

Blood Borne Pathogens

Health, Safety, and Employee Well-Being

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Overall Objectives

By the end of this training session, you should be able to:

- Appreciate that biological agents can be found in various parts of York University and understand the various terminology associated with Biosafety
- Be able to identify areas of campus where Biological agents are exclusively handled and manipulated
- Understand and establish safe practices, and if you are required to, undertake safe precautions when handling biological agents
- Become a competent, qualified and safe personnel



Where can you find Biological Agents?

Biological agents can be found almost everywhere throughout campus. They may be present naturally in the environment (e.g. wastewater, soil) or be intentionally handled and manipulated (e.g. in labs and animal care facilities)





Course Overview

Part I: Biological Hazards, Classification, Infection & Transmission

Part II: Blood Borne Pathogens

Part III: Sharps and Biohazardous Waste Handling

Part IV: Precautions, Spill and Exposure Response



What Are Biological Hazards?

A biological hazard (Biohazard) is a potentially infectious agent or hazardous biological material that presents a risk or a potential risk to the health of humans, animals, plants and/or the environment

These include:

- Certain types of recombinant DNA/ RNA
- Microorganisms infectious to humans, animals or plants e.g. bacteria, viruses, fungi, parasites
- Biological active agents toxins, allergens, venom









Where can I find Biological Hazards?

Biohazards can be found in:

- Blood
- Human or animal bodily fluids/secretions
 e.g. saliva, mucous, vomit, fecal matter, urine, semen/vaginal secretions
- Human or animal tissue samples (from labs or naturally in the environment)
- Diagnostic samples
- Vaccines
- Soil
- Waste water







Biohazard Signage

You will find the universal Biohazard symbol in all areas that intentionally work with Biohazardous Materials

- ✓ At the entrance to any laboratory/room handling or storing
 Biohazardous agents
- ✓ Animal care facility
- \checkmark On any container containing biohazardous material







How Are Biological Hazards Transmitted?

Direct Contact

- person to person exposure
 - e.g., blood, mucus, vomit, secretions through open wounds etc.

Indirect Contact

- surface to person exposure
 - e.g. person touching contaminated surface/object

Airborne Route

 inhalation of aerosols that an infected person coughs or sneezes into the air

Injection/Inoculation

- contaminated sharp objects
- infected animal/insect to person
 - e.g. HIV, Malaria, West Nile, Rabies, Lyme disease



Infection

- An infection occurs when a host (human or animal) is colonized by a pathogen/germ
- The infecting organism causes mild or severe disease in the host
- Four things must happen for this to occur:
 - 1. Host comes in contact with infectious Biohazards
 - 2. Sufficient Biohazards are present
 - **3**. Biohazards get into the body
 - The host's natural defenses are 'weaker' than the Biohazard



What is My Risk of Infection?!?!?!

The true risk of exposure is difficult to assess as there are many factors to consider:

- What is present and how much?
- Is the biological agent hazardous to humans?
- What is the mode of transmission?
- Is anything known about the person's health status?
- What is your immune status?
- Are there any available vaccines/treatment methods?

We can practice **good hygiene practices** to prevent ourselves and others from being exposed (Part IV)





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What is a Bloodborne Pathogen?

A blood borne pathogen is a microorganism that is present in human blood and can cause serious disease

- HIV
- Hepatitis B
- Hepatitis C

Prevalent in North America

- Viral Hemorrhagic Fevers
 - Hantavirus, Ebola
- ₁ Malaria, West Nile Virus





How are Bloodborne Pathogens Transmitted?

In a laboratory setting, blood-borne pathogens are transmitted via:

Direct Contact with infected blood:

- with broken or damaged skin (open sores)
- With mucous membranes (eyes, mouth, rectal, vaginal)
- Bite from an infected animal

Injection/Inoculation

Needle-stick injuries: An accidental puncture by a sharp object, such as a needle, broken glass, or other "sharps", contaminated with the pathogen.



Human Immunodeficiency Virus

What is HIV?

- HIV is a virus that infects and kills the vital cells of the immune system
- HIV causes Acquired Immune Deficiency Syndrome (AIDS)
- AIDS is characterized by various symptoms and infections caused by the destruction of the immune system
- Opportunistic infections and cancers are able to thrive in a weakened immune system, making infected individuals succumb to various diseases



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Hepatitis

What is Hepatitis?

