

Blood-borne Pathogen Training, Practice, and Critique of Cinematic Misportrayals

Resource Type: Curriculum: Classroom

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Abstract

Three activities are described: an abbreviated blood-borne pathogen (BBP) training session, a BBP spill cleanup, and a critique of BBP mishaps in the movie *Outbreak*. The three activities may be done at the same time, individually, or in pairs; students work in small groups. For the training and the spill, students are asked to categorize the functions of spill kit components. For the movie, students are asked to identify examples of small and egregious errors in the movie and suggest ways that each error could have been avoided. The latter activity can also be used to demonstrate various terms from epidemiology, all under the guise of critiquing the movie portrayals.

Activity

Invitation for User Feedback. If you have used the activity and would like to provide feedback, please send an e-mail to MicrobeLibrary@asmusa.org. Feedback can include ideas which complement the activity and new approaches for implementing the activity. Your comments will be added to the activity under a separate section labeled "Feedback." Comments may be edited.

INTRODUCTION

Prep Time Required.

Training: approximately 1 hour for acquisition and display.

Movie: less than 30 minutes if compiling a sampler videotape of selected scenes; 2 to 3 hours if viewing the entire film.

Class Time Required.

Training: 15 to 20 minutes

Movie selection: 5 to 20 minutes

Learning Objectives.

This activity was designed give students an exposure to blood-borne pathogens training without exposure to the pathogens themselves. In addition to improving attention and response to common problems, the activities also aid in overcoming the students' perception that safety instruction is an obstacle to progress by presenting the training as preparation for a critique of the behavior of others. Students observe portrayals of several professional microbiologists and can then investigate real career options. They also see demonstrations and portrayals of a number of epidemiology terms and concepts.

At the completion of these activities students should be able to:

- explain safe microbiological procedures in the laboratory.
- explain safe protective procedures in the laboratory.
- explain emergency procedures in the laboratory.
- recognize unsafe practices performed by others.
- identify possible consequences of unsafe practices.

Background.

If this activity is included as part of a laboratory meeting, students should be familiar with basic expectations for safe behavior in the laboratory setting. Specifically, they should have been introduced to Universal Precautions and ideally should have signed a safety rules agreement, in which they agree to abide by Universal Precautions and other rules as set down in the document. If used in a lecture-only course, Universal Precautions should have been introduced. If this activity is being used as a demonstration of terms in epidemiology, there should have been at least some introduction to those terms. For either the lecture or the lab setting, some description of the four biosafety levels should have been given. These levels are presented visually in the scene of *Outbreak* listed first in Appendix 5, but I find introduction of the labels and definitions of basic levels should precede the film segment so students understand expectations and keywords and know what factors are being emphasized.

PROCEDURE

Materials.

BBP training:

- Universal Precautions (example in [Appendix 1](#))
- video playing equipment compatible with format of presentation
- BBP training video, run time 10 to 20 minutes, with optional handouts (sample outline in [Appendix 2](#))
- local campus or department Exposure Control Plan
- campus or department spill kit (contents list in [Appendix 3](#) and procedure in [Appendix 4](#))

Mock BBP spill:

- campus or department spill kit (contents list in [Appendix 3](#) and procedure in [Appendix 4](#))
- fake blood

Movie critique:

- video (*Outbreak*, Warner Home video, 1995; selected scenes listed by time in [Appendix 5](#) and by topic in [Appendix 6](#))
- Centers for Disease Control and Prevention (CDC) List of Notifiable Diseases (1999 list in [Appendix 7](#))
- definitions of biosafety levels (example in [Appendix 8](#))
- brief descriptions of real activities of the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) and CDC ([Appendix 9](#))

Student Version.

- [Student instructions](#)
- [Student worksheet](#)

Instructor Version.

1. For all three activities review Universal Precautions. If this information has previously been introduced, review that source. If another source (e.g., materials included with a training kit) is available, that material can be distributed. If no other source is available, a summary in outline form is included in Appendix 1, along with the websites for CDC information.
2. Distribute student instructions and student worksheets.
3. For the abbreviated training: cover BBP training topics (typical list included in Appendix 2). I use a training kit prepared by the campus Office of Risk Management, the same materials I use when giving BBP training to various groups on campus. (I train the Children's Center staff and the science faculty; the Director of Risk Management trains the nonacademic staff; the police and health service staff both have outside, specialized trainers.) This training kit contains a series of overheads of the outline, a professionally produced video, and a cleanup kit (typical contents listed in Appendix 3).
4. Have students examine contents of BBP cleanup kit; a list of common components and their functions is included in Appendix 3.
5. Have students identify which components of the cleanup kit are used for which functions (personal protective equipment, limit and disinfect spill, removal of spill, follow-up).
6. Fake spill: I have included a spill cleanup protocol and incident report in Appendix 4 and a recipe for fake blood, derived from Penn and Teller, under Supplementary Materials.
7. Movie critique: introduce biosafety levels (information included in Appendix 8) and show *Outbreak* scene on biosafety levels (first scene listed in Appendix 5).
8. Show other selected scenes from *Outbreak* as appropriate to support pedagogical content; the number and choice of scenes is not fixed. Ask students to record observations on worksheet.
9. Have students complete discussion questions in small groups after viewing the scenes.

