Biosafety Training

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Introduction

• RGN 2021: emergency exits, washroom…

• Attendance sheet:
  ➢ Confirm your name, email address
  ➢ Student? Technician? Professor?
  ➢ Department/Faculty, your supervisor
  ➢ Are you a user? (intend to use bio agents in the lab?)
Introduction

• Attend the Biosafety Training class
  ➢ Happens at the beginning of each school session (Jan, May, & Sept.)

• Submit a Biohazardous Material Users Registration (BMUR) form
  ➢ Mandatory if you are a RG2 or RG3 users
  ➢ Includes practical training

• Take the Biosafety Training quiz
  ➢ Available for 2 weeks after the class (Jan 23rd to Feb. 6th)
  ➢ Can be retaken once if failed

Take the class (pass the quiz) + BMUR form = You are Authorized!
Purpose of the Biosafety Training

• Prevent contamination
  - You
  - Your research
  - Our environment

• Establish good laboratory practices

• Ensure research funding continues $$$

Because research is now interdisciplinary, it is now necessary to retool yourself with new skills and new understanding.
To Ensure Good Science

• Good Science depends on:
  - good literature review
  - good conceptual design
  - experimental execution
  - aseptic technique
  - skill and practice

• To work safely and successfully:
  - Good organisational skills
  - A disciplined approach

“I WAS DRIVEN COMPLETELY BY A DESIRE TO UNDERSTAND HOW CELLS WORK.”

Randy Scheckman
Course Overview

• Regulatory Oversight
• Principles of Biosafety
• Biosafety Practices
  ➢ Risk Assessment
  ➢ Risk Mitigation
  ➢ Good Microbiological Practices
• Decontamination & Waste
• Incident/Accident
• uOttawa Requirements
Objectives

✓ Develop an understanding of biosafety and learn to comply with regulations from PHAC, CFIA and rules from uOttawa.

✓ Understand how to assess the risks involved and how to mitigate them.

✓ Help you develop Good Microbiological Practices (GMP)
The NEW Reality
Regulatory Oversight

- PHAC/CFIA/TC/ECCC
Public Health Agency of Canada (PHAC)

- Human pathogens and toxins
- Canadian Biosafety Standard (CBS)
- Canadian Biosafety Handbook (CBH)
- HPTA Licence
- Pathogen Safety Data Sheets (PSDS)
- Importation and transfers
- Reporting of incidents
- Biosecurity
Canadian Food Inspection Agency (CFIA)

- Animal pathogens
- Health of Animal Act (HAA) and Health of Animal Regulation (HAR)
- Zoonotic diseases
- Plant pest and injurious organisms
- Aquatic species
- Animal/plant product & food
- Import permit
Transport Canada (TC)  
Transportation of Dangerous Goods (TDG)

- Class 6.2 - Infectious Substances
  - Blood, tissue, organs, body fluids, vaccines, cultures etc.
  - Training
  - Packaging/labelling
  - Document
  - Shipping
Environment and Climate Change Canada (ECCC)

- Recombinant organisms
- Potential synthetic biology
- Releases to the environment
License / Permit

- **PHAC – HPTA License**
  (Human Pathogen and Toxin Act)
  - University-wide license
  - Risk Group 2 human and terrestrial animal pathogens (some RG3)

- **CFIA – Import Permit**
  - Required when import animal/plant pathogens, etc.

- **Other implications:**
  - PHAC’s security clearance (for SSBA), CFIA’s compliance letter
  - Facility certificate (BMUC), laboratory design, transfer, etc.
Biosafety and Biosecurity Governance Framework

a.k.a. Plan of Administrative Oversight

- Legal Requirements
- Underpins the Biosafety Program
- Engages Institutional Approval (authorization of use)
- Failure to comply to any of the 3 elements – jeopardizes your continued use, lab research and the UNIVERSITY’S LICENCES.

Oversight and Accountability

Biosafety Policy and Directives

Biosafety Program
Principles of Biosafety

• Terminology/Risk Groups/Containment Levels
Terminology: the source of confusion

- **BIOHAZARD**
  
  Risk associated with the material

- **BIOSAFETY**
  
  Focus on protecting you, us, environment

- **BIOSECURITY**
  
  Securing the material from others

- **BIOSURETY**
  
  All of the above + accountability
What is a BIOHAZARD?

• A potentially infectious agent or hazardous biological material that presents a risk or potential risk to the health of humans, animals, plants, and the environment.

CFIA, PHAC, EC, DFAIT, TC, TRICOUNCIL & OTHER FUNDING SOURCES, NIH....
Biohazard

- Viruses
- Bacteria
- Fungi
- Parasites
- Biological toxins
- Prions
- Other micro-organisms or genetic systems

By virtue of their replicative properties, they are potentially harmful to humans, animals, plants and/or the environment.
Biohazard

- Recombinant DNA
- Cultured cell lines
- Tissues
- Anatomical specimens
- Blood and other bodily fluids

These can be from human or animal subjects, and are also potentially infectious.
Naturally Occurring Organism

• What are its characteristics?
  ➢ Name it (the organism)
  ➢ What are the risks?
Synthetic Biology

- Have the risks really changed?
**E. coli (bacteria)**

Extensively used for recombinant DNA application.

- Found in your intestines
- Aid in food digestion
- *E. coli* synthesize vitamins B1, B2 & K
- Do not cause any harm if in limited number
- Deficiencies of these vitamins cause many diseases
- Beware of your antibiotics which can destroy your *E. coli*

But there are 4 pathogenic strains of *E. coli* in the PHAC’s PSDS!
Pathogenic *E. coli* strains

- **Mutation of the *E. coli* (O - 104:H4) bacteria in Europe**
  - 1,500 sick, 18 dead
  - 470 have developed a rare kidney failure complication

- **E - 0157:H7 (enterohemorrhagic strain)**
  - Caused 2006 North American *E. coli* outbreak
  - Causes an estimated 2,100 hospitalizations/yr. in the US

- **Vero/Shiga-toxin producing *E. coli***
  - Causes approximately 100,000+ illnesses/yr. in the US

**Risk may be strain-dependent!**

References: WHO/sfdcdp.org
**Pseudomonas spp. (bacteria)**

- **Species regulated**
  - *P. aeruginosa*
  - *P. stutzeri*
  - *P. fluorescens*

- **Characteristics**
  - Ubiquitous in the environment
  - Opportunistic
  - Affects humans, animals and plants
  - Survival out of host (months on dry surfaces)
Blood Borne Pathogens (BBP)

- Blood borne pathogens are microorganisms such as viruses or bacteria that are carried in blood and can cause disease in people.

- BBP can be found in:
  - Human blood products
  - Human bodily fluids
  - Human tissue/organs
  - Primary cell cultures
Blood Borne Pathogens (BBP)

- Transmitted through contact with infected human blood and other body fluids
- Most well-known infections:
  - Hepatitis viruses (HAV, HBV, HCV)
  - HIV
- Don’t assume that because you know the source there is no risk
- You may not know you are a carrier
What is BIOSAFETY?

