

Mycobacterium tuberculosis Complex (MTC) ***(M. tuberculosis, M. bovis, M. microti, M. africanum,*** ***M. pinnipedii, M. caprae, and M. canetti)***

Principal investigators are responsible for communicating this information to staff working with or around this agent, and for mitigation of associated risks. This document is not intended to be used as a sole source for diagnosis, medical treatment, or medical advice. Consult a CSU Authorized Treating Physician for concerns about work related medical conditions.

CONTAINMENT AND SPECIAL PRECAUTIONS

Containment

- BSL-3 Level practices, containment equipment and facilities are required for work involving infectious materials, animals, cultures and for activities with a high potential for aerosol production
- BSL2 practices and containment equipment can be utilized for handling some clinical specimens. Consult with CSU Biosafety office related to such work.

Special Considerations

- Many of the strains worked with at CSU are drug resistant and researchers should be aware of strains being worked with and antibiotic resistance profiles.
- Immuno-compromised individuals and those with pre-existing lung damage (e.g. cystic fibrosis, emphysema, smokers) are more susceptible.

HAZARD IDENTIFICATION

Disease: Tuberculosis (TB). There is more than one form of TB. For most people who breathe in TB bacteria and become infected, the body is able to fight the bacteria to stop them from growing. The bacteria are thought to remain alive in the body but can become active later. When there is infection but there are no signs or symptoms of TB, this is called latent TB infection and is manifest by evidence of a positive skin test or blood test (see below) but with no symptoms of disease. However, some people can go on to develop active TB from the latent infection. People with a compromised immune system such as certain immune problems, malignancies, medications, diabetes, other diseases and especially HIV are at particular risk of tuberculosis.

Transmission: Direct contact with mucous membranes or broken skin, injection, injection, aerosols, fomites; *M. bovis* can be transmitted by eating or drinking contaminated, unpasteurized milk products, and by inhalation of bacteria in the exhalation of infected animals

Communicability: Person to person by the aerosol route

Incubation: 2-12 weeks from infection to the development of a positive TB skin test or blood test for TB.

Infectious dose: as low as 1-10 bacilli, organisms can be stable in the environment

VIABILITY/INACTIVATION

Stability: Can survive on surfaces and in soil for months.

Inactivation:

- Mycobacteria are very resistant to inactivation, and inactivation methods should species and strain being worked with.
- Mycobacteria are autoclave sensitive, but longer cycles may be required

- The following disinfectants may be effective for inactivation, depending on species, strain, and conditions:
 - Sensitive to 5% phenol or 5% formaldehyde, 2% glutaraldehyde.
 - Minimum of 20% bleach (10,000 ppm available sodium hypochlorite) (*Note that bleach should not be used when waste will be subsequently processed by autoclaving*)
 - For a list of EPA Registered tuberculocidal products: http://www.epa.gov/oppad001/list_b_tuberculocide.pdf

MEDICAL

Signs and symptoms:

- A cough that lasts 3 weeks or longer
- Pain in the chest
- Coughing up sputum and/or blood
- Weakness or fatigue
- Weight loss
- No appetite
- Chills
- Fever
- Night sweats

Pre-exposure prophylaxis:

BCG vaccine is available but not used routinely in the United States.

CSU TB Surveillance: All personnel with the potential for occupational exposure to the MTB complex must be enrolled in the TB Surveillance Program. This consists of routine tuberculin skin testing every 6 or 12 months, depending on risk.

Diagnosis:

- TB Tuberculin Skin Test: Consists of injecting a small amount of tuberculin fluid (purified protein derivative of TB) under the skin to check for an inflammatory reaction (induration). Test must be read 48 to 72 hours by a trained health care professional.
- Blood test: Interferon-Gamma Release Assay (IGRA) may be used and is often done on individuals that are TB skin test positive or BCG vaccinated to determine if the skin reaction could be specific to tuberculosis.
- Chest X-Ray
- Culture of sputum
- Direct smear microscopy for acid fast bacilli
- Genetic methods (PCR, DNA probes, DNA fingerprinting)

Treatment:

- **Post-Exposure Prophylaxis**
 - Prophylactic antibiotic regimen may be initiated, depending on the strain involved and the nature of the exposure.
 - Skin testing is performed the day of the incident, then 10 weeks later and patient is monitored for symptoms.
- **Treatment of clinical cases:**
 - Persons who develop latent infection are offered treatment (usually isoniazid for 9 months). Treatment for active disease due to tuberculosis is dependent on the antibiotic susceptibility of the strain of *M. tuberculosis*.

Treatment could be a combination of isoniazid (INH), rifampin (RIF), ethambutol (EMB) and pyrazinamide (PZA) if the strain is fully susceptible.

WHAT TO DO IF AN EXPOSURE OCCURS

Employees, Graduate Students, Work Study

1. Employee notifies Biosafety (970-491-0270) and/or Occupational Health Program Coordinator (970-420-8172) to inform where medical attention will be sought and if transportation is needed.
 - The Principal Investigator/Supervisor must also be notified
2. Employee goes to an Authorized Treating Physician.
3. After the visit, individual fills out the following forms:
 - Biosafety Incident report form:
<http://www.ehs.colostate.edu/WBiosafety/PDF/IncidentReportForm.pdf>
 - Workers' Compensation (within 4 days or as soon as possible):
<http://www.ehs.colostate.edu/WWorkComp/Home.aspx>
4. Employee follows up as directed.

Student Not Paid by CSU

1. Contact supervisor/PI
2. Student or supervisor contact Biosafety (491-0270) or Occupational Health (420-8172) to inform where attention is being sought, and to arrange transportation if needed.
3. Student goes to CSU Health Network (Formerly Hartshorn Health Services)
4. After the visit to CSU Health Network, student fills out Biosafety Incident Report form
<http://www.ehs.colostate.edu/WBiosafety/PDF/IncidentReportForm.pdf>

Volunteers and Visitors

1. Contact supervisor/PI
2. Contact Biosafety (491-0270) or Occupational Health (420-8172) to inform where attention is being sought, and to arrange transportation if needed.
3. Individual goes to their personal physician, or as otherwise directed by their physician
4. Individual fills out Biosafety Incident Report form
<http://www.ehs.colostate.edu/WBiosafety/PDF/IncidentReportForm.pdf>

REFERENCES

- Best, M., Sattar, S. A., Springthorpe, V. S., & Kennedy, M. E. (1990). Efficacies of selected disinfectants against *Mycobacterium tuberculosis*. *Journal of Clinical Microbiology*, 28(10), 2234-2239 (<http://jcm.asm.org/content/28/10/2234>)
- CDC Web Page: <http://www.cdc.gov/tb/>
- MMWR Recommended Treatment of Exposed Individuals:
<http://www.cdc.gov/mmwr/preview/mmwrhtml/00031296.htm>
- MMWR Recommended Treatment of Infected Individuals:
<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5211a1.htm>
- Public Health Agency of Canada Pathogen Data Sheet: <http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/tuber-eng.php>
- Sanger Institute: <http://www.sanger.ac.uk/resources/downloads/bacteria/mycobacterium.html>
- WHO Web Page: <http://www.who.int/topics/tuberculosis/en/>

CONTENT REVIEW

This document has been reviewed by:

- CSU subject matter experts: Drs. Karen Dobos and Mary Jackson