Tips:

1. Borrow a BBP training tape from your local safety office. These tapes are outrageously expensive and highly under-exploited.
Sources for BBP training tapes: every science supply house (Fisher, VWR, etc.) has a section of safety materials (tapes, plans, and kits), often in the \$300 to \$500 range. In addition, companies specializing in safety (e.g., Lab Safety Supply, Janesville, Wis.) or in video training materials (e.g., Savant, Fullerton, Calif.) also carry training tapes. Finally, the Howard Hughes Medical Institute (HHMI) has produced a number of videos on safety in biomedical research; their 1994 film, *HIV: Controlling Your Risks in the Research Laboratory* can be used. HHMI videos can be ordered online at: <http://catalog.hhmi.org/index.jsp>.
2. Set time limits for analysis of each clip. Although stimulating, film discussions can get contentious and carried away.
3. Access the BBP Exposure Control Plan. If you, like I, participated on the team that wrote and updates these plans, you may well have your own copy in your office or in your department. If this is new to you, the Occupational Safety and Health Administration (OSHA) mandated writing of plans to aid employees in avoiding exposure to blood-borne pathogens, focusing on employees who might expect exposure as part of their work duties. Today, OSHA oversees compliance of this mandate for commercial sites (including hospitals), while state universities are reviewed by state agencies. Employees are divided into three categories based on their likelihood of exposure (high, moderate, or low), with police, health care workers, and daycare workers in the high likelihood for exposure group. Thus, somewhere on your campus there is an Exposure Control Plan, and as an employee, you have a right to know about the plan and may ask for access to read it or obtain a copy of it. If you are unsure of who has this document, try looking in the list of administrative offices for "Risk Management," "Safety," or some other division under the auspices of the Vice Chancellor for Administrative Affairs or equivalent office of higher administration. For example, our office has the comprehensive title of "Environmental Health, Risk Management, Safety and Loss Control."

Safety Issues.

- For the abbreviated BBP training or the critique of *Outbreak*, there are no safety issues.
- If mock spill cleanup of fake blood is included as a demonstration or for student participation, instruct the students to follow the steps for any potential BBP spill: treat the mock spill as though it is indeed a spill of blood and follow the protocol in Appendix 4. Safety rule of thumb: if you don't know what it is, assume it is blood or other potentially infectious material and act accordingly.

ASSESSMENT and OUTCOMES

Suggestions for Assessment.

- Peer oral assessment is incorporated into the activities through group discussion and whole class discussion and feedback.
- For each activity, students answer questions directly related to the activity. In addition, two to six questions are presented to stimulate further evaluation and integration of information.
- Concepts can be included on a subsequent quiz or exam.

Field Testing.

I have done these activities with several microbiology sections (a required course for most of our biology majors) and several sections of two nonmajors courses (one a general science course and one a terminal general biology course); other faculty have not previously tested these activities. However, the concept of using science fiction films to teach a wide range of basic science concepts is described in Dubeck et al., 1994, in an "edutainment" (education + entertainment) format.

My department uses a common Faculty and Course Evaluation sheet which does not have any place for relative comparison of labs. However, occasionally students have written or otherwise shared comments. They generally rate this as one of the top five class activities.

1. Students like this activity. Cynically, they don't have to "work." "Fun activity, but educational too."
2. Most students have never analyzed a movie for its degree of realism. They have experience with plot, characters, and special effects, but they have not looked at the portrayal of how a job is performed. "I've never thought about technical stuff in movies before—this was interesting."
3. Most students comment that it made them pause or work more carefully in lab. "I'm never touching any moving equipment again." "Made me wonder about touching sick people."
4. By the end of the movie, students are known to shout out comments at the characters, trying to warn them about potentially and inevitably dangerous actions they are about to perform. Scene 17—"Put down the syringe! Oh (expletive)!" Scene 19—"Don't touch that monkey!" Scene 19—"Don't open your helmet, you (expletive)!"

SUPPLEMENTARY MATERIALS

Possible Modifications.

- *Timing and setting:* I have used the three activities individually, together, or in pairings of the training with one of the others. I use variations for different audiences. It works well during a lab period where students need to complete some experiments but will not be beginning any new ones (especially before Thanksgiving, spring break, or the end of the semester). For the critique, I have shown selected scenes or the whole movie.
- *Audience:* This activity works well at different levels, with different emphases for nonmajors (portrayals and misportrayals of scientists in the media, stimulus for independent study or honors option project) and majors (identify errors, demonstrate epidemiology terms, identify career opportunities). Students, and most of the rest of us, love being asked to play critic in this fashion, and there are both good and hideous moments in this film. *An aside:* If you are familiar with the film, you may notice that I have cut virtually all of the military scenes. Once when I was showing the whole film, we had a marvelous time critiquing the microbiology, and then an ROTC student led us into a whole other critique of the portrayal of the military.

References.

Microbiology sources

Microbiology safety

1. **Barkley, W. E., and J. H. Richardson.** 1994. Laboratory safety. In P. Gerhardt, R. G. E. Murray, W. A. Wood, and N. R. Krieg (ed.), *Methods for general and molecular bacteriology*. American Society for Microbiology, Washington, D.C.
2. **Fleming, D. O., J. H. Richardson, J. J. Tulis, and D. Vesley.** 1995. *Laboratory safety: principles and practices*, 2nd ed. American Society for Microbiology, Washington, D.C.
Note: the third edition of this book is now available.
3. **Lennox, J. E.** Websites related to laboratory safety. <http://www.personal.psu.edu/faculty/j/e/jel5/micro/safety.htm>.
4. **U.S. Department of Health and Human Services (PHS, CDC, NIH).** 1999. *Biosafety in microbiological and biomedical laboratories*, 4th ed. U.S. GPO, Washington, D.C.

Microbiology lab manuals with Universal Precautions statements

1. **Atlas, R. M., A. E. Brown, and L. C. Parks.** 1995. *Experimental microbiology*. Mosby, St. Louis, Mo.
2. **Seeley, H. W., Jr., P. J. VanDemark, and J. J. Lee.** 1991. *Microbes in action*, 4th ed. W. H. Freeman and Co., New York, N.Y.

Note: most commercially published lab manuals have a Universal Precautions statement; several textbooks also include some such information.