• The combination of principles, technologies, practices and measures implemented when handling biohazardous materials to:
  ➢ Protect personnel from exposure to infectious agents, and
  ➢ Prevent environmental release and contamination

It’s good for you,
it’s good for the science and
it’s the law!
How is biosafety achieved?

1. Administrative Controls
   - Training, authorizations, certificates, compliance monitoring and verification, inventory, waste management.

2. Engineering Controls
   - Lab design, commissioning and decommissioning of the lab, equipment maintenance and verification.

3. Practices and Procedures
   - Risk assessment, good laboratory practices, experimental protocols.

4. Use of Personal Protective Equipment
   - Lab coat, gloves, safety glasses.
Biosafety Responsibilities

• **YOU**
  - You are ultimately responsible for all your actions and your own safety in the lab
  - Compliance to safety policies and program requirements

• **LAB/PI**
  - Informs you of specific hazards, ensures lab is compliant to the Biosafety Program and ensures the safety of your research

• **FACULTY**
  - Resources, services, guidance and support

• **ORM**
  - Provides training, develop & manage Biosafety Program and monitor & verify compliance
What is BIOSECURITY?

Biosecurity: refers to the security measures designed to prevent the loss, theft, misuse, diversion, or intentional release of infectious material or toxins

(CBH, 2nd Edition)
How is biosecurity achieved?

- **Physical Barriers**: buildings, doors, locks, key card access.
- **Psychological Barriers**: security personnel, cameras.
- **Monitoring Activities**: patrols, monitoring by support staff.
- **Personnel Clearance**: access to authorized personnel only.
What is BIOSURETY?

- Biosurety is the integrated management of biohazardous materials, biosafety, biosecurity, agent accountability and personnel reliability to prevent unauthorized access and misuse.
To be diligent

To be safe and compliant, it is really quite easy, it’s all about:

- Knowing your responsibilities
- Knowing the risks
- Knowing how to mitigate risks
- Good lab practices – complying to the required procedures
Risks (biorisk)

Pathogenic ........................................ Non-pathogenic
Naturally occurring .............................. Manipulated
Ubiquitous ........................................ Evolving/Rare
Live .................................................. Attenuated

So let’s get a hand on risk!
How exposure can occur

- Ingestion
- Inhalation
- Skin Contact & Absorption

Boston University School of Public Health (2016)
How infection can occur

• **Source of Infection**
  - Microorganisms
  - Cells and tissues
  - Blood and body fluids
  - Any items contaminated with the above

• **Route of Transmission**
  - Percutaneous inoculations
  - Inhalation of aerosols
  - Contact of mucous membranes
  - Ingestion

• **Susceptible Host**
  - Immune system
  - Vaccination status
  - Age
Risk Classification of Biological Agents

Risk Classification is based upon:

- Pathogenicity
- Route of infection
- Infectious dose
- Mode of transmission
- Host range
- Availability of effective preventive measures
- Availability of effective treatment
Risk Classification Criteria

- Canada,
- World Health Organization,
- Australia,
- European Union (EU),
- USA CDC/NIH.
## Risk Groups

As easy as: 1-2-3-4!

<table>
<thead>
<tr>
<th>Risk Group</th>
<th>Individual</th>
<th>Community</th>
<th>Implications</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>RG1</td>
<td>Low</td>
<td>Low</td>
<td>Unlikely to cause disease in healthy workers or animals</td>
<td>Non-pathogenic strains of E. coli, Non-infectious blood &amp; primary tissue samples</td>
</tr>
<tr>
<td>RG2</td>
<td>Moderate</td>
<td>Low</td>
<td>Rarely cause serious human or animal disease</td>
<td>Pathogenic strains of E. coli, HBV/HCV, Hela cell line</td>
</tr>
<tr>
<td>RG3</td>
<td>High</td>
<td>Low</td>
<td>May cause serious disease</td>
<td>HIV, Rabies virus, Prions</td>
</tr>
<tr>
<td>RG4</td>
<td>High</td>
<td>High</td>
<td>Likely to cause very serious disease</td>
<td>Ebola virus</td>
</tr>
</tbody>
</table>
Mammalian Cell Lines

- Untransformed mammalian cell lines – Risk Group 1
  - MCF-7 (Human breast carcinoma cell line)
  - NIH 3T3 (Mouse fibroblast cell line)

- Transformed mammalian cell lines – Risk Group 2
  - HeLa (Human immortalized cell line)

Recombinant DNA

- Novel DNA that constructed by combining genetic material from more than one source

- Level of risk depends on:
  - the source of DNA being transferred
  - the vector
  - the host
  - gene product
### Prions
- Prions are misfolded proteins which can cause progressive neurological diseases, e.g., CJD, BSE, Scrapie
- Resistant to destruction
- Precautions:
  - Handle tissues as Risk Group 2 or higher
  - Handle formalin-fixed tissues and paraffin-embedded blocks as if still infectious
  - Follow up-to-date disinfection protocols

### Toxins
- Biological toxins are naturally produced poisonous substances by the metabolic activities of microorganisms, plants and animals
- Can also be artificially produced
- Tetrodotoxin (TTX) is a potent neurotoxin with no known antidote.
CONTAINMENT (Biocontainment)

- Refers to the combination of physical design parameters and operational practices that protects personnel and the environment from exposure to potentially hazardous biological material.

- **Containment level**: minimum physical containment and operational practice requirements.

- There are four containment levels:

  - CBS specifies the minimum requirements for CL2, CL3 and CL4.
  - Specific to the risk group level and amounts being used.
Containment Level 1 (CL1)

- Basic laboratory – basic physical containment design elements
- To achieve biosafety: Good Microbiological Lab Practices
- Biological safety cabinets are not required and work may be performed on the open bench
Containment Level 2 (CL2)

- Clinical, diagnostic, research and teaching facilities with RG2 agents
- Physical containment requirements must be met
- May require a class I or class II biological safety cabinet
- Emergency response plan in place
- Access-controlled
Containment Level 3 (CL3)

- Specialized design and construction including commissioning and annual certification
- Research projects reviewed by a specific panel
- Standard operating procedures are strictly enforced for the safety of the individual and proper operation of the lab
- Personnel – additional training and supervision.
- Very specific PPE
- A medical surveillance program must be in effect
Containment Level 4 (CL4)

- All manipulations pose a high risk of exposure and infection
- Design specifications are extremely stringent
- The worker is completely isolated from infectious material
- Personnel security clearance and qualifications scrutinized
- Entry & exits are through airlocks

Canadian Centre for Human and Animal Health in Winnipeg, Man.
Biohazard Warning Signage

For CL2 and CL2+ facilities, a \textit{biohazard warning signage} must be posted at the containment zone entry.

- International biohazard warning symbol
- Containment level
- Contact person /phone #
- Entry requirement
Biosafety Practices

- Risk Assessment/Risk Mitigation/GMP
Biosafety Practices

1. Wait !!!

2. How?

3. Good to go!

- Risk Assessment
- Risk Mitigation
- Good Practices
RISK ASSESSMENT

- Risk assessment is the basis of all components of a biosafety program. *(PHAC, CBH 2nd ed)*
- Risk group & containment level
- Help avoid lab associated/acquired infections (LAI)
Laboratory Associated Infections (LAI)

- Laboratory Associated Infections (LAIs) are any infections, whether symptomatic or asymptomatic, acquired through laboratory or laboratory-related activities.

