

preparators, will focus on a holistic approach to stabilization and will help participants in determining when preventive or inter-ventive measures are necessary.

For more information visit the SPNHC 2012 website <http://peabody.yale.edu/collections/spnhc2012/home> or contact Catherine Hawks, [hawksc\[at\]si.edu](mailto:hawksc[at]si.edu) (oral session); and Rachael Arenstein, [rachael\[at\]AMArtConservation.com](mailto:rachael[at]AMArtConservation.com) or Lisa Goldberg, [lgoldberg\[at\]stny.rr.com](mailto:lgoldberg[at]stny.rr.com) (poster session) with questions.

## Health & Safety

### Rare But There

While most conservators are aware of the dangers inherent in the chemicals we use, health hazards presented by microorganisms like bacteria, fungi, parasites, and viruses are often overlooked or simply unknown. In general, these hazards are more difficult to define because their survival is dependent upon key, but uncommon, environmental factors. However, although their ability to cause significant illness is rare, it is there.

Aside from mold, which is addressed at length in many other publications, it is unlikely that most conservators and museum professionals will ever be exposed to some types of microorganisms during their entire career. Nevertheless, it is important to be aware of their existence in areas and on surfaces that may not be immediately obvious, especially because microorganisms are adaptable when they are given the right environmental requirements. People working with collections such as those found in natural history museums (including ethnographic, archaeological, taxidermy, wet specimens, and botanical), living museums (live animals and plants), and outdoors are more likely to encounter possible exposure than others. Consider for a moment museum specimens such as swords or arrowheads that may be contaminated with intentionally placed poisons or dried residual blood and perhaps air-borne pathogens on their surfaces, human and animal mummies that may harbor ancient dormant viruses and other diseases, or newly fabricated drums with animal skin and hides that might host anthrax spores. Conservators and museum professionals need to be armed with an awareness about the possible, albeit remote, existence of these hazards among our collections and work spaces; knowledge about their habits and characteristics; resources for information; and an understanding of human health, safety concerns, and best practices for personal protection.

Some excellent publications listing characteristics of specific microorganisms and the accompanying health and safety guidelines are readily available, many on the internet. The National Park Service *Museum Handbook, Part I* (2005) and *Health & Safety for Museum Professionals* (C. Hawks, et al, 2011) are just two of the comprehensive resources available.

Hundreds of tiny seemingly invisible pathogens exist on our planet. Be aware and take appropriate action to protect yourself. A sampling of the rare organisms to be aware of (but are not limited to) are listed in table 1 (see pages 14–15).

—Cheryl Podniki, *Conservator in Private Practice and members of the Health & Safety Committee*

### Recommended Resources

- American Public Health Association. 1995 *Control of Communicable Diseases Manual*
- Center for Disease Control and Prevention. [www.cdc.gov](http://www.cdc.gov)
- Emergency Preparedness and Response. Center for Disease Control and Prevention. [www.bt.cdc.gov](http://www.bt.cdc.gov)
- Hawks, C. and K. Makos. 2000. Inherent and acquired hazards in museum objects: implications for care and use of collections. *Cultural Resource Management*. No. 5. 31–37.
- Hawks, C., M. McCann, K. Makos, L. Goldberg, D. Hinkamp, D. Ertel, P. Silence, ed. 2011. *Health & Safety for Museum Professionals*. Society for the Preservation of Natural History Collections/ Health & Safety Committee of the American Institute for Conservation of Historic & Artistic Works: New York.
- Hinkamp, D. 2003. A Practical Guide for Work with Bird Droppings and Roosts. *AIC Newsletter guide insert*. July 2003 (28:4). 17–20.
- Jacob, J.P., J. M. Gaskin, H.R. Wilson and F. B. Mather. 2009. *Avian Diseases Transmitted to Humans*. Publication # PS23. University of Florida IFAS Extension. <http://edis.ifas.ufl.edu/ps019>
- MedicineNet. [www.medicinenet.com](http://www.medicinenet.com)
- Metcalfe, N. 2004. The History of Woolsorter's Disease: a Yorkshire Beginning with an International Future? *Occupational Medicine*. London: Society of Occupational Medicine. Vol. 54 No. 7.
- Morris, P. ed. 2004. The Work Environment. In *Museum Collections Management Handbook. Vol. II: Practices and Procedures*. California Department of Parks and Recreation. 2.1–2.48. [www.parks.ca.gov/pages/22491/files/museum\\_collections\\_management\\_handbook.pdf](http://www.parks.ca.gov/pages/22491/files/museum_collections_management_handbook.pdf)
- National Digestive Diseases Information Clearinghouse. 2011. National Institute of Health (NIH) <http://digestive.niddk.nih.gov>
- Pringle, H. 2001. *The Mummy Congress*. New York: Penguin/Viking.
- PubMed Health. 2011. US National Library of Medicine. <http://www.ncbi.nlm.nih.gov/pubmedhealth>
- VaccineInformation.org. [www.vaccineinformation.org](http://www.vaccineinformation.org)
- Wattiau, P., S. Klee, D. Fretin, M. VanHessche, M. Menart, T. Franz, C. Chasseur, P. Butaye, and H. Imberechts. 2008. Occurrence and Genetic diversity of *Bacillus Anthracis* Strains Isolated in an Active Wool-Cleaning Factory. *Applied and Environmental Microbiology*. American Society for Microbiology. July 2008. Vol. 74. No.13. 4005–4011.
- Williams, S. and C. Hawks. 2005. Curatorial Care of Biological Collections. In *NPS Museum Handbook, Part I*. 2005. Washington, DC: National Park Service. Appendix T. RTI–T62 [www.nps.gov/museum/publications/MHI/AppendixT.pdf](http://www.nps.gov/museum/publications/MHI/AppendixT.pdf)