Safety sources

1. **Fuscaldo, A. A., B. J. Erlick, and B. Hindman (ed.).** 1980. *Laboratory safety: theory and practice*. Academic Press, New York, N.Y.
2. **Martin, J. C.** 1980. Behavioral factors in laboratory safety: personnel characteristics and the modification of unsafe acts.

- In A. A. Fuscaldo, B. J. Erlick, and B. Hindman (ed.), Laboratory safety: theory and practice. Academic Press, New York, N.Y.
3. **University of Wisconsin—Whitewater.** 1993. Bloodborne pathogens exposure control plan. Office of Risk Management and Safety, University of Wisconsin—Whitewater, Whitewater, Wis.
 4. **Federal Register.** 1991. Bloodborne pathogens. Fed. Regist. **56**:64175-64182.

Other resources

1. **Dubeck, L. W., S. E. Mozier, and J. E. Boss.** 1994. Fantastic voyages: learning science through science fiction films. American Institute of Physics, Woodbury, N.Y.
2. **Dworet, L., and R. R. Pool.** 1995. Outbreak. Warner Brothers, Burbank, Calif.
Note: the movie is available from Warner Home Video in VHS format.
3. **Garrett, L.** 1994. The coming plague: newly emerging diseases in a world out of balance. Farrar, Straus, and Giroux, New York, N.Y.
4. **Preston, R.** 1994. The hot zone. Anchor Books Doubleday, New York, N.Y.

Appendices.

- [Appendix 1. Brief Description of Universal Precautions](#)
- [Appendix 2. Outline of Topics for Bloodborne Pathogens Training](#)
- [Appendix 3. Bloodborne Pathogens Cleanup Kit Contents List](#)
- [Appendix 4. BBP Cleanup Protocol and Incident Report Form](#)
- [Appendix 5. *Outbreak* by Scenes \(with times\)](#)
- [Appendix 6. *Outbreak* by Topics in Epidemiology](#)
- [Appendix 7. CDC List of National Notifiable Infectious Diseases for 1999](#)
- [Appendix 8. Definitions of Biosafety Levels](#)
- [Appendix 9. The Real Microbiologists—USAMRIID and CDC](#)

Recipes.

Recipe for fake blood from Penn and Teller's Bleeding Heart Gelatin Dessert:

- 1 cup corn syrup
- 1/2 cup grenadine
- 0.3 oz. red food coloring
- 3 drops blue food coloring

Jillette, P. and T. Jillette 1992. Penn and Teller's how to play with your food, p.104-109. Villard Books, New York, N.Y.

Curriculum Resources

Appendix 1. Brief Description of Universal Precautions

Blood and other body fluids should be considered infective.

Work in microbiology laboratories

Workers in microbiological research laboratories are exposed to health hazards and need to employ Universal Precautions.

1. Suit up with personal protective equipment before starting procedure.
2. Secure the samples; avoid spills and leaks.
3. Use the biohazard cabinet. Prevent aerosol formation by manipulating specimens in the safety hood.
4. Transfer liquids with positive displacement devices-**no** mouth pipetting!
5. Avoid contact with sharps. Use needles and syringes only if no alternative. Discard safely. Do not reuse.
6. Decontaminate work surfaces if a spill occurs and each time you are done working.
7. Decontaminate or dispose of any contaminated, consumable supplies. Use the autoclave bags with clearly marked biohazard labels or logos.
8. Decontaminate and clean equipment after you finish work, if there is a spill, and before you or someone else repairs the instrument.
9. Wash your hands and remove protective clothing before leaving the laboratory.
10. Work in the laboratory, eat or drink in the safe area, do personal care in the rest room.
11. Follow the Spill Protocol.

Work with patients

Medical histories and external examination cannot identify all patients infected with human immunodeficiency virus or other blood-borne pathogens; precautions should be used for **all** patients.

1. Wear gloves plus other barriers when in contact with humans.
2. Wash your hands immediately and thoroughly if contact is made with bodily fluids. Wash your hands immediately after removing gloves.
3. Be supremely careful with sharps—needles, syringes, scalpel blades, etc. Dispose of them in a puncture-resistant container.
4. Do not work with patients or patient care equipment if you have damaged skin (weeping lesions, dermatitis, etc.).

Online availability of Centers for Disease Control and Prevention materials on Universal Precautions

Summary document: "Universal Precautions for Prevention of Transmission of HIV and Other Bloodborne Infections" <http://www.cdc.gov/ncidod/hip/blood/universa.htm>

Written guidelines: Universal Precautions are discussed in the following documents:

1. **Centers for Disease Control and Prevention.** 1987. Recommendations for prevention of

HIV transmission in health-care settings. *Morb. Mortal. Wkly. Rep.* **36**: (suppl no. 2S).
<http://aepo-xdv-www.epo.cdc.gov/wonder/prevguid/p0000318/p0000318.asp>

2. Centers for Disease Control and Prevention. 1988. Update: universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B virus, and other bloodborne pathogens in health-care settings. *Morb. Mortal. Wkly. Rep.* **37**:377-388.
<http://aepo-xdv-www.epo.cdc.gov/wonder/prevguid/p0000255/p0000255.asp>

3. Centers for Disease Control and Prevention. 1989. Guidelines for prevention of transmission of human immunodeficiency virus and hepatitis B virus to health-care and public-safety workers. *Morb. Mortal. Wkly. Rep.* **38**(S-6):1-36. <http://aepo-xdv-www.epo.cdc.gov/wonder/prevguid/p0000114/p0000114.asp>

These three documents may be obtained by calling the AIDS Hotline at 1-800-342-2437 or the National AIDS Information Clearinghouse at 1-800-458-5231.

