☐ Flame-resistant lab coat
☐ Fire extinguisher
☐ Eyewash/safety shower
☐ First aid kit
☐ Spill kit
☐ Specialized medical supplies (e.g. calcium gluconate for hydrofluoric acid and amyl nitrite for cyanides
☐ Other (list):

Identify the appropriate training (check all that apply). Identify the general safety and procedure based/specific training appropriate for your procedure.

General Safety Training

General/Chemical Safety
☐ Lab Safety Compliance & Practices
☒ Managing Lab Chemicals
☐ Compressed Gas Safety
☐ Fume Hood Training
☐ Hydrofluoric Acid Safety
☐ Formaldehyde Safety

Biosafety
☐ Biosafety Training
☐ Bloodborne Pathogens

Radiation Safety
☐ Radiation Safety
☐ Laser Safety

Field Safety
☐ First Aid & CPR
☐ SCUBA certification/diving safety
☐ Driving safety
☐ Other (list):

Job Specific Training

☒ Lab/job-specific training
x Lab SOP(s) to review (list):
Caterpillar Diet
Insect preservation
Insect rearing
Respirometry
Water bath
☐ Emergency plans or field evacuation plans
☐ Equipment SOP(s) to review (list):
☐ Other (list):

PHASE 3: CHALLENGE

Question your methods. What have you missed and who can advise you? Challenge your hazard control measures by asking "What if…?" questions. "What if" questions should challenge you to find the gaps in your knowledge or logic. Include possible accident scenarios. Factors to consider are human error, equipment failures, and deviations from the planned/expected parameters (e.g., temperature, pressure, time, flow rate, and scale/concentration). Update your plan to include any new controls required to address these possibilities.

What If Analysis
What if…? Challenging weather conditions are experienced in the field
Then… Leave fieldsite and seek shelter. See field safety plan.
What if…?
Then…
What if…?
Then…
What if…?
Then…
What if…?
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What if…?
Then…
What if…?
Then…

Assign a risk rating to the experiment. Based on your procedure outline and the what if analysis, determine the risk rating for the experiment or procedure.

Risk Rating: ___Low___

1The Risk Rating is subjective. The primary goal is for researchers to think about risk, and differentiate unacceptable and high-level risk steps from those with a lower level risk. This will help drive additional consultation and control measures where needed.

Likelihood of Incident Occurrence	Severity of Consequences – Personnel Safety			
	No injuries	Minor Injury	Significant Injury	Life threatening
Very Likely	Low	High *	Unacceptable **	Unacceptable **
Likely	Low	Medium	High *	Unacceptable **
Possible	Low	Medium	High *	High *
Rare	Low	Low	Medium	High *

Revise plan if the risk rating is too high. Are these risks acceptable? Use this table to determine the action to take based on the risk rating. What are the highest risk steps? What more can you do to control the risks? Return to planning and use the hierarchy of controls to design a safer experiment.

Hazard Risk Level	Action
Unacceptable **	**STOP!** Additional controls needed to reduce risk. **Consult with PI.**
High *	Additional controls recommended to reduce risk. **Consult with PI.**
Medium	Ensure you are following best practices. Consult with peers, PI, and EH&S as needed.
Low	Perform work within controls

PI/Supervisor Approval:

___Lauren Buckley_____

*****Signature for **High** risk ratings. If needed, contact EH&S (206.221.2339) for recommendations.

NOTE: **Unacceptable risk-rated experiments **should not proceed**. Introduce further controls to reduce risk. Contact EH&S (206.221.2339) for recommendations and best practices.

PHASE 4: ASSESS

Perform a trial run. How you can test your experimental design? Can you do a dry run of the procedure without hazardous chemicals/reagents/gases to familiarize yourself with equipment and demonstrate your ability to manipulate the experimental apparatus? Can you run the procedure with a less hazardous material? Can you test your experimental design at a smaller scale? If your procedure requires multiple people, would a table top exercise be useful?

Trial Run
Trial Run Procedure / Date: Summer 2024
Did the trial go as expected? Yes x No ☐
Experimental design changes needed (if any): None

Perform and evaluate. Run your procedure using the appropriate controls you've identified. Evaluate controls and hazards as you work. Critique the controls and process you used by answering the following questions. If changes to controls are needed, update your risk assessment tool and re-evaluate any time you revise your process (e.g. changes in scale, reagent, equipment, or conditions that might increase the hazard/risk). Share your assessment with your PI/colleagues for the next iteration of the experiment.

Evaluate Your Procedure
What went well? All
Did the controls perform as expected? Yes
Did anything unexpected occur? No
Did a hazard manifest itself that was not previously identified? No
Were there any close-calls or near misses that indicate areas of needed improvement? No
Did something go exceptionally well that others could learn from? NA
I plan to evolve my procedure by… NA

Procedure Risk Assessment is Complete	
Form Completed By: Lauren Buckley	
Signature: 	**Date: 11/21/24**
PI / Supervisor Signature: