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Section: Laboratory Safety Manual	Subject Title: Classification of Biological Agents According to Risk	
Issued by: LABORATORY MANAGER	Original Date: April 20, 2001	
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Policy:

Provide staff with a reference for the classification of biological agents according to risk

Purpose:

The classification of biological agents according to risk allows staff to handle all specimens and organisms in a safe and responsible manner.

Responsibility:

Management

Key Elements:

- Explanation of risk groups
- Listings of organisms in each risk group

RISK GROUP 1 AGENTS: REQUIRING CONTAINMENT LEVEL 1

Risk Group 1 (low individual and community risk)

This group includes those microorganisms, bacteria, fungi, viruses and parasites, which are unlikely to cause disease in healthy workers or animals.

RISK GROUP 2 AGENTS: REQUIRING CONTAINMENT LEVEL 2

Risk Group 2 (moderate individual risk, limited community risk)

A pathogen that can cause human or animal disease but under normal circumstances, is unlikely to be a serious hazard to healthy laboratory workers, the community, livestock, or the environment. Laboratory exposures rarely cause infection leading to serious disease; effective treatment and preventive measures are available and the risk of spread is limited.

Risk Group 2 Bacteria, Chlamydia, Mycoplasma

Actinobacillus - all species

Actinomyces pyogenes (C. pyogenes)

Bacillus cereus

Bartonella bacilliformis, B. henselae, B. quintana, B. elizabethae

Bordetella pertussis, B. parapertussis and *B. bronchiseptica*

Borrelia recurrentis and *B. burgdorferi*

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Risk Group 2 Bacteria, Chlamydia, Mycoplasma continued

Campylobacter spp. (*C. coli*, *C. fetus*, *C. jejuni*)
Chlamydia pneumoniae, *C. psittaci* (non-avian strains), *C. trachomatis*,
Clostridium botulinum, *Cl. chauvoei*, *Cl. difficile*, *Cl. haemolyticum*,
Cl. histolyticum, *Cl. novyi*, *Cl. perfringens*, *Cl. septicum*,
Cl. sordellii, *Cl. tetani*
Corynebacterium diphtheriae, *C. haemolyticum*,
C. pseudotuberculosis, *C. pyogenes* (*A. pyogenes*)
Edwardsiella tarda
Erysipelothrix rhusiopathae (*insidiosa*)
Escherichia coli enterotoxigenic/invasive/hemorrhagic strains
Francisella tularensis Type B, (biovar palaeartica), *F. novocida*
Fusobacterium necrophorum
Haemophilus influenzae, *H. ducreyi*
Helicobacter pylori
Legionella spp.
Leptospira interrogans - all serovars
Listeria monocytogenes
Mycobacteria - all species (except *M. tuberculosis*, and *M. bovis* (non-BCG strain), which are in Risk Group 3)
Mycoplasma pneumoniae, *M. hominis* *Neisseria gonorrhoeae*, *N. meningitidis*
Nocardia asteroides, *N. brasiliensis*
Pasteurella, all species (except *P. multocida* type B in Level 3)
Pseudomonas aeruginosa
Salmonella enterica (*S. choleraesuis*)
Salmonella enterica serovar arizonae (*Arizona hinshawii*)
Salmonella enterica ser. gallinarum-pullorum (*S. gallinarum-pullorum*)
Salmonella enterica ser. meleagridis (*S. meleagridis*)
Salmonella enterica ser. paratyphi B (*S. paratyphi B*) (Schottmulleri)
Salmonella enterica ser. typhi (*S. typhi*)
Salmonella enterica ser. typhimurium (*S. typhimurium*)
Shigella boydii, *S. dysenteriae*, *S. flexneri*, *S. sonnei*
Staphylococcus aureus
Streptobacillus moniliformis
Streptococcus spp. (Lancefield Groups A, B, C, D, G)
Treponema carateum, *T. pallidum* (including *pertenue*), *T. Vincentii*
Ureaplasma urealyticum
Vibrio cholerae (incl. *El Tor*), *V. parahaemolyticus*, *V. vulnificus*
Yersinia enterocolitica, *Y. pseudotuberculosis*

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Risk Group 2 Fungi

Cryptococcaceae

Candida albicans

Cryptococcus neoformans

Moniliaceae

Aspergillus flavus

Aspergillus fumigatus

Epidermophyton floccosum

Microsporum spp.