- Hepatitis is the medical term for inflammation of the liver, usually caused by infection of Hepatitis viruses (5 types)
- Many infected people do not have any symptoms
- The minority of people who do get symptoms display:
 - Flu like symptoms (fever, fatigue, muscle and joint aches, loss of appetite, nausea, headaches, vomiting)
 - Jaundice (yellowing of the skin or whites of the eyes)
- Hepatitis B & C produce long term effects: damage and scarring of the liver, kidney dysfunction, lowered life expectancy, and liver

15 cancers







Hepatitis

"There are about 3,000 reported cases of each hepatitis A and hepatitis B in Canada each year. Since many infected people have no symptoms, however, we can assume the true rate of infection is higher than this."

- Ministry of Health and Long-Term Care

"The rates of Hepatitis B infection have been reported to be several times greater in laboratory staff than the general population and is one of the most frequently reported laboratory acquired infection."

- Public Health Agency of Canada



Hepatitis Viruses

What are the different types of hepatitis viruses?

There are five hepatitis viruses : A, B, C, D, and E

Hepatitis A, B, and C are the common causes of liver inflammation in North America

• Hepatitis A:

- Transmitted via fecal-oral route
- No long term consequences
- Vaccine available
- Hepatitis B and C:
 - Blood borne pathogens
 - Can be chronically infected and a carrier for life
 - Hep B is the most reported laboratory acquired infection
 - There is a Hep B Vaccine available



Hepatitis B Virus Structure



Hepatitis – Treatment?

No cure for Hepatitis A & B

- There are no safe drugs that can completely eliminate these viruses.
 - Although there are some developments in this area, the only option is to wait for the infection to run its course.

 The only prevention is through vaccination (immunoprophylaxis)
 – Hep A/B combination vaccine is available in most clinics, administered at 0, 1 and 6
 months





Hepatitis – Prevention

Immunoprophylaxis involves 2 steps:

- 1. Screening for Hepatitis A & B antibodies
 - Performed by blood test
 - If negative for antibodies, vaccine may be given
- 2. Series of Vaccine injections:
 - Injections required at 0, 1, 6 months
 - Vaccines names:
 - Hep A: Havrix, Vaqta
 - Hep B: Recomivax nb, Engerix- B
 - Hep A/B combination: Twinrix





Pathogens in Other Body Fluids

Saliva

- Common cold viruses (coronavirus, rhinovirus)
- Influenza
- Herpes simplex 1

Vomit/Urine

- Salmonella
- E.coli
- Leptospira
- Yersinia

Fecal Matter

- Hepatitis A
- Viruses causing stomach gastroenterisis (*rotaviruses, noroviruses, adenoviruses*)
- Salmonella
- E. coli





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Sharps

Examples:





Key points when using sharps:

- Wear gloves for all manipulations with needles and syringes
- Do not forcefully expel a stream of fluid into an open vial
- Use plastic disposable syringes/lancets instead of reusable glass
- Use safety needles as much as possible
- Avoid quick and unnecessary movements of the hand holding the sharp
- Never reuse sharps between participants



If You Find Sharps:

- Treat all sharps as being contaminated/infectious
 - Avoid direct handling: Wear gloves and use tongs or dustpan and broom to pick up sharps.
- Warning: Gloves do not protect against punctures or cuts!
 - For needles, pick up by the blunt end (e.g. the plastic fitting where it is fixed onto a syringe) If there is more than one, pick them up one at a time.
 - DO NOT bend or recap contaminated needles and other sharps.
 - Carefully transfer to a puncture-proof container.
 - Remove gloves and dispose of appropriately.
- ²³ Wash hands thoroughly with soap and water.