- Majority of LAI are caused by human errors.

- Some are caused by equipment failure.
Laboratory Associated Infections (LAI)

• **20%** are the result of:
  - Punctures with syringe, needles or other contaminated sharps;
  - Spills and splashes onto skin and mucous membranes;
  - Ingestion or exposure through mouth pipetting touching mouth or eyes with fingers or contaminated objects.
  - Animal bites and scratches.

• **80%** are the result of:
  - Inhalation of infectious aerosols (and droplets).

*MMWR Supplements 2012 / 61(01):1-101*
Aerosols

- Airborne biological materials can be generated through many laboratory practices.

- Potential exposure to aerosols can occur in three ways:
  - Breathable infectious airborne particles
  - Aerosols can settle on surfaces and become an ingestion hazard through contamination of the hands
  - Spills or splashes can infect mucous membranes

- Precautions should be taken to minimize the production of aerosols.
  - All manipulations involving biohazards should be performed in a biological safety cabinet (BSC)
  - Decontaminate surfaces and equipment after use
What need to be assessed?

- Biological Material & Agent Characteristic
- Personal Supervision & Personnel Using the Material
- Environment: Laboratory, Facility, Community
- Experimental Protocols
- Lab Practices & Equipment
Biological Material & Agent Characteristics

- Is this a material you have used before?
- What are the characteristics of the material?
- What are the implications of the manipulations you are planning?
- Is this a material of concern for which LAI have been reported (gov’t, society, etc.)?
- Do you know the source and whether it has been tested for which agents and to prove it is non-replicating?
Pathogen Safety Data Sheets (PSDS)

- Risk assessment documents for well-characterized human pathogens and toxins
- Internationally recognized resource
- Designed, researched and maintained by the PHAC and CFIA
- PSDS App is available


ONLY IN CANADA
PSDS – how to use it?

• Infectious Agent – Characteristics
  ➢ What are they?
  ➢ Infectious dose
  ➢ Stability and viability
  ➢ First aid/medical information

• Laboratory Risk
  ➢ Risk Group/Containment Level
  ➢ Spill/disposal/storage
4 pathogenic strains of E.coli!

- *Escherichia coli, enterohemorrhagic*
- *Escherichia coli, enteroinvasive*
- *Escherichia coli, enteropathogenic*
- *Escherichia coli, enterotoxigenic*

**SECTION I - INFECTIOUS AGENT**

**NAME:** *Escherichia coli, enteroinvasive*

**SYNONYM OR CROSS REFERENCE:** EIEC, intestinal pathogenic *E. coli*, bacillary dysentery.

**CHARACTERISTICS:** Enteroinvasive *Escherichia coli* (EIEC) are in the family Enterobacteriaceae. They are Gram negative, rod shaped, non-spore forming, motile with peritrichous flagella or nonmotile, grow on MacConkey agar (colonies are 2 to 3 mm in diameter and red or colorless), and are capable of aerobic or anaerobic growth. Strains belonging to EIEC are biochemically, genetically, and pathogenically closely related to *Shigella* spp.

**SECTION II - HAZARD IDENTIFICATION**

**PATHOGENICITY/TOXICITY:** EIEC causes bacillary dysentery, an acute ulcerative infection of the large intestine. EIEC invade cells of the colon and causes watery diarrhea (might be bloody), fever, and abdominal cramps. In severe cases, the bacteria may attack the colonic mucosa, invading epithelial cells, multiplying, and causing ulceration of the bowel.

**EPIDEMIOLOGY:** EIEC is endemic in most developing countries and may cause occasional outbreaks in industrialized countries. Species of *Shigella* are the major cause of bacillary dysentery, although up to 10% of cases are caused by enteroinvasive *E. coli*. EIEC are rare in the United States and Canada, and are less common than ETEC and EPEC strains in the developing world. Three large outbreaks in the United States have been reported. EIEC infections primarily affect children under 5 years living in developing countries.

**HOST RANGE:** Humans.

**INFECTION DOSE:** $10^6$-$10^{10}$ organisms.

**MODE OF TRANSMISSION:** EIEC are spread by the fecal/oral route. Contaminated food and water are the usual vehicles for the spread. Food-borne outbreaks have occurred. Person-to-person transmission can also occur.
SECTION VI - LABORATORY HAZARDS

LABORATORY ACQUIRED INFECTIONS: Twelve cases of laboratory acquired infections with *E. coli* have been reported, the majority of which have been caused by *E. coli* enterohemorrhagic (EHEC) 17.

SOURCES / SPECIMENS: Stool 5, food, and water 18.

PRIMARY HAZARD: Ingestion 17.

SPECIAL HAZARD: None.

SECTION VII – EXPOSURE CONTROLS / PERSONAL PROTECTION

RISK GROUP CLASSIFICATION: Risk Group 2 19.

CONTAINMENT REQUIREMENTS: Containment Level 2 facilities, equipment, and operational practices for work involving infectious or potentially infectious materials, animals, or cultures 20.

PROTECTIVE CLOTHING: Lab coat. Gloves when direct skin contact with infected materials or animals is unavoidable. Eye protection must be used where there is a known or potential risk of exposure to splashes 20.

OTHER PRECAUTIONS: All procedures that may produce aerosols, or involve high concentrations or large volumes should be conducted in a biological safety cabinet (BSC) 20. The use of needles, syringes, and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large scale activities.
Adenovirus types 1, 2, 3, 4, 5 and 7 - Pathogen Safety Data Sheet

SECTION I - INFECTIOUS AGENT

NAME: Adenovirus (excluding serotypes 40 and 41)

SYNONYM OR CROSS REFERENCE: Acute respiratory disease (ARD), childhood febrile illness, adenovirus species A, B, C, D, E, F, G, pharyngoconjunctival fever.

CHARACTERISTICS: Human adenoviruses are members of the family Adenoviridae and genus *Mastadenovirus*. Within the almost 100 different serotypes of human adenovirus, 51 are known to be pathogenic in humans \(^1\)\(^2\). The virus is nonenveloped with an icosahedral capsid at 70-90 nm in diameter and each contains a single linear, double-stranded DNA genome of approximately 36 kb \(^2\).

HOST RANGE: Humans.

INFECTION DOSE: Inhalation of as few as 5 adenovirus particles can cause disease in susceptible individuals \(^3\). The National Institutes of Health lists the infectious dose for adenovirus serotype 7 as >150 viral units, administered as nasal drops \(^9\).

MODE OF TRANSMISSION: Respiratory and fecal-oral routes. Infection can also spread through contaminated fomites, fingers, ophthalmic solutions, and airborne particulates \(^2\)\(^5\)\(^1\).

