

Fungal Agents

Agent: *Blastomyces dermatitidis*

Laboratory-associated local infections have been reported following accidental parenteral inoculation with infected tissues or cultures containing yeast forms of *B. dermatitidis*.⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾⁽⁵⁾⁽⁶⁾⁽⁷⁾⁽⁸⁾ Pulmonary infections have occurred following the presumed inhalation of conidia; two persons developed pneumonia and one had an osteolytic lesion from which *B. dermatitidis* was cultured.⁽⁹⁾⁽¹⁰⁾ Presumably, pulmonary infections are associated only with sporulating mold forms (conidia).

Laboratory Hazards: Yeast forms may be present in the tissues of infected animals and in clinical specimens. Parenteral (subcutaneous) inoculation of these materials may cause local granulomas. Mold form cultures of *B. dermatitidis* containing infectious conidia, and processing of soil or other environmental samples, may pose a hazard of aerosol exposure.

Recommended Precautions: Biosafety Level 2 and Animal Biosafety Level 2 practices and facilities are recommended for activities with clinical materials, animal tissues, cultures, environmental samples and infected animals.

Transfer of Agent: For a permit to import this agent, contact CDC. Laboratory registration with CDC is required before sending or receiving this select agent.

Agent: *Coccidioides immitis*

Laboratory-associated coccidioidomycosis is a documented hazard.^{(11)(12)(13)(14)(15)(16)(17)(18)(19)(20) (21)(22)} Smith reported that 28 of 31 (90%) laboratory-associated infections in his institution resulted in clinical disease, whereas more than half of infections acquired in nature were asymptomatic.⁽²³⁾

Laboratory Hazards: Because of the size (2-5 millimicrons), the arthroconidia are conducive to ready dispersal in air and retention in the deep pulmonary spaces. The much larger size of the spherule (30-60 millimicrons) considerably reduces the effectiveness of this form of the fungus as an airborne pathogen. Spherules of the fungus may be present in clinical specimens and animal tissues, and infectious arthroconidia in mold cultures and soil or other samples from natural sites. Inhalation of arthroconidia from environmental samples or cultures of the mold form is a serious laboratory hazard. A theoretical laboratory hazard is posed by clinical specimens or tissues from infected animals or humans that have been stored or shipped in such a manner as to promote germination of arthroconidia. There is a single report of a veterinarian with coccidioidomycosis beginning 13 days after autopsy of a horse with that infection, though the veterinarian lived in an endemic area.⁽²⁴⁾ Accidental percutaneous inoculation of the spherule form may result in local granuloma formation.⁽²⁵⁾ Disseminated disease occurs at a much greater frequency in blacks and Filipinos than in whites.

Recommended Precautions: Biosafety Level 2 practices and facilities are recommended for handling and processing clinical specimens, identifying isolates, and processing animal tissues. Animal Biosafety Level 2 practices and facilities are recommended for experimental animal studies when the route of challenge is parenteral.

Biosafety Level 3 practices and facilities are recommended for propagating and manipulating sporulating cultures already identified as *C. immitis* and for processing soil or other environmental materials known or likely to contain infectious arthroconidia.

Transfer of Agent: For a permit to import this agent, contact CDC. Laboratory registration with CDC is required before sending or receiving this select agent.

Agent: *Cryptococcus neoformans*

Accidental inoculation of a heavy inoculum of *Cryptococcus neoformans* into the hands of laboratory workers has occurred during injection or necropsy of laboratory animals.⁽²⁶⁾⁽²⁷⁾ Either a local granuloma or no lesion has resulted, suggesting low pathogenicity by this route. Respiratory infections as a consequence of laboratory exposure have not been recorded.

Laboratory Hazards: Accidental parenteral inoculation of cultures or other infectious materials represents a potential hazard to laboratory personnel, particularly to those who may be immunocompromised. Bites by experimentally infected mice and manipulations of infectious environmental materials (e.g., pigeon droppings) may also represent a potential hazard to laboratory personnel.

Recommended Precautions: Biosafety Level 2 and Animal Biosafety Level 2 practices and facilities are recommended, respectively, for activities with known or potentially infectious clinical, environmental, or culture materials and with experimentally infected animals. The processing of soil or other environmental materials known or likely to contain infectious yeast cells should be conducted in a Class I or Class II biological safety cabinet. This precaution is also indicated for culture of the perfect or sexual state of the agent.

Transfer of Agent: For a permit to import this agent, contact CDC.