Table 1. Rare but There Organisms

Disease and Agent	Source	Transmission	Risk	Symptoms and Illnesses
<b>BACTERIA</b>				
<b>Anthrax</b> ( <i>Bacillus anthracis</i> ), also referred to as Industrial Anthrax, or Woolsorter's Disease	Spores are found naturally in soil and on hoofed animals, and can remain viable for up to 50 years.	Disturbance of the spores can make them airborne. This agent can enter the body by inhalation, ingestion, or through open wounds such as punctures, abrasions, and lacerations.	Personnel dealing with textiles or ethnographic artifacts are at risk. Anthrax spores can be carried on wool, hair, and hides that are used in various textiles and drum heads. High-risk professions also include laboratory technicians, textile and leather mill workers, field collectors, and handlers of contaminated hides.	Anthrax infection is a reportable disease. 95% of anthrax infections are cutaneous anthrax, characterized by a raised, itchy bump that develops into a vesicle and then a painless ulcer. Inhalation anthrax results in cold-like symptoms that become severe breathing issues. Gastrointestinal anthrax can cause abdominal pain, nausea, bloody vomiting, and bloody diarrhea. All forms of the disease, particularly the inhaled and gastrointestinal forms, are life threatening.
<b>Avian tuberculosis</b> ( <i>Mycobacterium avium</i> )	The bacteria are found in birds.	Transmitted to humans by ingestion or skin wound contamination with food or water contaminated by feces from shedder birds, as well as inhalation.	Professionals working in outdoor environments, with live animals, or in recovery operations.	Local wound infections with swelling of regional lymph nodes. The avian strain is highly resistant to antibiotics. Note that humans are generally resistant to <i>Mycobacterium avium</i> infections, but susceptibility increases with immune disorders.
<b>Lyme disease</b> ( <i>Borrelia burgdorferi</i> )	Ticks may be carried by deer, birds, other animals and can be present in high grass and brush habitats.	Transmitted to humans and animals via the bite of certain ticks.	Professionals working in outdoor environments, with live animals, or in recovery operations.	Bacterial infections, with body-wide itching, chills, headache, muscle pain, light-headedness, joint pains, swelling, fatigue, and a possible bulls eye rash. Lyme disease is becoming more widespread throughout the United States.
<b>Plague</b> ( <i>Yersinia pestis</i> ), also referred to as Bubonic Plague or Black Plague	The reservoir source is a rodent flea.	Transmission is via the bite of a rodent flea or by handling an infected animal, including infected rats and rat fleas. Transmission can also occur via skin wound contamination or inhalation of cough or sneeze droplets from infected humans or animals.	Professionals working in outdoor environments, with live animals, or in recovery operations.	The pathogen enters through the skin and travels through the lymphatic system. If the pathogen targets the lungs it is known as pneumonic plague and is highly contagious via coughing and sneezing. The disease causes painful swollen lymph nodes called "bubos." If it enters the blood stream it becomes lethal <i>septicemic plague</i> .
<b>Q-fever</b> ( <i>Coxiella burnetii</i> )	The pathogen is excreted into milk, urine and feces of infected animals, primarily cattle, goats and sheep, thus contaminating the soil.	Primary transmission via inhalation from airborne barnyard dust, contaminated dried placenta material, birth fluids, and excrement. Other rare transmissions can occur from tick bites, ingestion of unpasteurized milk or dairy products, and from person to person.	Professionals working in outdoor environments, with live animals, or in recovery operations. Infection can occur from handling contaminated carcasses.	An acute febrile rickettsial disease. Onset may be sudden and can include high fevers, severe headache, chills and sweats, cough, nausea, vomiting, malaise, abdominal pain, and chest pain. Q-fever is a severe disease in <5% of infected patients. Mild forms can occur resembling common viral infections.
<b>Tetanus</b> ( <i>Clostridium tetani</i> ), also referred to as lockjaw	Bacteria are found naturally in soil and in the intestines and feces of many household and farm animals as well as in humans. Spores can be transported and remain dormant in collection items that were once exposed to infected soil or objects made from contaminated materials. Dormant spores can remain infectious for at least 40 years.	Typical entry into the human body is via punctured skin or an open wound. Tetanus can also be transported via splinters, piercing and tattooing and contaminated needles.	Professionals dealing with hides, non-sterile sharp implements or working in outdoor environments. Note that spores are ubiquitous and worldwide, found in many soil contaminated materials.	Tightening of the muscles throughout the body, spasms, drooling, excessive sweating, fever, irritability, difficulty swallowing, uncontrolled urination or defecation and possible locking of the jaw. Spores will germinate in the presence of low or no oxygen conditions and attack the central nervous system. Note that this is one of the most preventable illnesses in this table.

