

Biosafety-related Flow Cytometry Publications

- Merrill JT: Evaluation of selected aerosol-control measures on flow sorters. *Cytometry* 1:342-345, 1981.
First paper discussing the efficiency of aerosol control measures on cell sorters using T4 bacteriophage to tag aerosol droplets
- Kwan J: Assessment and characterization of aerosols generated from a dual-beam high-speed flow cytometer. Hazard Control Department Annual Technical Review, UCRL-50007-85, 1985.
Describes the use of lambda bacteriophage for measuring aerosol containment on a high-speed cell sorter with the settle plate method and with active air sampling
- Giorgi JV: Cell sorting of biohazardous specimens for assay of immune function. In: *Methods in Cell Biology* 42, Flow Cytometry, Darzynkiewicz Z, Robinson JP, Crissman HA (eds.), Academic Press, New York, 1994, pp 359-369.
The first chapter addressing the various laboratory aspects involved in biohazardous sorting experiments and describing a standardized method for assessment of aerosol containment using T4 bacteriophage
- Ferbas J, Chadwick KR, Logar A, Patterson AE, Gilpin RW, Margolick JB: Assessment of aerosol containment on the ELITE flow cytometer. *Cytometry (Communications in Clinical Cytometry)* 22:45-47, 1995.
Describes the effect of various aerosol control measures on containment as assessed with T4 bacteriophage using settle plates and active air sampling; presents also results on measuring the release of airborne particles using a particle counter
- Schmid I, Nicholson JKA, Giorgi JV, Janossy G, Kunkl A, Lopez PA, Perfetto S, Seamer LC, Dean PN. Biosafety guidelines for sorting of unfixed cells. *Cytometry* 1997;28:99-117.
Comprehensive official ISAC-approved guideline for performing sorting experiments using unfixed cells and known infected sort samples including a detailed protocol for aerosol containment measurement using T4 bacteriophage
- Schmid I, Hultin LE, Ferbas J: Testing the efficiency of aerosol containment on cell sorters. In: *Current Protocols in Cytometry*, Volume 1, Unit 3.3, Robinson JP, Darzynkiewicz Z, Dean P, Dressler L, Tanke H, Rabinovitch P, Stewart C, Wheelless L (eds.), Wiley & Sons, NY, 1997.
Detailed step-by-step protocol for measuring aerosol containment using T4 bacteriophage with the settle plate method and with an active air sampling method
- Sorensen TU, Gram GJ, Nielsen SD, Hansen JE: Safe sorting of GFP-transduced live cells for subsequent culture using a modified FACS vantage. *Cytometry* 1999; 37:284-290.
Describes aerosol control modifications on a cell sorter
- Schmid I, Kunkl A, Nicholson JKA: Biosafety considerations for flow cytometric analysis of human immunodeficiency virus-infected samples. *Cytometry (Communications in Clinical Cytometry)* 38:195-200, 1999.
Addresses the various safety aspects of performing analytic flow cytometry experiments on samples known to be infected with HIV
- Schmid I, Nicholson JKA, Kunkl A: Biosafety concerns for flow cytometric HIV immunophenotyping: Questions and answers. Adult AIDS Clinical Trial Group website at <http://aactg.s-3com/immlab.htm>.
Q and A about the practical laboratory aspects of analytic flow cytometry of HIV-infected samples
- Schmid I: Biosafety in the Flow Cytometry Laboratory. In: *In Living Color, Protocols in Flow Cytometry and Cell Sorting*, Diamond RA, DeMaggio S (eds). Springer, New York, 2000, pp. 655-665.
Review article about various safety concerns specific for flow cytometry and cell sorting
- Oberyszyn AS and Robertson FM: Novel rapid method for visualization of extent and location of aerosol contamination during high-speed sorting of potentially biohazardous samples. *Cytometry*. 2001;43:217-22.
First paper describing the use of fluorescent GloGerm particles for measuring aerosol containment during cell sorting
- Harris NB, Zinniel DK, Hsieh MK, Cirillo JD, Barletta RG: Cell sorting of formalin-treated pathogenic *Mycobacterium paratuberculosis* expressing GFP. *Biotechniques* 2002; 32:522-524.

Discusses the option of fixing infectious sort samples for operator safety

Oberszyn AS: Method for Visualizing Aerosol Contamination in Flow Sorters. In: Current Protocols in Cytometry, Volume 2, Unit 3.5, Robinson JP, Darzynkiewicz Z, Dean P, Hibbs AR, Orfao A., Rabinovitch P, Wheelless L (eds.), Wiley & Sons, NY, 2002.

Step-by-step protocol for assessment of aerosol containment using GloGerm particles in powder form

Lopez PA. Basic aspects of high-speed sorting for clinical applications. Cytometry 2002; 4:87-88.

Focuses on the multiple aspects of preparative cell sorting for therapeutic applications

Keane-Moore M, Coder D, Marti G. Public Meeting and Workshop on Safety Issues pertaining to the clinical application of flow cytometry to human-derived cells. Cytometry 2002; 4:89-90.