Sharps Disposal

- All sharps must be placed disposed in a labeled puncture-proof container for disposal as biomedical waste
- Researchers: Puncture proof containers are available from Science Stores
- Staff: Puncture proof containers are provided by Housing (clean up) or Health Education and Promotion Centre (individual use)
- Discard syringes immediately into a sharps container
- DO NOT discard syringes into garbage or biohazard bag
- Never refill sharps container above the fill line





Biohazardous Waste Disposal

- Sharps and human body tissue and fluids (excluding urine) are considered regulated waste
- Regulated waste must be placed in designated yellow bags and boxes
 - Available from Science Stores ask for assistance, or contact departmental Health and Safety Officer
- Label waste container with:
 - PI name
 - Room number
 - Contact number
- Sharps containers should be placed in a box inside the biohazardous waste room of Farquharson Life Sciences





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Exposure Precautions

Universal/Standard Precautions

Treat / handle all blood / body fluids as if they are infectious

- Wear protective clothing and gloves when administering first aid, during experiment, or during cleanup
- 2. Wash hands regularly and properly
- 3. Follow proper disposal procedures
- 4. Safe sharps handling and disposal





- 1. Use Barrier Protection to prevent skin and mucous membrane contact with blood or other body fluids.
- 2. Wear gloves to prevent contact with blood, infectious materials, or other potentially contaminated surfaces or items.
- 3. Wear face protection if blood or bodily fluid droplets may be generated during a procedure.
- 4. Wear protective clothing if blood or bodily fluid may be splashed during a procedure.
- 5. Wash hands and skin immediately and thoroughly if contaminated with blood or bodily fluids.
- 6. Wash hands immediately after gloves are removed.
- 7. Use care when using or handling sharp instruments and needles. Place used sharps in labeled, puncture resistance containers.
- 8. If you have sustained an exposure or puncture wound, immediately flush the exposed area and notify your supervisor.



Personal Protective Equipment (PPE)

Wear personal protective equipment where contamination of the body and street clothing is possible.

- Tie up long hair (if applicable)
- Remove jewelry
- Wear lab coat/gown
- Closed-toe shoes
- Eye protection personal eye glasses do not offer the required p
- Gloves (double gloves when handli



PPE - Protective Clothing

These include: Lab coats, tyvex suits, aprons, gowns, etc.

- Prevents contamination of street clothes and body areas
- Lab coats are long-sleeved, knee-length with snaps and fitted cuffs
- Gowns are back-closing
- Must always be worn closed
- Never wash with regular clothing
- Never wear your lab coat in offices, conference rooms, lunch areas or outside
- Can be disposable









PPE - Gloves *Wear gloves as a skin barrier*

- Not a substitute for hand washing
- Ensure it is a proper fit
- Avoid wearing for longer than 2 hours
- Never reuse disposable gloves
- Remove contaminated gloves properly
- Dispose gloves in appropriate containers
- Wash hands after removing gloves







Proper glove removal



(1) Pinch glove near your wrist and pull slowly towards your fingers. Turn the glove inside out while pulling.







(3) Slide finger from glove-free hand under other glove. Slide approximately half of your finger under the glove.



(4) Rotate your finger ~180°, and pull glove outwards towards your fingertips. Turn the glove inside out while pulling.



(5) Holding the glove by the uncontaminated surface, transfer to appropriate waste bin.



Handwashing

- Hand washing is the single most important procedure for preventing the spread of biological contamination
 - At least 30 seconds
 - (sing happy birthday -TWICE)
 - Lather and scrub past wrists (or further if needed)





Handwashing



Handwashing with soap and water

http://www.publichealthontario.ca/en/BrowseByTopic/InfectiousDiseases/JustCleanYourHands/Pages/Just-Clean-Your-Hands.aspx#.VFkxy_nF_AQ



Handwashing vs. Hand Sanitizing

- Whenever possible it is better to wash hands than use hand sanitizers
- Hand sanitizers must be at least 70% alcohol-based to show equivalent efficacy as hand washing
- Hand sanitizer efficacy is exponential to the amount used – squirt twice!
- Hand sanitizing is not effective if hands are visibly soiled





Areas missed during hand-washing



Spill Clean-up Procedure

- Cleanup of such biological materials may be a result of an accident or due to poor hygiene practices.
- Incidents that involve urine, feces, vomit, or blood body fluids may contain infectious materials, and must be handled following universal precautions. It is important to clean and then sanitize surfaces after a spill.
- Spill responses will vary according to what, where and how much material is spilt
- Clean spills at your comfort level.
- When unsure, contact your supervisor
- Knowing how to properly clean up spills will ensure that you are safe and that your exposure is minimized.