Curriculum Resources

Appendix 2. Outline of Topics for Blood-borne Pathogens Training

Outline

- I. Background
 - A. OSHA
 - B. BBP
 - C. OSHA Standard
 - i. Exposure Control Plan
 - ii. Training
 - iii. Setting – PPE & engineering controls
 - iv. Vaccination
- II. Villains
 - A. Human immunodeficiency virus (HIV)
 - B. Hepatitis B virus (HBV)
 - C. Transmission
- III. Who's at risk?
 - A. Level 1
 - B. Level 2
 - C. Level 3
 - D. "Good Samaritans"
- IV. Reducing chances of exposure
 - A. Universal precautions
 - B. Engineering controls
 - C. Personal protective equipment
 - D. Housekeeping controls
 - E. Exposure control plan
 - F. Fair Warning: labels, bags, containers
 - G. Behaviors to avoid
- V. What to do if an exposure occurs
 - A. Victim – wash injury, visit emergency room, receive medical tests, maintain privacy of records
 - B. Response – contain spill, area; disinfect; dispose of contamination
 - C. Incident report – privacy of records

BBP Training Topics - Notes

I. Background

- OSHA = Occupational Safety and Health Administration: federal agency with mission of improving safety of working conditions.
- BBP = blood-borne pathogens: agents of disease carried by blood and bodily fluids.
- OSHA Standard: federal statute that covers employees who, as a result of doing their job, could come into contact with blood or other potentially infectious material (OPIM) through the eyes, skin, mucous membrane, or under the skin by means of a needlestick, cut, or human bite.
- Exposure control plan: analysis of work to identify those at risk; determine methods for lowering risk and improving protection.
- Training: regular instruction in correct (safe and efficient) work practices, use of equipment, etc. to aid in avoiding exposure to pathogens.
- PPE = personal protective equipment: gloves and other clothing, equipment and devices **worn** to

protect an individual from exposure to pathogens.

- Engineering controls: structural barriers, equipment, and other **objects** that aid in reducing exposure to pathogens.
- Vaccination: hepatitis B vaccination: hepatitis B virus (HBV) is a bigger risk than HIV (see below).

Vaccine against HBV available & will prevent disease; it must be provided by employer free of charge; employee may decline and later accept.

II. Villains

- HIV = human immunodeficiency virus; leads to AIDS (acquired immunodeficiency syndrome); no vaccine, no proven treatment; near 100% mortality.
- HBV = hepatitis B virus; acute and chronic swelling of liver, disease has minimum 3-6 month recovery time; no treatment, but vaccine exists; 0.5 to 1% fatality, but 15 to 25% premature death due to cirrhosis or cancer following infection.
- Both caused by viruses that can be carried in blood or other bodily fluids.
- Transmission of blood-borne diseases: carried by blood and bodily fluids; stopped by intact skin but can enter through eyes, skin (broken, rash, etc.), or mucous membranes; can enter under skin by means of a needlestick, cut, or human bite.
- Blood and OPIM: bodily fluids may include semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, and amniotic fluid.
- Caution around blood, OPIM, saliva, any fluid that visibly contains blood, and unidentified fluid.

III. Who's at risk?

- Level 1: all employees may be expected to incur occupational exposure to human blood or OPIM.
 - Examples: clinical staff, child care providers, life guards, athletic trainers, campus police and security officers; and instructors, researchers and student employees in laboratories where human blood and OPIM are normally used on a frequent basis.
- Level 2: some employees may have occupational exposure.
 - Examples: Custodial and housekeeping staff, launderers, plumbers; and instructors, researchers and student employees in laboratories where human blood and OPIM are used in selected laboratories.
- Level 3: Exposure to blood and bodily fluid is not a condition of employment nor is it expected among job-related duties.
 - Examples: secretaries, administrators, accountants, and instructors.
- "Good Samaritans": people who choose to help and are not being exposed because it is a requirement in their job descriptions.

IV. Reducing chances of exposure

- Work practices incorporate Universal Precautions: regular handwashing, avoiding cuts, minimizing spray or splash of fluids, assuming materials are dangerous; no eating, drinking, or facial contact (including contact lenses); storing food and drink separately from samples.
- Engineering controls: eliminate and improve hazardous structures and equipment; identify, remove sharps; check and maintain equipment; never touch used sharp, discard into puncture-resistant, leakproof, labeled container.
- PPE = personal protective equipment: items of clothing and covering provided free of charge by employer that do **not** allow passage of blood or OPIM; must be accessible and available in appropriate sizes; hypoallergenic if necessary; clean and in good repair.
- Housekeeping controls: avoid spills, cleanup immediately if they happen; have a regular written schedule of review; maintain supplies for decontamination; arrange for proper disposal of sharps and

collected materials (autoclave or biomedical waste hauler).

- Exposure control plan: written set of rules and protocols for avoiding or dealing with exposure incidents.
- Communicating hazards: have red or orange signs and bags with three-bladed logo in black available; post signs on packages of regulated waste, storage areas including refrigerators or freezers, and shipping containers.

V. What to do if an exposure occurs

- Follow written protocol in Exposure Control Plan; have plan posted on walls.
- Victim: wash injury, arrange for visit to emergency room or designated health care provider; medical test(s) will be performed and charged to employer.
- Response: follow clean up protocol in Exposure Control Plan. Contain spill and area so material is not spread; disinfect; and dispose of contamination.
- Incident report: records will be private and secure; filled by safety office, **not** supervisor or co-workers.
- Occupational exposure incident: person in a work situation comes into contact with blood or OPIM. Employer must provide immediate and confidential medical evaluation-how incident occurred, identify and test source of OPIM if possible, test employee's blood if consent given, provide counseling, and evaluate reported illness

Internet BBP resources

1. Information from OSHA

BBP Standard - Regulations from OSHA

The BBP Standard was effective December 1991, issued in 1992 as CPL 2-2.44C. http://www.osha-slc.gov/OshStd_data/1910_1030.html

"Scope and Application. This section applies to all occupational exposure to blood or other potentially infectious materials as defined by paragraph (b) of this section."