INCUBATION PERIOD: Approximately 2 to 14 days \(^2\).
When you can’t find it in the PSDS

293 [HEK-293] (ATCC® CRL-1573™)

Organism: *Homo sapiens, human* / Tissue: *embryonic kidney*

<table>
<thead>
<tr>
<th>GENERAL INFORMATION</th>
<th>CHARACTERISTICS</th>
<th>CULTURE METHOD</th>
<th>SPECIFICATIONS</th>
<th>HISTORY</th>
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<td>Biosafety Level</td>
<td>2. [Cells contain adenovirus]</td>
<td>2. [Cells contain adenovirus]</td>
<td>2. [Cells contain adenovirus]</td>
<td>2. [Cells contain adenovirus]</td>
</tr>
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Biosafety classification is based on U.S. Public Health Service Guidelines. It is the responsibility of the customer to ensure that their facilities comply with biosafety regulations for their own country.

Check the supplier’s Production Information Sheet

Risk Group 2
Human blood and tissue samples

• What type of samples? blood, brain, organ ....
• Is there a risk of infection known or probable to the samples? (BBP)
• Did the sample come from a high risk population for the agent? (e.g., PSDS)
• What was the criteria for pre-screening of the donor of the sample?
• Were the samples analysed for any infective agents, if yes which ones, and are positive samples excluded from the transfer?
• To manipulate this sample, do you need an ethics approval?
• To obtain this sample, is the transfer of the sample to third parties specifically to the consignee (receiver) authorized?
Potential presence of BBP

• Occupational exposure to BBP:
  ➢ Infection of mucous membranes (e.g. splash to eye, nose, mouth)
  ➢ Directly into the bloodstream through skin that is damaged (scraped, cut, abraded)
  ➢ Puncture wound (through needle-stick injury)

• Unless otherwise stated, human blood and tissue samples should be considered as infectious due to the potential presence of BBP.
Personal Supervision & Personnel Using the Material

You must remain aware of:

• Your knowledge and experience
• Level of mentorship available
• Your and other people’s health status
• Due diligence: PPE, reporting infractions, near misses, proper inventory maintenance
Personal Health Assessment

• Your personal health status and history.
  ➢ Are you a risk?
  ➢ Are you immune compromised?
  ➢ Vaccination status?
• Agent’s exposure/release.
• Post-exposure prophylaxis.
• Agent’s infective dose.
• Medical response and timeline.
• Member of the vulnerable community? Is there an increased risk?
  E.g., an immunocompromised individual working with an opportunistic RG1 pathogen? (CL2/BSC)

Safety first, for me, you and us.
Environment: laboratory, facility, community

Regulatory Requirements
(PhAC, CFIA, EC, Fed/Prov./Municipal)

Lab Design
(Conception, construction, renovations, maintenance)

Contain the Biohazard
(Primary and secondary containment)

Control Access
(Physical controls: lab and inventory)
Laboratory Design

- Lockable door
- Paper/computer work stations are segregated from laboratory work station
- Sealed & non-absorbent surfaces
- Sink at the exit
- Emergency eyewash and shower
- Primary & secondary containment
- Air ventilation
- Equipment location
Primary Containment

• First line of defence (physical barrier).
• Ensures protection of personnel and immediate environment from exposure to the infectious agent.
• ‘Protective envelope’ that encapsulates the infectious agent or animal.
  - Petri dishes, vials, flasks
  - Biological safety cabinets
  - Animal caging equipment
Secondary Containment

• Protects the environment external to the laboratory from exposure
• Includes facility design and operational practices
• Implications:
  ➢ Directional airflow
  ➢ Air and drain filtration
  ➢ HEPA filtration of lab air
  ➢ Pressure differentials
  ➢ Laboratory design
  ➢ Operational practices
Experimental Protocols

• have to be researched thoroughly
• designed with safety in mind as well as research
• engage the supervisor
• consider use of alternative biological agents (if applicable)
• protocols on-line: http://www.protocol-online.org

Remember once you start the protocol, you are in research mode, so you better have thought of safety first!
Lab Practices & Equipment

Work practices that may present a risk.
Failure to use and maintain equipment

• Use & maintain properly!
Centrifuges

• Before use
  ➢ Check centrifuge rotors & tubes for cracks
  ➢ Avoid Overfilling
  ➢ Place caps or stoppers properly
  ➢ Balance loads
  ➢ Use sealed buckets (safety cups) or sealed rotors

• Before leaving
  ➢ Ensure centrifuge achieves run conditions

• After run
  ➢ Centrifuge has to be completely stopped before opening the lid
  ➢ Check for spills or leaks before removing samples
  ➢ Clean spills
  ➢ Allow aerosols to settle or open in a BSC
Blenders, Grinders, Sonicators, & Lyophilizers

• Blender
  ➢ Do not use glass blender jars
  ➢ Use safety blenders which can be autoclaved

• Sonicator
  ➢ Operate in a BSC whenever possible
  ➢ Allow aerosols to settle for 5 minutes before opening
  ➢ Decontaminate after use

• Lyophilizer (used for dehydration process)
  ➢ Use glassware designed for vacuum work, ensure there is no
damage before using
  ➢ Use vapour traps whenever possible
Cryostats, Nitrogen Storage Vessels, -80 °C Freezers

• Wear gloves during preparation of frozen sections and heavy gloves when accessing the cryostat.
• Decontaminate frequently.
Let’s take a break 😊
### RISK MITIGATION

<table>
<thead>
<tr>
<th>Level</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most</td>
<td>• Elimination</td>
</tr>
<tr>
<td>Effective</td>
<td>• Substitution</td>
</tr>
<tr>
<td></td>
<td>• Engineering Controls</td>
</tr>
<tr>
<td>Least</td>
<td>• Administrative Controls</td>
</tr>
<tr>
<td>Effective</td>
<td>• Personal Protective Equipment</td>
</tr>
</tbody>
</table>
Elimination

- Do you have to use a pathogenic strain?
- Can you remove one of the transmission requirements?
  
  E.g., mosquito vector – winter work schedule
- Avoid use of sharps whenever possible
Substitution

• Material substitution:
  - Live vs. attenuated virus
  - Un-characterized vs. characterized
  - Blood – human vs. mammal vs. sterile
  - First generation vs. established cell lines
  - Modified to reduce infectivity
  - Non-indigenous vs. indigenous (double edge knife, what are you protecting)

• Equipment substitution:
  - Metal inoculating loops vs. disposable sterile loops
Blood substitution
Engineering Controls

• Lab Design (containment zones)
  – Surfaces
  – HVAC
  – Facility services
  – Effluent treatment

• Equipment Use
  – Biological safety cabinets
  – Centrifuges
  – Autoclaves
HEPA Filtration Systems

- HEPA: High efficiency particulate air.
- HEPA filters: remove particles (min 0.3 microns) from supply and exhaust air with 99.97% efficiency.
Laminar Flow Hood (LFH)

- Vertical or horizontal laminar flow
- HEPA filtered supply air only
- Provide product protection only
Biological Safety Cabinet (BSC)

- HEPA filtrate supply and exhaust air
- Operator, product and environment protection
Biological Safety Cabinet (BSC)

• Principles:
  - HEPA filter: contaminated air is filtered
  - Laminar flow: no turbulence, contaminants are taken away
  - Air curtain: prevents aerosols from escaping through the opening

• BSC does NOT protect the operator from chemical fumes or vapours
  - Use chemical fume hood for working with chemicals