Spill Kit Equipment Recommendations

- Create a spill kit for quick and easy clean up:
 - Caution sign
 - <u>Personal Protective Equipment (PPE)</u>
 - Gloves
 - Safety Goggles
 - Protective clothing e.g. plastic apron
 - Mask (e.g. N95)
 - Absorbent Material (MegaSorb)
 - Disinfectant solution

e.g. household bleach (10% fresh solution) or ED Disinfectant

- Dust Pan/Broom
- Garbage container/bag



Safe Handling of Bleach

- Refer to <u>Material</u> <u>Safety</u> <u>Data</u> <u>Sheet</u>
- Avoid contact with eyes, skin, clothing
- Wear safety glasses, rubber or nitrile gloves
- For disinfection: 10% household bleach for 30 minutes
- DO NOT MIX WITH OTHER CHEMICALS
 - Strong oxidizing agent
 - INCOMPATIBLE WITH other household chemicals such as toilet bowl cleaners, rust removers, vinegar, acids, ammonia-containing products to produce extremely hazardous chlorine gases



Spill Response

- 1. Put on appropriate personal protective equipment.
- 2. Post a "spill cleanup in progress" sign, to warn others.
- 3. Cover the spill with an absorbent (e.g. paper towels)
- 4. Gently pour disinfectant (e.g. 10% bleach solution) around and over the spill **
- 5. Allow appropriate contact time (e.g. 30 minutes for 10% bleach) to destroy potential pathogens.
- 6. Sweep/collect waste material onto dustpan or dispose directly into a garbage bag for regular waste disposal. Treated liquid waste can be poured into the sanitary sewer system.
- Sanitize area by reapplying disinfectant to the spill area after initial cleaning**
- 8. Do final wipe down with water to remove residual disinfectant.

** Care should be taken to avoid splashing or generating aerosols during clean up



Spill Response - absorbing surface (carpet, upholstery, etc.)

- 1. Put on appropriate personal protective equipment.
- 2. Post a "spill cleanup in progress" sign, to warn others.
- 3. Gently pour disinfectant solution onto the absorbed spill site.
- 4. Allow appropriate contact time to destroy potential pathogens.
- 5. If solid waste, remove as much as possible into waste bag/container
- 6. Blot up what is possible with a dry cloth. Do not rub.
- 7. Apply soap/water or appropriate carpet spotter to remove visible staining

(NOTE: MUST BE COMPATIBLE WITH DISINFECTANT !!)

8. Place all cleaned up waste into a garbage bag for regular waste disposal.



Post-Spill Response

Don't forget post-spill cleanup:

- Clean used equipment (e.g. dustpan and broom) with a suitable disinfectant
- Discarding soiled equipment in appropriate waste stream (autoclave, sharps, municipal waste)
- Wash hands thoroughly



Exposure Response - Immediate

MAJOR or LIFE-THREATENING INJURIES - SEEK MEDICAL ATTENTION IMMEDIATELY:

- Call 911 and Campus Security x33333
- First Aiders can administer first aid

CLOTHING:

- Remove contaminated clothing and prepare for disinfecting
- Place contaminated clothing in autoclave bags for autoclaving or in chemical disinfectant bath for appropriate disinfection time

Exposure Response - Immediate

SKIN:

- Wash the exposed surface with soap and water
- For cuts to skin, allow to bleed freely if safe to do so
- After rinsing the wound apply a skin antiseptic and cover using a dressing or bandage

• EYES/NOSE/MOUTH:

Flush thoroughly with water (~15minutes)



What should I do if I become exposed?

Report to your supervisor.

- If employee: supervisor must fill out the Supervisor's Accident Investigation Report (SAIR)
- If doing research student duties: Get supervisor to fill out a faculty student accident report form
- If you feel you had a possible exposure to biohazards:
 - Seek medical attention immediately. Inform physician of possible exposure.
 - MUST contact Biosafety Officer (x55491 or x44745)
 - Public Health needs to be informed (no personal data sent)
 - Can get advice from Occupational Medical Doctor



Thank you for being safe!



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