Sporothrix schenckii

Trichophyton spp.

Risk Group 2 Viruses

***Arthropod-borne viruses are identified with an asterisk. Only those viruses which may be associated with human or animal disease have been included in this list. Agents listed in this group may be present in blood, CSF, central nervous system and other tissues, and infected arthropods, depending on the agent and the stage of infection.**

Adenoviridae

Adenoviruses, all serotypes

Arenaviridae

Lymphocytic choriomeningitis virus (laboratory-adapted strains)

Tacaribe virus complex: Tamiami, Tacaribe, Pichinde

Bunyaviridae*

Genus Bunyavirus

Bunyamwera and related viruses

California encephalitis group, including LaCrosse, Lumbo and snowshoe hare

Genus Phlebovirus

All species except Rift Valley fever virus (see Table 1)

Caliciviridae - all isolates (including Hepatitis E & Norwalk)

Coronaviridae

Human coronavirus, all strains

Transmissible gastroenteritis virus of swine

Hemagglutinating encephalomyelitis virus of swine

Mouse hepatitis virus

Bovine coronavirus

Feline infectious peritonitis virus

Avian infectious bronchitis virus

Canine, Rat and Rabbit corona viruses

Flaviviridae*

Yellow fever virus (17D vaccine strain)

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Dengue virus (serotypes 1,2,3,4)
 Kunjin virus
 Hepadnaviridae
 Hepatitis B virus, includes Delta agen
 Herpesviridae
 Alphaherpesvirinae
 Genus Simplexvirus: all isolates, including HHV 1 and HHV 2,
 except Herpes B virus which is in Risk Group 4
 Genus Varicellovirus: all isolates, including varicella/zoster virus
 (HHV 3) and pseudorabies virus (see Table 1)
 Betaherpesvirinae
 Genus Cytomegalovirus: all isolates including CMV (HHV 5)
 Genus Muromegalovirus: all isolates
 Gammaherpesvirinae
 Genus Lymphocryptovirus: Epstein Barr Virus (HHV 4) and EB-like isolates
 Genus Rhadinovirus: all isolates (except *H. ateles* and *H. saimiri*, see Risk Group 3)
 Genus Thetalympocryptovirus: all isolates
 Unassigned Herpesviruses: includes HHV 6 (human á-lymphotrophic virus), HHV 7,
 HHV 8, etc.
 Orthomyxoviridae
 Genus Influenzavirus:
 Influenza virus type A, all isolates
 Influenza virus type B, all isolates
 Influenza virus type C, all isolates
 Papovaviridae
 Genus Papillomavirus: all isolates
 Genus Polyomavirus: all isolates
 Paramyxoviridae
 Genus Paramyxovirus: all isolates
 Genus Pneumovirus: all isolates
 Genus Morbillivirus: all isolates (except Rinderpest-see Table 1)
 Parvoviridae
 Genus Parvovirus: all isolates
 Picornaviridae
 Genus Aphthovirus - See Table 1
 Genus Cardiovirus - all isolates
 Genus Enterovirus - all isolates (see Table 1 for restrictions)
 Genus Hepatovirus - all isolates (Hepatitis A)
 Genus Rhinovirus - all isolates
 Poxviridae (see Table 1 for restrictions)
 Chordopoxvirinae (poxviruses of vertebrates)
 Genus Capripoxvirus
 Genus Molluscipoxvirus

