Biological Safety

- Bloodborne Pathogens
- Waste, Disinfection, Spills
- CDC/NIH Guidelines
- Work Practices & Golden Rules
- Select Agents
- Medical Considerations

Common Causes of Laboratory Infection

R.M. Pike: 703 Total Cases

- Contact from sprays, spills, etc. 188
- Needle/Syringe Accidents 177
- Broken Glass or Other Sharp 112
- Animal Bite or Scratch 95
- Aspiration through pipette 92

10 Most Common Overt Laboratory Acquired Infections: 1979-2004

Harding & Byers, 2006

- *M. tuberculosis* 199
- *Arbovirus* 192
- *Q Fever* 177
- *Hantavirus* 155
- *Brucella* sp. 143
- *Hepatitis B* 82
- *Shigella* sp. 66
- *Salmonella* sp. 64
- *Hepatitis C* (non-A, non-B) 32
- *Neisseria meningitidis* 31
OSHA Bloodborne Pathogen Standard

- A Bloodborne Pathogen is a pathogenic microorganism that is present in human blood and can cause disease in humans.
- Other Fluids, Tissues & Cells
- Occupational exposure?

Human Immunodeficiency Virus (HIV)

- As of 2006: 57 documented occupational seroconversions
  - 48 percutaneous
  - 5 mucocutaneous
  - 2 percutaneous & mucocutaneous
  - 2 unknown routes
- 49 HIV infected blood
- 5 Body fluids
- 3 concentrated virus

About 1.1M infected in U.S.

Modes of HIV Transmission

- Most occupational exposures occur through needle sticks!
- Sexual contact & exchange of Body fluids
- Sharing IV needles with infected person
- Blood transfusions with infected blood
- Mother to baby via breast feeding
Symptoms of HIV Infection

Early Stages:
• None at all, or...
• Flu-like symptoms
• Chronic weight loss

Late Stages (AIDS):
• Kaposi Sarcoma
• Oral Hairy Leukoplakia (EBV)
• Cancers/Infections

Hepatitis B

• Inflammation of the Liver
• Vaccine is available

• Occupational Infections
  - 1983: >10,000
  - 2001: < 400
  - 2007: < 100

• Most Contagious BBP

HBV

Transmission/Symptoms

• Modes of transmission are very similar to HIV

Symptoms:
• None at all
• Flu-like symptoms
• Nausea
• Diarrhea
• Hepatomas
• Jaundice

Transmission/Symptoms
Hepatitis C
- Bloodborne Pathogen
- 2007: 17,000 new cases in the U.S.
- Symptoms are similar to HBV
- 80% of cases are asymptomatic
- No vaccine

Infectivity
- HIV ~0.3%
- HCV ~2%
- HBV ~25%

Exposure Control Plan
- Exposure Determination
- Methods of Compliance
- HBV Vaccination Program
- Post Exposure and Follow-up
- Communication of Hazards
Universal Precautions

- Universal Precaution is an approach to infection control. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens.

Hepatitis B Vaccination

- Free of charge
- Must sign consent or declination form.
- Current declination is not permanent
- Contact Supervisor
- No Booster Needed

Regulated Medical Waste Disposal (Infectious Waste)

Stocks & materials contaminated with:

1. Microorganisms likely to be pathogenic to healthy humans.
2. Unfixed Human Materials

Categories of Waste:
- Liquids
- Sharps
- Other
Liquid Infectious Waste
• Decontaminate appropriately (e.g. 5-10% bleach for 15 minutes)

OR
• Autoclave, then pour down the drain followed by running water.

What is a Sharp?
• Hypodermic needles
• Syringes with needles
• Glass Pasteur pipettes
• Scalpels
• Glass culture dishes
• Cover slips
• Slides
• Broken glass
• Capillary tubes
• Anything that can puncture human skin!
Sharps Containers

- Needles
- Syringes with Needles
- Scalpels & Suture Needles

MUST ALWAYS be disposed in Sharps Container

- Glass Pasteur Pipettes
- Lancets
- Slides & Cover slips
- Capillary tubes
- Broken glass & Other Sharp Items

IF CONTAMINATED dispose in Sharps container
IF UNCONTAMINATED dispose in broken glass box

Dispose of all “full” Sharps containers into a CMC

Other Disposables

- Contaminated (non-sharp, non-liquid)
Contaminated Materials Container
“CMCs”

- Infectious Waste
- Full Sharps Containers
- Minimal Liquids
- No Hazardous Chemical Waste
- No Radioactive Waste
- No Animal Carcasses
- No Regular Trash
Requirements for Autoclaving Contaminated Waste

- Maintain a log book
- Autoclave for minimum of 30 minutes
- Document validation techniques

Where to Obtain Supplies:

- 2 Gallon sharps containers
- 2 Ft³ CMCs
  - Jordan: Room G240
  - MR4 Loading dock
  - MR5: Room G037C
  - MR6: Room G530A
  - Aurbach: Room 1241
  - Snyder: Room 171 C
  - Cobb: Sub basement
- Contact Materials Support Services for other sizes.