• Proper use of a BSC: https://vimeo.com/7642083
Working in a BSC

Start-up:

- Ensure BSC is certified
- Decontaminate work surfaces with appropriate disinfectant
- Turn off UV lamp, turn on fluorescent lamp
- Place essential items inside cabinet from “clean” to “dirty”
- Allow the blower to run for 5-10 min before work

*uOttawa Biosafety SOP and Guidelines:*
- Working with BSC SOP
- Guideline: Use of UV Lamps in BSC
Working in a BSC

While working in a BSC:

• Wear the right PPE
• Adjust your chair to the proper height
• Avoid excessive movement of hands and arms to maintain the air curtain
• Work flows from “clean” to “dirty” areas to avoid the spread of contamination
• Material and equipment is placed near the back of the hood
• Air intake and exhaust grilles are free from any obstructions
• Small waste containers are kept in the BSC while working in the cabinet
• Your outermost layer of gloves should be removed before exiting the BSC
• Sustained open flame is NOT allowed to be used in the BSC
Working in a BSC

Completing BSC work:

- Leave blower on at least 5 minutes to purge cabinet

- Place all contaminated waste into waste containers inside the cabinet, including your outermost gloves

- Put on new gloves

- Decontaminate surface of all objects in the cabinet

- Remove and decontaminate equipment and materials

- Disinfect cabinet surfaces. Including the area beneath the front grille

- Remove your gloves and wash your hands

- Turn off blower and fluorescent lamp, turn on UV lamp
What is wrong in these pictures?

- Crowded surface: rear grill is blocked.
- Bunsen burner: open flame in BSC.
- Crowded surface: rear grill is blocked.
- Overflowing waste: risk of spill.
Open flame in a BSC

• Why not?
  - Conflicts air flow patterns result in vortexing and turbulence.
  - Destroys HEPA filter and seals, leading to loss of containment.
  - Poses a serious fire risk to the entire lab.

• Alternatives:
  - Use of disposable sterile loops, needles and pipettes
  - Autoclave the instruments before use.
  - Replace open flame with a micro-incinerator or glass bead sterilizer.
  - If open flame is absolutely necessary, use on-demand flame. (e.g., touch-plate burner)

*uOttawa Biosafety Cheat Sheets:
✓ Use of Open Flame in BSC
Administrative Controls

- Course Review
- Protocol Review
- Scientific Justification
- Standard Procedures
- Training
- Supervision
- Health Assessment
Personal Protective Equipment (PPE)

- Criteria for consideration:
  - Routes of exposure that need to be blocked
  - Degree of protection offered
  - Ease of use

- Only effective if correctly selected, fitted, used and cared for. (Refer to PSDS)

- PPE is your last defence against exposure

- Ensure PPE is removed before leaving the lab
Lab coats, protect your research from you! & you from your research!

Lab coats protect you:
- Protect street clothing from spills.
- Offer additional body protection.
  - Must be worn closed.
  - Tuck sleeves in your gloves.
- Regular cleaning is required.
- Never wash with regular clothing.

NOT All lab coats are equal....
Pick the best one, it has to be appropriate and comfortable.

*uOttawa Biosafety Cheat Sheet: ✓ Lab Coat Selection
Lab coats protect your research:

- 30,000 – 40,000 cells are shed every hour
  ➢ 1 million in 24 hrs. *(Boston Globe, 2008)*
- Street cloths are porous and easily shed those cells to your research
- Disposable sleeves can be worn over your lab coat sleeves

*Human skin cell under 400x*

Regular T-shirt under 200x

Lab coat under 200x
Gloves, yes they are mandatory!

- Double gloving a good practice
- Gloves should not be reused
- Gloves should be changed frequently
- Glove selection: latex, nitrile, rubber & vinyl
- Use the correct donning and doffing technique
- Dispose of gloves into the proper container

Herpes simplex virus (HSV) infection
Eyewear, Face Protection & Footwear

Eyewear
- NO CONTACTS!
- Eye glasses, goggles, face shield etc.

Face protection
- Agents that have flu-like symptoms.
- Exposure to splashes/flying objects.

Footwear
- Closed toe and heel shoes only.
- No sandals!

Epstein-Barr Virus
Influenza Virus
Streptococci Bacteria
GOOD MICROBIOLOGICAL PRACTICES

• **GMP** is *basic code of practice and techniques* that provide *a basic level of protection* to the individual laboratory worker and the environment from the microorganisms being manipulated.

  (PHAC, Canadian Biosafety Handbook, 2nd ed., 21.2.2)

• GMP mitigates the risk of:
  - Personnel exposure
  - Contamination of samples & environment

*uOttawa Biosafety Cheat Sheets:*
✓ Good Microbiological Practices
GMP includes, but is not limited to:

- Access
- Use of PPE
- Uncluttered work surface
- Experimental set up
- Proper use of BSC
- Aseptic technique
- Decontamination
- Waste management
- Handwashing
- Spill response
- Leaving the lab

*It’s you or them, make your decision!*
GMP – Workspace/Work Surface

• Workspace/work surface have to be kept organized and clean and uncluttered.
• Over crowding your workspace can increase the risk of spill.
GMP – Personal Behavior

- No food/drink in the lab
- Do not apply cosmetics in the lab
- Never wear contact in the lab
- Long hair tied back
- No hand to mouth contact
- Handwashing often even when outside of the lab
- Gloves & lab coats & closed shoes
GMP – Handwashing

- Before starting any manipulations
- Before leaving the lab
- Whenever the integrity of your gloves is questioned or your hands are obviously soiled
- Before and after completing any task in a BSC
- Every time gloves are removed
- Before contact with one’s face or mouth
- At the end of the day

FREQUENTLY – ABC
Handwashing

1. Wet hands.
2. Apply soap.
3. Lather for 15 seconds. Rub between fingers, back of hands, fingertips, under nails.
4. Rinse well under running water.
5. Dry hands well with paper towel or hot air blower.
6. Turn taps off with paper towel, if available.
GMP – Needles and Syringes

- Avoid use whenever possible
- Use a BSC for all operations with infectious material
- Fill syringes carefully
- Shield needles when withdrawing from stoppers
- Do not bend, shear or recap needles
- Dispose of all used needles/syringes in yellow SHARPS container
GMP – Pipettes

• Mouth pipetting is prohibited
• Never force fluids out
• To avoid splashes, discharge the liquid down the receiving container wall
• Never mix material by suction and expulsion
• Reusable pipettes should be placed horizontally in a disinfectant-filled pan
GMP – Inoculation Loops

- Allow the loop to cool before any procedures
- Use shorter loops to minimize excessive vibrations
- Culture the bacteria/cell line on smooth surface to avoid aerosols
- Use a sterile disposable loop instead of open flame in a BSC
  - Eliminate aerosols generated from flame
  - Avoid open flame in BSC

Risk mitigation strategy: substitution!
GMP – Aseptic Technique

Aseptic technique is a set of specific practices and procedures performed under carefully controlled conditions with the goal of minimizing contamination by pathogens.