Summary of the issues discussed at the CBER/FDA workshop held in Washington DC on April 20, 2001

Perfetto SP, Ambrozak DR, Koup RA, Roederer M. Measuring containment of viable infectious cell sorting in high-velocity cell sorters. Cytometry 2003; 52A:122-130.

First report of the use of the GloGerm method for measuring aerosol containment with an active air sampling device

Schmid I, Merlin S, Perfetto SP. Biosafety concerns for shared flow cytometry core facilities. Cytometry 2003, 56A: 113-119.

Focuses on the necessity for obtaining accurate information about the biohazard potential of samples submitted to shared flow cytometry facilities and provides a template for a biosafety questionnaire

Perfetto SP, Ambrozak DR, Roederer M, Koup RA. Viable Infectious Cell Sorting in a BSL-3 Facility. Methods Mol Biol. 2004; 263:419-24.

Step-by-step protocol for measuring aerosol containment using the GloGerm method and a the AeroTech concentrator

Schmid I, Roederer M, Koup R, Ambrozak D, Perfetto SP. Biohazard Sorting. In: Methods in Cell Biology, Vol. 75. Cytometry 4th ed., Darzynkiewicz Z, Roederer M, Tanke H (eds.), Elsevier, 2004, pp 221-240.

Comprehensive discussion of various aspects of performing cell sorting experiments using unfixed cells and cells known to be potentially infectious including instrument decontamination and step-by-step protocols for assessment of aerosol containment using various methods

Lennartz K, Mengji L, Flasshove M, Moritz, T, Kirstein U. Improving the biosafety of cell sorting by adaptation of a cell sorting system to a biosafety cabinet. Cytometry Part A 2005, 66A:119-127.

Validates the use of a specially designed safety cabinet to contain cell sorter-produced aerosols

Leary J. Ultra high-speed sorting. Cytometry Part A 2005, 67A:76-85.

Emphasizes the safety concerns associated with high-speed sorting and discusses the development of alternate future technologies with less biohazard potential

Biosafety-related Web Links

Laser Institute of America: www.laserinstitute.org/

Occupational Safety and Health Administration: www.osha.gov

National Committee for Clinical Laboratory Standards: www.nccls.org

Center for Disease Control and Prevention, Ohasis (Office of Health and Safety Information System): www.cdc.gov/od/ohs

National Institutes of Health, National Library of Medicine, Medline plus:
www.nlm.nih.gov/medlineplus/occupationalhealth.html

American Biological Safety Association:
<http://www.absa.org>

American Industrial Hygiene Association
<http://www.aiha.org>
<http://www.aiha.org/Committees/html/safetycom.htm>

European BioSafety Association
<http://ebsa.be>

World Health Organization
<http://www.who.int>
<http://www.who.int/biologicals>
http://www.who.int/occupational_health/en/

Convention on Biological Diversity (Cartagena Protocol on Biosafety)
www.biodiv.org/biosafety/default.aspx

Biosafety in Europe
<http://www.biosafety.be/Menu/BiosEur.html>

Bionomics International
<http://bioint.org>

Comparative Review of Biosecurity-related Legislation
<http://cns.miis.edu/research/cbw/biosec/pdfs/biolaw.pdf>

European Biological Resource Centre Network
http://www.wfcc.info/new/EBRCN_Resource_Legislation_file_WP5_2.htm
http://www.socgenmicrobiol.org.uk/pubs/micro_today/pdf/0299brc.pdf

Institute of Safety in Technology and Research
<http://www.istr.bham.ac.uk>

European Agency for Safety and Health at Work
<http://uk.osha.eu.int>

Institute of Occupational Safety and Health (IOSH)
<http://www.iosh.co.uk/>

Bloodborne Pathogen Safety Training Session
<http://www.vcu.edu/oehs/chemical/training/LABORATORY-BIOSAFETY-BBP.html>

University of Wisconsin-Milwaukee Biosafety Site
<http://www.uwm.edu/Dept/EHSRM/BIO/>

UCLA Flow Cytometry Core Facility, Biosafety
<http://cyto.mednet.ucla.edu>

Adult AIDS Clinical Trial Group (ACTG), Quality Control Issues and Practices in Flow Cytometric HIV Immunophenotyping
<http://aactg.s-3.com/iqa.htm>

University of Edinburgh Safety Resources
<http://www.safety.ed.ac.uk/resources/links.html>

Publications from the National Committee for Clinical Laboratory Standards (NCCLS) of interest to flow cytometry laboratories

Procedures for the Handling and Processing of Blood Specimens. NCCLS Document H18-A, 1990

Clinical Laboratory Waste Management, Approved Guideline. NCCLS Document GP5-A, 1993

Procedures for the Handling and transport of Diagnostic Specimens and Etiologic Agents – Third Edition, Approved Standard. NCCLS Document H5-A3, 1994

Protection of Laboratory Workers from Instrument Biohazards and Infectious Disease Transmitted by Blood, Body Fluids, and Tissue; Approved Guideline. NCCLS Document M29-A, 1997