Disease and Agent	Source	Transmission	Risk	Symptoms and Illnesses
<b>M. bovis Tuberculosis</b> ( <i>Mycobacterium bovis</i> )	Aerobic bacteria are found in soils, domestic cattle, and in certain wildlife species.	Transmitted usually via ingestion of raw or unpasteurized materials from infected animals. Inhalation of infectious aerosols (coughing and sneezing) from infected humans or animals is also possible.	Professionals working in outdoor environments or with live animals.	Most often attacks the lungs, but can affect almost any tissue in the body. Symptoms include cough, excessive sweating, fatigue, fever, breathing difficulty, chest pain, and weight loss. Gastrointestinal symptoms can also be prominent.
<b>Tularemia</b> ( <i>Francisella tularensis</i> ), also referred to as Deerfly fever, Rabbit fever, Pahvant Valley fever, Ohare disease, Yato-byo (Japan), or Lemming fever	Common in wild animals, especially burrowing rodents such as ground squirrels, rabbits, and hares along with muskrat and beaver.	Transmission through contact with an infected animal, tissue, or carcass via a skin puncture, by tick bites, mosquitoes and biting flies, by ingesting infected meat or by inhaling infected dusts.	Professionals working in outdoor environments, with live animals, or in recovery operations. Infection can occur from handling contaminated carcasses.	Pneumonia commonly occurs after inhalation. Other symptoms include swollen lymph nodes, skin ulcers at bites or infection sites, mouth ulcers, and sore throat after ingestion. Other possible complications include bone infection, pericarditis and meningitis. Possible agent for biological warfare.
<b>Whipple's Disease</b> ( <i>Tropheryma whippelii</i> ), also referred to as Intestinal Lipodystrophy	Source is unknown, but the bacteria are believed to be present in soils and animals.	Transmission is unclear, although it appears that some people are more vulnerable to the disease than others, likely due to genetic factors.	Most commonly affecting middle-aged Caucasian men, especially farmers or those exposed to the outdoor environment.	Bacteria attack the intestinal system, prevent the proper absorption of nutrients, and can manifest in abdominal pain, diarrhea, fever, gray to brown skin color, mental changes, joint pain, and memory loss. The bacteria are very rare. This disorder can be mistaken for other chronic intestinal disorders.
<b>FUNGUS</b>				
<b>Valley Fever</b> ( <i>Coccidioides immitis</i> or <i>Coccidioides posadasii</i> )	Spore-like organisms found in the soil typically in arid regions, commonly found the Southwest U.S. and Central and South America.	Soil disturbances such as wind or digging (e.g. at archaeological or construction sites), or natural disasters (e.g., dust storms and earthquakes) make the organisms available for inhalation.	Professionals working in outdoor environments.	Infection starts in the lungs, but symptoms can be widespread and include swollen ankles, feet, and legs; cough; chest pain; fever; headache; loss of appetite; changes in mental state; painful; red lumps on lower legs; and enlarged lymph nodes.
<b>Histoplasmosis</b> ( <i>Histoplasma capsulatum</i> )	Spore-like organisms found in bird or bat droppings and mammals associated with areas where bird or bat excrement accumulates. Soil enriched with bird and bat droppings is one main source of contamination. Spores are common in the soils of endemic areas such as the Atlantic and Central U.S.	Inhalation of airborne spores can be transmitted to humans, and domestic and wild animals.	Professionals working in caves, on construction sites, outdoor sculptures, and building exteriors where birds and/or mammals (i.e. bats) roost.	Most infected people have no apparent ill effects. Symptoms can vary from mild respiratory illness to debilitating fever, GI symptoms, chills, headache, cough, and chest pains. Distinct patterns may be seen in a chest x-ray. The disseminated form is fatal if not treated.
<b>VIRUS</b>				
<b>Hantaviruses</b> Hantavirus pulmonary syndrome—HPS or hemorrhagic fever with renal syndrome—HFRS including a number of pathogenic Hantavirus types	Rodent excretions, secretions, and infectious aerosols (droplets).	Inhalation, mucous membrane contact or open skin wound, contact with rodent contaminated food, water or living quarters.	Professionals working in outdoor environments or in recovery operations. Rodent nests are often in storage areas and outdoor structures.	This infection is highly contagious. Symptoms include fever, malaise, and flu-like symptoms that progress to respiratory and gastrointestinal problems.
<b>Nipah virus</b> (Family Paramyxoviridae, order Mononegavirales)	Bats of the genus <i>Pteropus</i> in Malaysia and pigs in Malaysia and Singapore (South Asia).	Close contact with infected animals can transmit the virus to humans, cats, and dogs. Human to human infections are also reported.	Professionals handling contaminated carcasses.	The virus often begins with influenza-like symptoms and then attack the central nervous system causing inflammation in the brain and respiratory illness.