- Space and work flow
- Clean, aseptic, or sterile technique
- Routine, aseptic or surgical hand hygiene
- Instruments and supplies
- PPE: personal protective equipment
- Trash: sharps, infectious waste, radioactive waste, pathology or routine waste
Aseptic Technique

a·sep·sis  /āsepsis/

The absence of bacteria, viruses, and other microorganisms. The exclusion of bacteria and other microorganisms, typically during surgery.

http://www.youtube.com/watch?v=4mKhULnxqcw
Universal Precautions

• A set of strategies developed to prevent transmission of blood borne pathogens (BBP).

• GMP is to research as universal precaution is to health care.

• 5 major components:
  - Training/risk assessment
  - Hand hygiene
  - PPE and safe work practices
  - Environmental controls
  - Administrative controls
Biomedical Waste & Decontamination

- Decontamination/Waste Management
Biomedical Waste

- Discarded biological material from teaching, clinical and research laboratories and operations.
- Includes but is not limited to:
  - Biological material: cell/bacterial cultures, samples
  - Biological laboratory waste: tubs, petri dishes, pipettes, gloves
  - Anatomical waste: human & animal
  - Blood and bodily fluid waste: human & animal
  - Biomedical sharps

*uOttawa Biosafety SOP and Guidelines:
✓ Biomedical Waste Management Procedures
Biomedical Waste Management

• All biological waste should be decontaminated prior to final disposal (including RG 1 agents)

• At uOttawa, chemical disinfection and autoclaving are the major methods used for biomedical waste decontamination

• Treated biomedical waste is no longer considered ‘biomedical’ (i.e. microbiological waste, blood and bodily fluid waste) and can be disposed of in the regular waste stream/chemical waste stream

• Any biomedical waste that cannot be treated (i.e. sharps, carcasses, tissues and body parts) must be sent for off-site treatment

• Transfer your waste by using a secondary container
Different Concepts

• **Decontamination**
  - The destruction of microorganisms to a lower level such that it removes danger of infection to individuals

• **Sterilization**
  - The complete destruction of all viable microorganisms

• **Disinfection**
  - Use of agents (physical or chemical) to destroy harmful organisms on inanimate objects
Ways to Achieve Decontamination

- **Heat**
  - Autoclaving (most practical and recommended)
  - Incineration (for disposal of sharps and tissues)

- **Irradiation**
  - UV light (wavelength of 253 nm is germicidal)
  - Gamma (disrupts DNA and RNA)

- **Filtration**
  - HEPA (biological safety cabinets, ventilation)

- **Chemical disinfection**
  - Chemical disinfectant
Autoclave

- Can be used for both decontamination & sterilization.
- Penetration of steam/heat at
  - a specific temperature
  - a certain pressure
  - a given period of time
- Validation test required for every 6 operation days.
  - Use biological indicators
  - Result to be kept for 5 years!

uOttawa Autoclave Safety Training:
https://web30.uottawa.ca/hr/web/en/node/1411

*uOttawa Biosafety SOP and Guidelines:
  ✓ A Guideline for the Safe Use of Autoclaves
  ✓ uOttawa Autoclave Procedures
# Autoclavable Items

<table>
<thead>
<tr>
<th>CAN</th>
<th>CANNOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Culture dishes and related devices</td>
<td>• Chemicals (flammables, oxidizers, phenols, acids, alkali)</td>
</tr>
<tr>
<td>• Cultures and stocks of infectious material</td>
<td>• Chemotherapeutic or radioactive waste</td>
</tr>
<tr>
<td>• Discarded live and attenuated vaccines</td>
<td>• <strong>Bleach</strong> (or other chlorinated products)</td>
</tr>
<tr>
<td>• Contaminated solid items (petri dishes, Eppendorf tips, pipettes, gloves)</td>
<td>• Certain kinds of plastics</td>
</tr>
<tr>
<td></td>
<td>• Sharps (not at uOttawa)</td>
</tr>
</tbody>
</table>
Chemical Disinfectant

- Generally for decontamination rather than sterilization
- **Surface decontamination** & **liquid waste decontamination**
- Choice depends on:
  - Type of material to be disinfected
  - Organic load
  - Chemical characteristics
- Most common are chlorine compounds and alcohols (broad range)
  - 70% ethanol: weekly.
  - 10% bleach: 24 hr.
  - Virox.
- **Label** the preparation date.
- Contact time: 10-30 min.
Disinfectant For Different Agents

• Vegetative bacteria (E.coli, Staph)
  ➢ 2% domestic bleach
  ➢ 70% Ethanol
  ➢ Quaternary ammonia
  ➢ 6% formulated Hydrogen peroxide

• Mycobacteria and fungi
  ➢ 10% domestic bleach
  ➢ 70% Ethanol
  ➢ Phenolic compounds

• Spore forming bacteria (Bacillus)
  ➢ 10% domestic bleach
  ➢ Glutaraldehyde
  ➢ Formaldehyde
  ➢ 6% formulated Hydrogen peroxide

• Viruses Enveloped (HIV, Herpes)
  ➢ 2% domestic bleach
  ➢ 70% Ethanol
  ➢ Quaternary ammonia
  ➢ 6% formulated Hydrogen peroxide*

• Non enveloped (Hepatitis, Adenovirus)
  ➢ 10% domestic bleach
  ➢ 6% formulated Hydrogen peroxide*
  ➢ Glutaraldehyde
  ➢ Formaldehyde
Liquid Waste Disinfection

- Container should be leak-proof.
- Should contain maximum half its volume of liquid waste.
- Undiluted bleach should comprise 10% of final waste volume.
- Collect treated liquid waste in a hazardous waste bin!
- Bleach CANNOT be autoclaved, so plan your decontamination and waste preparation accordingly.
Liquid Aspiration System

Aspiration through vacuum-traps should be serially set-up with 10% volume of bleach in both containers

- Flasks have to be vacuum grade
- In-line HEPA filters must be used
- Place flasks inside secondary containers in the case of a spill
- Date the flask when it was prepared
Treated Biomedical Waste Disposal

- Solid waste

- Liquid waste
Waste Handling for Off-Site Treatment

- Biomedical sharps waste
- Anatomical waste
## Waste Handling for Off-Site Treatment