BBP Standard - Updates from OSHA

The BBP Standard was updated in 1999, reflecting 7 years of new technology, research, treatments, and interpretations, issued as CPL 2-2.44D.

<http://www.osha.gov/media/oshnews/nov99/national-19991105.html>

2. A very nice overview or background reading

Texas A&M University – Fact Pages on BBP (6 pages), 1997

<http://safety.science.tamu.edu/bloodborne.html>

3. Full-blown, online training

Oklahoma State University – Training Module

<http://www.pp.okstate.edu/ehs/MODULES/bbp1.htm>

"This training module is designed to provide a basic understanding of bloodborne pathogens, common modes of their transmission, methods of prevention, and other pertinent information."

University of Medicine & Dentistry of New Jersey Environmental & Occupational Health & Safety Services (EOHSS) – Self-Study Module (PDF)

<http://www2.umdj.edu/eohssweb/clinical/booklet.pdf>

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Appendix 3. Blood-borne Pathogens Cleanup Kit Contents List

Personal protective equipment (PPE)

- Hands: gloves, latex or nylon
- Front body and arms: gown, aprons
- Eyes and face: goggles, safety glasses, eye shield, facemask (surgical mask)
- Feet: shoe cover, booties (removed following cleanup to prevent transfer to other areas)
- Gross exposure pack includes gown, face mask, shoe covers

Limit and disinfect

- Trap: paper towels, wipes
- Absorb: paper towels, powder (e.g., cat litter), absorbent beads, absorbent pillow, wipes with polyethylene backing
- Disinfect: spray bottle with 10% bleach solution, made fresh daily or just in time for use

Removal

- Disposable bag: orange or red with three-bladed biohazard symbol
- Scoop: disposable, disinfectable
- Bag closure: tape or tie

Follow-up

- Handwipes and sanitizers for cleanup personnel
- Exposure/incident report form

Curriculum Resources

Appendix 4. Blood-borne Pathogens Cleanup Protocol

I. Simple sample spill

Secure the area, yourself, & the spill

PPE: personal protective equipment

L&D: limit and disposal

Removal: removal of contaminated materials

Communicate: letting others know

Spill in a BSL 1 Area

PPE - Wear disposable gloves.

L&D - Soak paper towels in disinfectant and place over spill area.

- Clean spill area with fresh towels soaked in disinfectant.

Removal - Place paper towels in plastic bag for disposal.

Spill in a BSL 2 area

Communicate - Alert people in immediate area of spill.

PPE - Put on protective equipment: lab coat with long sleeves, back-fastening gown or jumpsuit, disposable gloves, disposable shoe covers, safety goggles, and mask or full-face shield.

L&D - Cover spill area with paper towels or other absorbent materials.

- Carefully pour a freshly prepared 1 in 10 dilution of household bleach around the edges of the spill, and then onto the spill.
- Avoid splashing.
- Allow a 20-minute contact period.
- Use paper towels to wipe up the spill, working from the edges into the center.
- Place paper towels in plastic bag for disposal.
- Clean spill area with fresh towels soaked in disinfectant.

Removal - Place towels in a plastic bag and decontaminate in autoclave.

II. Spill and emergency (injury)

5 C's: calm, care, communicate, contain, clean

- Calm yourself, call for help from other occupants of room.
- Attend to injured or contaminated persons and remove them from exposure.
- Have person knowledgeable of incident and laboratory assist emergency personnel.
- Mark spill to avoid wandering. Cordon off area if possible.
- Clean area as above after injury has been treated.

Curriculum Resources

Appendix 4. *Outbreak* by Scenes (with times)

Timing

<i>Outbreak</i> (Warner Bros., 1995) - Selected scenes		
Time^{a,b}	Duration^c	Synopsis
00:04:58 to 00:08:05	3 min 10 s	Visit to USAMRIID at Fort Detrick, Virology Section: brief definitions of four biosafety levels.
00:13:53 to 00:17:15	3 min 20 s	Epidemic village: inexperienced team member panics.
00:24:07 to 00:26:28	2 min 30 s	Two experienced researchers suit-up with buddy system, one finding tear on distracted partner.
00:33:13 to 00:34:19	1 min 5 s	Series of transmissions: monkey is stolen, infects thief (sputum), taken to pet store and infects storeowner (scratch) and another monkey (food).
00:34:57 to 00:38:12	3 min 15 s	More transmissions: monkey released in forest; thief ill on plane, kisses girlfriend (bodily fluids), collapses in Boston; store owner collapses in California, hospital personnel respond; med tech opens running centrifuge (broken tube & blood spray).
00:38:45 to 00:40:50	2 min 5 s	Thief and girlfriend in isolation ward at hospital as Center for Disease Control and Prevention (CDC) team arrives; thief dies; autopsy and transfer of scalpel.
00:42:05 to 00:44:14	2 min 10 s	More transmission: med tech coughing in theatre in California (airborne); viral view of movement.
00:44:15 to 00:44:50	35 s	Team back at CDC Epidemic Control Center: all passengers on plane (other than thief) okay; then FAX from California hospital – epidemic.
00:48:20 to 00:52:36	4 min 20 s	Army quarantines California town; CDC team arrives; rounds of patients in "isolation"; patient in another ward shows signs (nosocomial); viral view of movement.
00:53:48 to 00:55:10	1 min 25 s	Examination of viral scanning electron micrographs; analysis of cases: too short for mutation, must have two viruses.