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Genus Yatapoxvirus
 Genus Avipoxvirus - all isolates
 Genus Leporipoxvirus - all isolates
 Genus Orthopoxvirinae - all isolates (except Variola and Monkeypox in Level 4)
 Genus Parapoxvirus: all isolates
 vGenus Suipoxvirus: Swinepox (see Table 1 for restrictions)
 All other ungrouped poxviruses of vertebrates
 Reoviridae
 Genus Orbivirus - all isolates (see Table 1 for restrictions)
 Genus Orthoreovirus, types 1, 2 and 3
 Genus Rotavirus - all isolates
 Retroviridae
 Oncovirinae
 Genus Oncornavirus C
 Subgenus Oncornavirus C avian - all isolates
 Subgenus Oncornavirus C mammalian - all isolates except HTLV-I, HTLV-II
 Genus Oncornavirus B - all isolates
 Lentivirinae - all isolates except HIV-I, HIV-II
 Spumavirinae - all isolates
 Rhabdoviridae
 Genus Vesiculovirus (see Table 1 for restrictions) (All laboratory adapted strains)
 Genus Lyssavirus: Rabies virus (Fixed Virus)
 Togaviridae
 Genus Alphavirus*
 Semliki forest virus
 Sindbis
 O'Nyong-Nyong
 Ross river virus
 Venezuelan equine encephalitis (Strain TC-83 only, no animal inoculation, see Table 1)
 Genus Rubivirus
 Rubella virus
 Genus Pestivirus
 Hepatitis C virus
 Bovine diarrhoea virus
 Border disease virus
 Genus Arterivirus
 Equine arteritis virus
 Unclassified viruses
 Toroviridae
 Other Hepatitis Viruses
 Borna disease virus
 Astro viruses
 Chronic infectious neuropathic agents (CHINAs):
 Scrapie, BSE (except Kuru, CJD, see Risk Group 3)

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Risk Group 2 Parasites

Infective stages of the following parasites have caused laboratory infections by ingestion, skin or mucosal penetration or accidental injection. Preparations of these parasites known to be free of infective stages do not require this level of containment.

Protozoa

Babesia microti
Babesia divergens
Balantidium coli
Cryptosporidium spp.
Entamoeba histolytica
Giardia spp. (mammalian)
Leishmania spp. (mammalian)
Naegleria fowleri
Plasmodium spp. (human or simian)
Pneumocystis carinii
Toxoplasma gondii
Trypanosoma brucei, *T. cruzi*

Helminths

Nematodes -

Ancylostoma duodenale
Angiostrongylus spp.
Ascaris spp.
Brugia spp.
Loa loa
Necator americanus
Onchocerca volvulus
Strongyloides spp.
Toxocara canis
Trichinella spp.
Trichuris trichiura
Wuchereria bancrofti

Cestodes

Echinococcus (gravid segments)
Hymenolepis diminuta
Hymenolepis nana (human origin)
Taenia saginata
Taenia solium

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Trematodes

Clonorchis sinensis
Fasciola hepatica
Opisthorchis spp.
Paragonimus westermani
Schistosoma haematobium
Schistosoma japonicum
Schistosoma mansoni

RISK GROUP 3 AGENTS: REQUIRING CONTAINMENT LEVEL 3

Risk Group 3 (high individual risk, low community risk)

A pathogen that usually causes serious human or animal disease, or which can result in serious economic consequences but does not ordinarily spread by casual contact from one individual to another, or that can be treated by antimicrobial or antiparasitic agents.

Risk Group 3

Bacteria, Chlamydia, Rickettsia

Bacillus anthracis
Brucella - all species
Burkholderia (Pseudomonas) mallei; *B. pseudomallei*
Chlamydia psittaci - avian strains only
Coxiella burnetii
Francisella tularensis, type A (biovar tularensis)
Mycobacterium tuberculosis; *M. bovis* (non-BCG strains)
Pasteurella multocida, type B
Rickettsia - all species (also see Table 1)
Yersinia pestis

(Note: Preparation of smears and primary culture of *M. tuberculosis* may be performed at Level 2 physical containment using containment Level 3 operational requirements. All other manipulations of *M. tuberculosis* require containment Level 3 physical and operational requirements.)