Biohazard Spill Clean Up
Recommended Surface Disinfectants
- Cavicide
- Beaucoup
- 5-10% Bleach

Our “Alcohol Problem”
- 70%: Submerge 10 minutes to decontaminate
- Alcohols readily evaporate making sufficient contact time difficult
- Not sporicidal
- Isopropanol: Limited effect against non-lipid viruses (e.g. Rhinovirus)

Wipes
**Viral Vectors & Recombinant DNA**

- Adenovirus
- Adeno-associated virus
- Epstein-Barr virus
- Herpes virus
- Retrovirus
  - Lentivirus
  - MMLV (amphotropic)
- Vaccinia
- Transgene Properties
  - Oncogene (e.g. Src)
  - Immunomodulation
  - Toxin producing
- Tropism (e.g. VSV-G)
- Recombination (Replication competent virus breakthrough)

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**Dual Use Research**

- Biological research with legitimate scientific purpose that may be intentionally misused to pose a biologic threat to public health and/or national security.
- Oversight: National Science Advisory Board for Biosecurity (NSABB)
- Some categories with Dual Use Potential:
  - Enhance the harmful consequences of a biological agent or toxin.
  - Decrease immunity or effectiveness of immunization.
  - Confer biological agent resistance.
  - Increase stability, transmissibility, etc. of biological agent.
  - Alter host range of a biological agent.
  - Generation of a novel or eradicated biological agent.
  - Scientists have a professional responsibility to:
    - Understand dual use research issues and concerns.
    - Be aware of the implications of their work and the various ways in which information and products from their work could be misused.
    - Take steps to minimize misuse of their work.
    - The UVa IBC should be consulted about potential dual use research of concern.
    - For more information: www.biosecurityboard.gov

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**Select Agents & Toxins**

- Federal regulations restricting the possession of certain biological agents that may threaten public health.
  - Access Restriction
  - Background Checks
  - Rigorous Inventory
  - Reporting of loss, theft, release
  - See Biosafety webpage for listed agents.
Biological Toxins

- Mammalian LD₅₀ of ≤ 100 µg/kg body weight
- Reconstitution of stocks presents significant risk and requires containment.
- Special inactivation & disposal requirements
- Biosecurity & Inventory
- See Appendix B of Biosafety Manual

Biosafety Level 2

Personal Protective Equipment

- Proper use of PPE
  - Gloves
  - Laboratory coats
  - Eye protection
**Eye Protection & Vaccinia**

- Eye protection is required (even for vaccinated personnel).
- Medical Counseling

**Latex Allergy**

- Affects up to 6% of population, Greater for HC workers
- Itchy skin, poison ivy-like symptoms
- Reactions can be delayed
- Report allergy to supervisor.
- Use low latex protein gloves.
- Alternative: nitrile

**Engineering Controls**
Centrifugation

- Disruption or leakage during centrifugation generates aerosols
- Sealed centrifuge safety cups are advisable for high concentrations or large volumes of infectious agents.
- Required for BSL3
- Must be opened in the BSC

Aerosols

- Grinding
- Blending
- Sonication
- Homogenization
- Intranasal inoculation
- Harvesting infected tissues
Biological Safety Cabinet (BSC)

- The BSC is the principle device used to provide containment of infectious splashes or aerosols.
- Class II, Type A2 BSCs provide personnel environment, and product protection.
- If BSC is unavailable, PPE (e.g. surgical mask & faceshield) must be used.
- Refer to Biosafety Webpage.

Chemical Fumehood

Open Flame Use in Jordan Hall BSC
**Bunsen Burner Alternatives**

![Image of Bunsen Burner]

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**Biological Safety Cabinet Certification**

- Required annually or when moved.
- Refer to EHS Biosafety Webpage for program information and to view eligible vendors

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**Golden Rules**

- Do Not Mouth Pipette
- Avoid Spills & *Aerosolization*
- Sharps: Avoid, Do Not Recap, Dispose
- Use Lab Coats & Gloves
- Wash Hands After Working with Agents
- Decontaminate Work Surfaces Often
- Never Ingest Anything in the Lab
Post Exposure & Follow-up

- Wash exposed area
- Notify supervisor & report to UVA WORK MED (243-0075) or Student Health (924-5362)
- Report to Biosafety Office
- After Hours or Severe Injury: Hospital Emergency Department
- Questions: OEHS 2-4911
Susceptible Individuals

- Pregnancy
- Organ Transplants
- Immunocompromised
  - Chemotherapy
  - Radiation Treatment
  - HIV Positive
  - UVA WorkMed 3-0075

Tell your physician if you work with biological agents, especially in cases of unexplained illness!

When in Doubt ......

Contact OEHS:

- Phone 982-4911
- Written programs available
- Consultation
- www.ehs.virginia.edu