00:57:44 to 00:58:21	40 s	CDC team enters pet shop looking for host, finds second monkey.
1:00:14 to 1:00:56	45 s	Conduct enzyme-linked immunosorbent assay for virus.
1:02:05 to 1:04:20	2 min 15 s	Army unloads "E-1101" antiserum; analyzing "E-1101."
1:06:10 to 1:06:57	45 s	Taking blood samples from community members; second monkey ill; blood testing positive.
1:07:55 to 1:09:40	1 min 45 s	Contact with importer/holding facility (source of host = first monkey); exhaustion of personnel, carelessness leads to torn suit.
1:11:50 to 1:12:34	45 s	Disposal of dead: body bags, trucks, barn, burn.
1:15:45 to 1:19:19	3 min 35 s	Second monkey up, antiserum works; suit victim has seizure; needlestick during exam (exposure).
1:32:13 to 1:34:38	2 min 25 s	Tracking first monkey: dead body of original owner, discovery of photo of first monkey, appeal for help in finding it.
1:49:31 to 1:52:11	2 min 45 s	Capture of first monkey; removal of containment suit guarantees exposure.

^a Times were

measured for a VHS copy of the movie playing on a VCR timer, beginning at the start of the first scene (on my copy, ~1 min, 25 s from the start of **tape movement**); times recorded may vary from an alternate source (e.g., DVD).

^b Times are approximate. They are listed here to help users speed through to key scenes.

^c The time of duration was measured by stopwatch, then rounded up to the nearest 5 s interval.

DWB's top five scenes (in numerical order):

Scene 1. This scene shows biosafety level 1 through 4 labs, with on-screen written description of characteristic features of each. Good visual introduction or reinforcement of the levels and differences between them.

Scene 4 and/or 5. These scenes show sequential movement of virus (reasonably realistic), by different modes of transmission (unlikely one pathogen would do all). Each example provides visual display of portal of exit (mouth, wound, bite, scratch) and type of transmission (contact, fomites). End of Scene 5 has major lab screw-up, which can be a strong warning to students.

Scene 9. In this scene, there is a large-scale quarantine (a rather foreign concept to most students). Medical personnel participate in rounds and exams, giving students a chance to observe the steps from

the side instead of as patient. End of scene has identification of nosocomial infection, providing reinforcement of that problem. I mention the increasing number of hospitals hiring Infection Control Officers at this point.

Scene 10. Abbreviated but logical example of scientific method and logical analysis. Teams participate in brainstorming, review collected data, make predictions, and arrive at a conclusion that instead of one virus, they are dealing with two. Good presentation of communication skills in scientific work group: respectful, energetic, somewhat tense but still logical.

Scene 17. Patient (one of medical personnel) goes into seizure; strong example of damage. Another individual has needlestick event; exemplifies appropriate follow-up, and also the fact that that won't be enough.

 Curriculum Resources
Appendix 6. *Outbreak by Topics in Epidemiology*

Topic and context	Segment # ^a
Antiserum – as treatment	17
Antiserum – aka: antibodies, gamma globulin, plasma	13
Autopsy – thief	6
Blood-borne pathogen (BBP) – engineering controls (layouts of rooms)	1
BBP – personal protective equipment (PPE) (and buddy system)	3
BBP – PPE (environmental suits, initiation of quarantine)	9
BBP – PPE (environmental suits, Centers for Disease Control and Prevention [CDC] at pet store)	11
BBP – PPE (environmental suits, epidemic village)	2
BBP – PPE (gear used at each level)	1
BBP – PPE (hospital personnel)	5
BBP – PPE (level 4)	3
BBP – psychological aspects: correct protocol (transfer of scalpel)	6
BBP – psychological aspects: exhaustion and error (exposure incident)	15
BBP – psychological aspects: inattention and error (needlestick; exposure incident)	17
BBP – psychological aspects: inattention and error (med tech and broken tubes in centrifuge; exposure incident)	5
BBP – psychological aspects: lack of concentration	3
BBP – psychological aspects: panic	2
Behavior of pathogenic agent within host population: infectious, communicable, contagious	4
Biosafety level 4	3
Biosafety levels – definitions (printed on screen)	1

Biological warfare – research (Fort Detrick)	1
CDC	6,8
Compromised host, secondary infection	9
Development of disease – incubation, prodrome, clinical signs and symptoms, recovery or death (thief)	4,5,6
Development of disease – incubation, prodrome, clinical signs and symptoms, recovery or death (Army agent)	15,17
Development of disease – incubation, prodrome, clinical signs and symptoms, recovery or death (CDC agent)	17,18
Diagnosis – examination (CDC personnel examine thief and girlfriend)	6
Diagnosis – examination (hospital personnel examine thief)	5
Diagnosis – tests (bloodwork)	10
Diagnosis – tests (bloodwork)	14
Diagnosis – tests (enzyme-linked immunosorbent assay [ELISA])	12
ELISA	12
Epidemic – in situ (epidemic village)	2
Epidemic – multiple sites and numbers of affected individuals	8
Epidemiology – descriptive: collect all data (CDC collection of data)	8
Epidemiology – field work (epidemic village)	2
Epidemiology – field work (hospital visit)	6
Epidemiology – field work (epidemic town)	9
Epidemiology – field (examination of body of first owner of carrier monkey on ship; TV appeal for assistance)	18
Epidemiology – field work (capture carrier monkey)	19
Epidemiology – field work (CDC at pet store)	11
Epidemiology – field work (contact importer)	15
Epidemiology – surveillance (tracking current cases)	9, 14
Etiology – identification of pathogen	10,12