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Risk Group 3 Fungi

Moniliaceae

Ajellomyces dermatitidis (*Blastomyces dermatitidis*)

Coccidioides immitis

Ajellomyces capsulatum (*Histoplasma capsulatum* including var. *duboisii*)

Paracoccidioides brasiliensis

Risk Group 3 Viruses

Arthropod-borne viruses are identified with an asterisk.

Arenaviridae

Lymphocytic choriomeningitis virus, neurotropic strains

Bunyaviridae

Unclassified Bunyavirus

Hantaan, Korean haemorrhagic fever and epidemic nephrosis viruses including virus responsible for Hantavirus pulmonary syndrome)

Rift Valley fever virus

Flaviviridae*

Yellow fever virus (Wild type)

St. Louis encephalitis virus

Japanese encephalitis virus

Murray Valley encephalitis virus

Powassan

Herpesviridae

Gammaherpesvirinae

Genus Rhadinovirus: *Herpesvirus ateles*; *Herpesvirus saimiri*

Retroviridae

Oncovirinae

Genus Oncornavirus C

Human T-cell leukemia/lymphoma virus (**see note below**)

Genus Oncornavirus D

Mason-Pfizer monkey virus

Viruses from non-human primates

Lentiviridae

Human immunodeficiency viruses (HIV - all isolates) (**see note below**)

Rhabdoviridae

Genus Vesiculovirus (see Table 1 for restrictions) (wild type strains)

Genus Lyssavirus

Rabies virus (Street virus)TML\MSH Microbiology Department Policy & Procedure Manual	Policy # MI\LS\08\v02	Page 9 of 10
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Togaviridae

Genus Alphavirus*

Eastern equine encephalitis virus

Chikungunya

Venezuelan equine encephalitis (except Strain TC-83)

Western equine encephalitis

Unclassified Viruses

Chronic infectious neuropathic agents (CHINAs): Kuru, Creutzfeldt-Jakob agent (level of precautions depends on the nature of the manipulations and the amount of sera, bio/necropsy materials handled).

Note:Laboratories engaging primary isolation and identification of HTLV or HIV may perform these activities in containment level 2 laboratories (physical requirements) using containment level 3 operational requirements. All research and production activities require containment level 3 physical and operational requirements.

Risk Group 3 Parasites

None

RISK GROUP 4 AGENTS: REQUIRING CONTAINMENT LEVEL 4

Risk Group 4 (high individual risk, high community risk)

A pathogen that usually produces very serious human animal disease, often untreatable, and may be readily transmitted from one individual to another, or from animal to human or vice-versa directly or indirectly, or casual contact.

Risk Group 4 Bacteria

None

Risk Group 4 Fungi

None

Risk Group 4 Viruses

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Arthropod-borne viruses are identified with an asterisk.

Arenaviridae

Lassa, Junin, Machupo viruses, Sabia, Guanarito

Bunyaviridae*

Genus Nairovirus

Crimean-Congo hemorrhagic fever

Filoviridae

Marburg virus

Ebola virus

Flaviviridae*

Tick-borne encephalitis complex, including -

Russian Spring-Summer Encephalitis

Kyasanur forest virus

Omsk hemorrhagic fever virus

Herpesviridae

Alphaherpesvirinae

Genus Simplexvirus: Herpes B virus (Monkey virus)

Poxviridae

Genus Orthopoxvirinae

Variola

Monkeypox

Risk Group 4 Parasites

None

Reference

1. Laboratory Biosafety Guidelines, 2nd edition, 1996. Laboratory Centre for Disease Control, Health Canada.