<table>
<thead>
<tr>
<th>Type of waste</th>
<th>Containers</th>
<th>Labelling</th>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-anatomical waste</strong></td>
<td>• Yellow pail with lid</td>
<td>• U of O Hazardous Waste label</td>
<td>• 4°C refrigeration required if non-anatomical waste stored for more than 4 days.</td>
</tr>
<tr>
<td>• Cells, cell tissues, etc.</td>
<td>• Cardboard box lined with yellow bag</td>
<td></td>
<td>• Refrigeration not required for sharps and lab associate waste.</td>
</tr>
<tr>
<td>• Blood and body fluids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lab associated waste</strong></td>
<td>• Yellow sharps container</td>
<td>• U of O Hazardous Waste label</td>
<td></td>
</tr>
<tr>
<td>• Gloves, gowning, etc.</td>
<td>• Yellow pail with lid</td>
<td>• Anatomical label</td>
<td>• Refrigerate at 4°C or below immediately.</td>
</tr>
<tr>
<td>• Ampules, vails, etc.</td>
<td></td>
<td>• U of O Incineration label (if disposed through ACVS)</td>
<td></td>
</tr>
<tr>
<td>• Disposal pipettes, loops, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sharps waste</strong></td>
<td>• Red pail with lid</td>
<td>• U of O Hazardous Waste label</td>
<td>• Refrigeration not required.</td>
</tr>
<tr>
<td>• Needles/syringes</td>
<td>• Cardboard box lined with red bag</td>
<td>• Cytotoxic label</td>
<td></td>
</tr>
<tr>
<td>• Razors, scalpels etc.</td>
<td>• Fiber drum lined with red bag (for ACVS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Empty broken ampules, vails</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Anatomical waste</strong></td>
<td></td>
<td>• U of O Hazardous Waste label</td>
<td></td>
</tr>
<tr>
<td>• Tissues, organs and body</td>
<td>• Red pail with lid</td>
<td>• Anatomical label</td>
<td></td>
</tr>
<tr>
<td>parts (not include teeth, hair</td>
<td>• Cardboard box lined with red bag</td>
<td>• U of O Incineration label (if disposed through ACVS)</td>
<td></td>
</tr>
<tr>
<td>and nails)</td>
<td>• Fiber drum lined with red bag</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cytotoxic waste</strong></td>
<td>• Red pail with lid</td>
<td>• U of O Hazardous Waste label</td>
<td>• Refrigeration not required.</td>
</tr>
<tr>
<td>• Material contact with</td>
<td>• Cardboard box lined with red bag</td>
<td>• Cytotoxic label</td>
<td></td>
</tr>
<tr>
<td>Cytotoxic drugs (Sharps require Cytotoxic sharps container)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pharmaceutical waste</strong></td>
<td>• White pails</td>
<td>• U of O Hazardous Waste label</td>
<td>• Refrigeration not required.</td>
</tr>
<tr>
<td>• Pharmaceutical products</td>
<td>• Cardboard box lined with red/clear bag</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

uOttawa.ca
University of Ottawa Hazardous Waste Label

- Must be completed:
  - Professor name
  - Lab location and phone number
  - Contact person
  - Date
  - Contents: Risk Group, content of waste

- Paste on all the hazardous waste containers:
  - Autoclave bags
  - Yellow/red pails
  - Bench top sharps containers
  - Other hazardous waste containers
uOttawa Hazardous Waste door-to-door Service

• Available for biomedical sharps containers.
  - 4.5 L benchtop sharps containers
  - 23 L yellow pails
    (Cardboard box with 2*yellow liners: if autoclave is not available)

• Fill out the online form to request pick-up & replacement.
  https://orm.uottawa.ca/programs/hazardous-waste

• Requirements to be met:
  - Completed “uOttawa hazardous waste” label.
  - No more than 3/4 full.
  - Keep the lid of the pail intact.
Waste preparation

- Label your container!
- Do not overfill! (3/4 full)
- Proper secondary container!
- Seal the container!
Waste preparation

Fill line.

Label attached.

Screw cap must be on!

Do not rip off lid rim!
Accident/Incident

- Emergency Response / Spill Response
Types of accidents causing LAIs

- Spills and sprays
- Needles
- Sharp objects and broken glass
- Bites or scratches from animals

Pseudomonas infection

Vaccinia virus infection

Attenuated – Lab Adapted Strains, Laboratory-Acquired Infection With an Attenuated Yersinia pestis Strain – Chicago, Illinois, 2009
Emergency Response

• Questions to ask yourself when an incident happens:
  ➢ Was anyone exposed?
  ➢ What is the risk?
  ➢ What is the route of exposure?
  ➢ Are aerosols still suspended?
  ➢ Is the risk contained?
Your expertise is needed to answer these questions ... 

• Where you can find emergency showers and eyewash stations? Are you familiar with their operation?
• What is the first aid method? (refer to PSDS/MSDS)
• How much hazardous material was transferred into the wound?
• What is the implications if you force bleed the wound?
Spill Response

- Spill response will vary depending on:
  - what, where, how much, when, who
  - What is spilled? – characteristics and hazards
  - How much is spilled? – volume and concentration
  - Where it is spilled? – BSC, lab, centrifuge, outside lab

- Knowing how to properly clean up spills will ensure that you are safe and that your exposure is minimized.

- All spills are to be reported to the bio.safety@uottawa.ca.
Spill Response Plan

• Don’t forget it must be tailored to be lab specific
  ➢ Use that Risk Assessment you did earlier
  ➢ Refer to the PSDS/MSDS

*uOttawa Biosafety SOP and Guidelines:
✓ Biosafety Spill Response Plan
✓ Blood Spill Procedures
Spill Response Procedures

• Wear appropriate PPE
• Cover spill area with absorbent material
• Soak the spill area with an appropriate disinfectant (10% bleach, Virox)
  ➢ Pour/spray disinfectant from the outside of the absorbent material towards the inside
• Pick up any broken glass with forceps and place in a sharps container
• Mark the spill area with label/tape
• Leave on for 30 minutes
• Wipe up with absorbent material
• Dispose the waste in appropriate waste container
Aerosols

- How far did my aerosolized material travel?
  - How much of the lab do I have to decontaminate to avoid secondary contamination?
**Inhalation Risk**

If the risk was inhalation, there may not be any evidence of an exposure having occurred.

To avoid:

- Inform all in the vicinity
- Restrict access to avoid re-suspending or relocation of particles
- Vacate area for 30 minutes before re-entering
- Report, apply appropriate signage & seek medical assistance
Reporting

All potential exposures should be reported immediately to:

- Your supervisor /PI
- 5411 (through Protection Services)
- ORM x 5892
- Occupational Health, Disability and Leave Form On-line

NO Excuses!
University Requirements

• Training/Certificate/Acquisition & Transfer/Decommission
Institutional Biosafety Approval – Biohazardous Materials Use Certificate

Lab handling RG2 or/and RG3 biological agents is required to have a University of Ottawa Biohazardous Material Use Certificate (BMUC):

• Internal biosafety certificate
• Application for a BMUC is done by the Principal Investigator (PI)
• Necessary for some grants and projects $$$
• Users are registered and trained
• Inventory of biological material stored and used
• All locations’ containment requirements are met

*uOttawa Biosafety Program:
✓ Getting Started with Right Foot
✓ BMUC Application
Biosafety Training Requirements

• Biohazardous Materials User Registration Form (BMUR)
  ➢ Mandatory for all the RG2 and RG3 agents users.

BMUR incorporates:
  ➢ Training in class,
  ➢ Quiz after class,
  ➢ Practical training,
  ➢ Experience, proposed work details etc.

Take the class (pass the quiz) + BMUR form = You are Authorized!
BMUR

• Practical Training
• Risk Assessment
• Health Assessment (optional)
# Health Assessment Form

To obtain: Contact uOttawa HR Health and Wellness Sector [hrhealth@uottawa.ca](mailto:hrhealth@uottawa.ca)

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**Biosafety Health Assessment Survey**

Once completed this form is confidential and must only be sent to Employee Health, Wellness and Leave Office, room 017, Tabaret Hall.