Exposure – remove containment suit	19
Immunity – species immunity, innate immunity, innate resistance	19
Infectious agent – visualization by scanning electron microscopy	10
Inference – logical analysis of data	10
Morbidity	14
Mortality – disposal of dead	16
Mortality – thief dies	6
Nosocomial infection – agent through air ducts	9
Occurrence frequency – epidemic, pandemic potential	8
Pathology - damage to organs	2,10
Quarantine – disposal of dead	16
Quarantine – establishment	9
Reservoir – sylvatic (wild animal)	4
Signs and symptoms – pet store owner	5
Signs and symptoms – thief and girlfriend in isolation ward	6
Signs and symptoms – thief in airport	5
Signs and symptoms – thief on plane	5
Transmission – direct contact (first monkey to store owner)	4
Transmission – direct contact (thief to girlfriend, kiss)	5
Transmission – droplet nuclei (sneeze-cough in theatre)	7
Transmission – indirect contact (food from first to second monkey)	4
Transmission – indirect contact by fomites (sputum from 1 st monkey to thief)	4
Transmission – indirect contact, via fomite (contaminated syringe)	17
Transmission – vehicle, airborne (hospital)	9
U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID)	1

^a Segment number corresponds to listing in Appendix 5.

Curriculum Resources

Appendix 7. Infectious Diseases Designated as Notifiable at the National Level During 1999 by the Centers for Diseases Control and Prevention

Source: <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4853a1.htm>

Acquired immunodeficiency syndrome (AIDS)

Anthrax

Botulism

Brucellosis

Chancroid

Chlamydia trachomatis, genital infection

Cholera

Coccidioidomycosis

Cryptosporidiosis

Cyclosporiasis

Diphtheria

Ehrlichiosis, human granulocytic

Ehrlichiosis, human monocytic

Encephalitis, California serogroup viral

Encephalitis, eastern equine

Encephalitis, St. Louis

Encephalitis, western equine

Escherichia coli O157:H7

Gonorrhea

Haemophilus influenzae, invasive disease

Hansen disease (leprosy)

Hantavirus pulmonary syndrome

Hemolytic uremic syndrome, postdiarrheal

Hepatitis A

Hepatitis B

Hepatitis C; non-A, non-B

Human immunodeficiency virus (HIV) infection, adult

HIV infection, pediatric

Legionellosis

Lyme disease

Malaria

Measles

Meningococcal disease

Mumps

Pertussis

Plague

Poliomyelitis, paralytic

Psittacosis

Rabies, animal

Rabies, human

Rocky Mountain spotted fever

Rubella

Rubella, congenital syndrome

Salmonellosis

Shigellosis

Streptococcal disease, invasive, group A

Streptococcus pneumoniae, drug-resistant, invasive disease

Streptococcal toxic-shock syndrome

Syphilis

Syphilis, congenital

Tetanus

Toxic-shock syndrome

Trichinosis

Tuberculosis

Typhoid fever

Varicella (chickenpox)*

Varicella deaths

Yellow fever

* Although varicella (chickenpox) is not a nationally notifiable disease, the Council of State and Territorial Epidemiologists recommends reporting cases of this disease to CDC.

Curriculum Resources

Appendix 8. Biosafety Levels

Biosafety Level (BSL)	Definitions - Agents, Settings, Practices, Containment
BSL 1	<p>Agents: defined, well-characterized microbes not known to cause disease in healthy adult humans. Example: <i>Bacillus subtilis</i>.</p> <p>Setting: undergraduate and secondary schools, training and teaching labs.</p> <p>Practices: good microbiological practices, Universal Precautions.</p> <p>Containment: no special barriers; sink for hand washing.</p> <p>Primary concern: opportunists.</p>
BSL 2	<p>Agents: wide range of moderate-risk indigenous agents – locally found, known to cause disease, vaccines and/or treatments are available. Examples: hepatitis B, Salmonellae.</p> <p>Setting: clinical, diagnostic, advanced teaching and other laboratories.</p> <p>Practices: Universal Precautions, blood-borne pathogen safety.</p> <p>Primary concern: accidental exposure (percutaneous or mucous membrane), ingestion.</p> <p>Primary containment: biological safety cabinet (BSC) recommended, personal protective equipment (PPE) required.</p> <p>Secondary containment: handwashing sinks, decontamination facilities or area.</p>
BSL 3	<p>Agents: indigenous or exotic agents; may cause serious or lethal infection; potential for respiratory transmission. Examples: <i>Mycobacterium tuberculosis</i>, St. Louis encephalitis.</p> <p>Setting: clinical, diagnostic, research, or production facilities.</p> <p>Practices: good microbiological practices, Universal Precautions, BBP.</p> <p>Primary concern: avoid escape from work area.</p> <p>Primary containment: BSC required, PPE required.</p> <p>Secondary containment: handwashing sinks, decontamination facilities or area; controlled access, filtered ventilation (minimize release).</p>

BSL 4	<p>Agents: dangerous and exotic agents of high risk for life-threatening infections; may be transmitted by aerosol; no available therapy or vaccine.</p> <p>Example: Ebola, hemorrhagic fevers.</p> <p>Setting: Military and government sponsored facilities (only 6? in the world).</p> <p>Primayr concern: respiratory exposure. (All work here is a threat.)</p> <p>Primary containment: full-body, air-supplied, positive-pressure suit (complete isolation from aerosol).</p> <p>Secondary containment: separate building; highly controlled access; decontamination suites between building entrance and laboratory.</p>
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Curriculum Resources

Appendix 9. The Real Microbiologists

Centers for Disease Control and Prevention <http://www.cdc.gov/>

"The Centers for Disease Control and Prevention (CDC) is recognized as the lead federal agency for protecting the health and safety of people—at home and abroad, providing credible information to enhance health decisions, and promoting health through strong partnerships. CDC serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities designed to improve the health of the people of the United States.