Agent: *Histoplasma capsulatum*

Laboratory-associated histoplasmosis is a documented hazard in facilities conducting diagnostic or investigative work.⁽²⁸⁾⁽²⁹⁾⁽³⁰⁾ Pulmonary infections have resulted from handling mold form cultures.⁽³¹⁾ Local infection has resulted from skin puncture during autopsy of an infected human⁽³²⁾ and from accidental needle inoculation of a viable culture.⁽³³⁾ Collecting and processing soil samples from endemic areas has caused pulmonary infections in laboratory workers. Encapsulated spores are resistant to drying and may remain viable for long periods of time. The small size of the infective conidia (less than 5 microns) is conducive to airborne dispersal and intrapulmonary retention.

Furcolow reported that 10 spores were almost as effective as a lethal inoculum in mice as 10,000 to 100,000 spores.⁽³⁴⁾

Laboratory Hazards: The infective stage of this dimorphic fungus (conidia) is present in sporulating mold form cultures and in soil from endemic areas. The yeast form in tissues or fluids from infected animals may produce local infection following parenteral inoculation. *Recommended Precautions:* Biosafety Level 2 and Animal Biosafety Level 2 practices and facilities are recommended for handling and processing clinical specimens, identifying isolates, animal tissues and mold cultures, identifying cultures in routine diagnostic laboratories, and for experimental animal studies when the route of challenge is parenteral. Biosafety Level 3 practices and facilities are recommended for propagating and manipulating cultures already identified as *H. capsulatum*, as well as processing soil or other environmental materials known or likely to contain infectious conidia.

Transfer of Agent: For a permit to import this agent, contact CDC.

Agent: *Sporothrix schenckii*

S. schenckii has caused a substantial number of local skin or eye infections in laboratory personnel.⁽³⁵⁾ Most cases have been associated with accidents and have involved splashing culture material into the eye,⁽³⁶⁾⁽³⁷⁾ scratching⁽³⁸⁾ or injecting⁽³⁹⁾ infected material into the skin or being bitten by an experimentally infected animal.⁽⁴⁰⁾⁽⁴¹⁾ Skin infections have resulted also from handling cultures⁽⁴²⁾⁽⁴³⁾⁽⁴⁴⁾ or necropsy of animals⁽⁴⁵⁾ without a known break in technique. No pulmonary infections have been reported to result from laboratory exposure, although naturally occurring lung disease is thought to result from inhalation. *Recommended Precautions:* Biosafety Level 2 and Animal Biosafety Level 2 practices and facilities are recommended for all laboratory and experimental animal activities with *S. schenckii*. Gloves should be worn when handling experimentally infected animals, and during operations with broth cultures that might result in hand contamination.

Transfer of Agent: For a permit to import this agent, contact CDC.

Agents: Pathogenic Members of the Genera Epidermophyton, Microsporum, and Trichophyton

Although skin, hair, and nail infections by these dermatophytid molds are among the most prevalent of human infections, the processing of clinical material has not been associated with laboratory infections. Infections have been acquired through contacts with naturally or experimentally infected laboratory animals (mice, rabbits, guinea pigs, etc.) and, occasionally, with handling cultures.⁽⁴⁶⁾⁽⁴⁷⁾⁽⁴⁸⁾⁽⁴⁹⁾

Laboratory Hazards: Agents are present in the skin, hair, and nails of human and animal hosts. Contact with infected laboratory animals with inapparent or apparent infections is

the primary hazard to laboratory personnel. Cultures and clinical materials are not an important source of human infection.

Recommended Precautions: Biosafety Level 2 and Animal Biosafety Level 2 practices and facilities are recommended for all laboratory and experimental animal activities with dermatophytes. Experimentally infected animals should be handled with disposable gloves.

Transfer of Agent: For a permit to import these agents, contact CDC.

Agent: Miscellaneous Molds

Several molds have caused serious infection in immunocompetent hosts following presumed inhalation or accidental subcutaneous inoculation from environmental sources. These agents are *Penicillium marneffeii*, *Exophiala (Wangiella) dermatitidis*, *Fonsecaea pedrosoi*, *Ochroconis gallopavum*, *Cladophialopora bantians*, and *Ramichlorisium mackenziei*, *Bipolaris* species. Even though no laboratory-acquired infections appear to have been reported with most of these agents, the gravity of naturally acquired illness is sufficient to merit special precautions in the laboratory. *Penicillium marneffeii* has caused a local inoculation infection in a laboratory worker.⁽⁵⁰⁾ *Stachybotrus atra* is probably not a cause of infection or toxicosis in humans when the mold or fomites containing the mold are inhaled, although ingestion of moldy grain containing the fungus has poisoned animals.

Laboratory Hazards: Inhalation of conidia from sporulating mold cultures or accidental injection into the skin during infection or experimental animals is a theoretical risk to laboratory personnel.

Recommended Precautions: Biosafety Level 2 practices and facilities are recommended for propagating and manipulating cultures known to contain these agents.

Transfer of Agent: For a permit to import these agents, contact CDC.

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