The information requested in this survey will be used to identify the required immunization and the medical surveillance to be implemented as a result of the project to be undertaken. It will remain confidential and will not be released to a third party without the expressed written permission of the employee. For more information, you may contact us at [santehr@uottawa.ca](mailto:santehr@uottawa.ca)

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### PERSONAL DATA

<table>
<thead>
<tr>
<th>Name:</th>
<th>Position:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>University of Ottawa affiliation (Faculty, Department)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Employee No.:</th>
<th>Student No.:</th>
<th>Name of Supervisor</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Host Institution</th>
<th>Department:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Work Address Building:</th>
<th>Room No.:</th>
<th>Telephone No.:</th>
</tr>
</thead>
</table>

### DESCRIPTION OF THE PROJECT

Briefly list the pathogens you will be working with, the nature of the work, and the personal protective equipment that will be used. Will you be working with human or primate cells, tissue, blood or blood product? Will this work involve cultivation or diagnostic specimens? Please describe. Following the risk assessment performed by the principal researcher-supervisor, is there any recommended immunisation? Please provide a summary of the protocol and the corresponding MSDS for the pathogen(s) you will be working with.
Biological Material Acquisition/Transfer

• Restrictions: permit/licence/agreement
  - HPTA Licence/Import Permit
  - BMUC
  - TDG – Class 6.2

• In order to facilitate a quick turnaround, provide:
  - Consignor/consignee
  - Copies of PSDS or other risk assessment documents

• Proactive approach:
  - Complete submission
  - Gov’t turn around (2-4 week)
  - Lead time
  - Grant cycle

Purchase/transfer? Import/export?
How soon do you need it?
When do you want it?
# Biomaterial Transfer Requirements Matrix

<table>
<thead>
<tr>
<th>Transfer Approach</th>
<th>Regulators Requirements</th>
<th>Material Transfer Agreement</th>
<th>Institutional Biosafety Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic Institutional Transfer</td>
<td>• HPTA Licence&lt;br&gt;• If compliance letter is required:&lt;br&gt;  ➢ Submit CL2 checklist to CFIA&lt;br&gt;• TDG restriction (uOttawa as consignor)</td>
<td>• Submit material transfer agreement (MTA) to the Innovation Support Service (ISS) for approval.</td>
<td>Transfer MUST be approved by BSO:&lt;br&gt;• Amending BMUC.&lt;br&gt;• Submit risk assessment document to ORM.&lt;br&gt;• Project been reviewed.&lt;br&gt;• Ensure containment level and decontamination requirements are met.&lt;br&gt;• BMTN is required when domestic institutional transfer happen.&lt;br&gt;• Update inventory by ORM.</td>
</tr>
<tr>
<td>Domestic Purchase</td>
<td>• HPTA Licence&lt;br&gt;• If compliance letter is required:&lt;br&gt;  ➢ Submit CL2 checklist to CFIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>International Institutional Transfer</td>
<td>• HPTA Licence&lt;br&gt;• If import permit is required:&lt;br&gt;  ➢ Submit permit application to CFIA&lt;br&gt;• If compliance letter is required:&lt;br&gt;  ➢ Submit CL2 checklist to CFIA&lt;br&gt;• TDG restriction (uOttawa as consignor)</td>
<td></td>
<td>*ORM must be informed if transfer happen between labs within uOttawa. For any question, contact: <a href="mailto:bio.safety@uottawa.ca">bio.safety@uottawa.ca</a></td>
</tr>
<tr>
<td>International Purchase</td>
<td>• HPTA Licence&lt;br&gt;• If import permit is required:&lt;br&gt;  ➢ Submit permit application to CFIA&lt;br&gt;• If compliance letter is required:&lt;br&gt;  ➢ Submit CL2 checklist to CFIA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: additional paperwork or authorization may be required base on the type of material to be transferred. (e.g. ethics approval for clinical sample transfer)
Security Sensitive Biological Agents (SSBA)

• Regulated by PHAC:
  ➢ 11 Toxins – trigger quantity
  ➢ 40 Viruses
  ➢ 11 Bacteria
  ➢ 2 Fungi
• Security Clearance may be required.
• **Cannot be acquired** without prior approval of the BSO!

  (bio.safety@uottawa.ca /ext. 3153)

*uOttawa Biosafety SOP and Guidelines:
✓ Biosafety Program Restriction: SSBA Acquisition
Biosafety Decommissioning

• Required when
  ➢ Lab relocation/PI’s retirement or leaving

• Ensure
  ➢ All biological material are relocated safely.
  ➢ All bio-associated equipment are decontaminated before moving (BSC MUST be decontaminated by authorized personnel)
  ➢ All biomedical waste is disposed
  ➢ Signage are removed

• May associated with
  ➢ BMUC/inventory transfer
  ➢ Lab commissioning
  ➢ BSC recertification

Let us know! For your & other people’s safety!
Other Biosafety Resources

- PHAC & CFIA e-learning portal: [www.publichealth.gc.ca/training](http://www.publichealth.gc.ca/training)
  - Biosafety training materials, templates, toolkits, posters, instructional videos
  - Introduction to Biosafety – sufficient for RG1 users

- JoVE: Journal of Visualized Experiments: [https://www.jove.com/](https://www.jove.com/)
  - Methods and protocols

- Protocols on line: [http://www.protocol-online.org](http://www.protocol-online.org)
  - Your lab’s reference book
UOttawa Biosafety Resources

- Alarm Equipment
  - Response Procedure to Equipment Alarm
- Autoclave
  - A Guideline for the Safe Use of Autoclaves
  - University of Ottawa Autoclave Procedures
- Bio-Acquisition and Transfer
  - Biohazardous Material Transfer Notification Form
- Biosafety Decommissioning
  - Biosafety Decommissioning Form
- Biohazard Warning Signage
  - Biohazard Warning Signage
- Biological Safety Cabinets (BSC)
  - Working with BSC SOP
  - Guideline: Use of UV Lamps in BSC
- Biological Spill Response
  - Biological Spill Response Plan
- Biomedical Waste Management
  - University of Ottawa Biomedical Waste Management Procedures
- Biosafety Inspection
  - Biosafety Inspection Checklist
- Blood and Bodily Fluids
  - Blood Spill Procedures
- Security Sensitive Biological Agents (SSBA)
  - Biosafety Program Restriction: SSBA Acquisition

- Biosafety Program
  - Getting Started on the Right Foot

- Cheat Sheets:
  - Good Microbiological Practices
  - HEPA Filter Certification
  - Lab Coat Selection
  - Use of Open Flame in BSC
  - Use of Bleach as Disinfectant

To obtain: bio.safety@uottawa.ca
SUMMARY

• Requirements: Regulators & uOttawa
• Biosafety Principles
• Risk Assessment
• Risk Mitigation
• Safe Operating Practices
• Decontamination & Waste Management
• Incident/Accidents
• Material Transfer
TAKE THE QUIZ!

• Same page as the one you registered on
• Jan. 26th – Feb. 6th, 2018
• Obtain your certificate and send a copy to your PI

Any question: bio.safety@uottawa.ca or ext. 3153
Have a safe semester 😊

Questions?