"CDC, located in Atlanta, Georgia, USA, is an agency of the Department of Health and Human Services."

U.S. Army Medical Research Institute of Infectious Diseases <http://www.usamriid.army.mil/>

"The U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) conducts research to develop strategies, products, information, procedures, and training programs for medical defense against biological warfare threats and naturally occurring infectious diseases that require special containment. USAMRIID, an organization of the U.S. Army Medical Research and Materiel Command, is the lead medical research laboratory for the U.S. Biological Defense Research Program. The Institute plays a key role in national defense and in infectious disease research as the largest biocontainment laboratory in the Department of Defense for the study of hazardous diseases."

"The U.S. Army Medical Research Institute of Infectious Diseases is located at Ft. Detrick, in the foothills of western Maryland's Catoctin Mountains."

Garrett, L. 1994. *The coming plague: newly emerging diseases in a world out of balance.* Farrar, Straus and Giroux, New York, N.Y.

"A long, carefully documented and quite readable text giving an overview of the worldwide efforts of the "insect fighters" at the Centers for Disease Control and Prevention (CDC) of the U.S. Public Health Service and other agencies ranging from the U.N. to state, university, and local agencies to combat a panoply of both biological agents like HIV, Ebola, and the West Nile virus as well as new and much more virulent and drug-resistant strains of old enemies like tuberculosis, bubonic plague, a number of venereal diseases, and complex new public health concerns."

Preston, R. 1994. *The hot zone.* Anchor Books Doubleday, New York, N.Y.

"The true story of how a deadly virus from the central African rain forest suddenly appears in a Washington, D.C., animal test lab. In a matter of days, 90% of the primates exposed to the virus are dead, and secret government forces are mobilized to stop the spread of this exotic "hot" virus..."

EXCITE – materials for teaching epidemiology to 7th through 12th grade and undergraduates.

<http://www.cdc.gov/excite/index.htm>

Curriculum Resources

Figure 1. Student instructions

Background

In the late 1980s and early 1990s, there was increased concern by federal officials over the number of workers who, as part of their job responsibilities, were being exposed to pathogens carried by blood and other bodily fluids. These concerns were heightened through fear of the viruses that cause AIDS and hepatitis B. To control such exposures, the U.S. Occupational Safety and Health Administration (OSHA) established a standard (29 CFR 1910.1030) in 1991 on appropriate work practices for individuals at risk for exposure to blood-borne pathogens (BBP). As a federal mandate, these regulations have been adopted at universities, hospitals, law enforcement agencies, day care centers, and other locations across the country. Here on our campus, we developed our own version of the "Exposure Control Plan," adapting the recommended work practices for our local setting.

Materials

- BBP training video and materials
- local campus Exposure Control Plan
- emergency response kit
- video *Outbreak* and projection system

BBP training

In this activity, you will participate in an abbreviated BBP training session, very similar to the sessions attended by university employees. We will cover which pathogens are of greatest concern, which workers at greatest risk, how employers and employees can lower risk of exposure, and what to do should an exposure occur. After the training session, you will examine the spill response kit on display and identify the safety function of each item.

Mock BBP Spill

In this activity, you will view a demonstration of, or participate in, the proper removal of a spill potentially contaminated with BBP. Before beginning, consider the contents of the spill response kit. How and when will each item help protect you? What steps are taken in cleanup? How is decontamination achieved? Explain each step **before** it is initiated. After completion, consider this: are the participants clean or contaminated?

Critique of cinematic misportrayals of microbiologists

Despite rules and regulations, scientists and health professionals are still human and do make mistakes. To illustrate this in a hypothetical and extreme manner, we will be viewing the 1995 movie *Outbreak*, in which an Ebola-like virus arrives in this country. As you view the movie, you should note scenes that relate to the following: (i) disease transmission due to general human error - poor judgment, poor hygiene, and direct contact of mucous membranes; (ii) disease transmission due to professional error; (iii) modes of transmission; (iv) epidemiology; and (v) pathogenesis.

Curriculum Resources

Figure 2. Student Worksheet

BBP training

1. What is the key idea of "Universal Precautions"?
2. What does each of the following acronyms represent? Give both the name represented by the initials and a brief definition.
 - a. AIDS
 - b. BBP
 - c. HBV
 - d. HIV
 - e. OPIM
 - f. OSHA
 - g. PPE
3. Why are BBPs of such concern? Which BBPs are of the greatest concern? Why is OSHA involved?
4. Who is at risk for exposure to BBPs at work?
5. Name the four requirements of the OSHA BBP standard for employers.
6. How can the team of employers and employees improve workplace safety with regard to BBP?

BBP spill kit

1. Examine the objects in the BBP spill cleanup kit on display. Categorize each of the items by its role in spill removal and list them in the table below.

Personal Protective Equipment	Limit & Disinfect Spill
Remove Spill	Follow-Up



2. Differentiate the following:

- engineering controls
- personal protective equipment
- work practices
- housekeeping

Critique of cinematic misportrayals - *Outbreak*

As you view the selected scenes, look for information related to the following points. Make notes on a blank piece of paper about any agents, practices, containment, or other microbiological factors. In particular, keep a list of events that contribute to the spread of the pathogens.

1. What modes of transmission are cited for the pathogen(s) in the movie?
2. List the actions by citizens and health personnel that lead to transmission of pathogens. List the near misses.
3. Which of the actions that aided in transmission were due to minor human error? Which were grossly negligent? Which were not really errors at all?

Follow-up – Discussion questions

1. What portions of the Universal Precautions aid in preventing spread of such diseases? What portions of the BBP Exposure Control Plan serve this purpose?
2. What is the value of an Exposure Control Plan to nonscientist employees of a university or research facility, and to the general public?