Objective

To describe a variety of zoonotic disease of concern for individuals handling research animals and the procedure for reporting and seeking treatment for suspected zoonotic disease exposures or illnesses. Zoonotic diseases have been almost completely eradicated from purpose bred research animal colonies, however, at UK extensive amounts of fieldwork and collection of animal specimens for surveillance often place researchers in contact with wild animal populations. This document seeks to provide awareness and biosafety tips for UK personnel with potential for zoonotic disease exposure.

Definitions and Acronyms

Personal Protective Equipment (PPE): Clothing or equipment utilized to reduce exposure to hazards in the event that the risk associated with exposure to the hazard cannot be effectively mitigated through engineering (biological safety cabinets, fume hoods) or administrative (work practices) controls.

Zoonotic Disease: An infectious disease that can be transmitted from animals to humans. Many times transmission occurs through an insect vector. “Approximately 75% of recently emerging infectious diseases affecting humans are diseases of animal origin; approximately 60% of all human pathogens are zoonotic” (http://www.cdc.gov/ncezid/).

Background Information

The majority of known human pathogens are zoonotic. Additionally, it should be noted that the vast majority of emerging infectious diseases identified in the recent past, including West Nile Virus and SARS-Coronavirus, are zoonotic diseases. Individuals whose research or employment places them in close contact with live animals or unfixed animal specimens should be familiar with the particular zoonotic diseases associated with the animal species in use. This may vary depending on the type of activity involved with the animal species, the area of the world in which the animal or specimen was collected and even the season in which collection or fieldwork occurs. For example, transmission of Q-fever from sheep to humans is most likely to be associated with exposure to biological materials present in the birthing process. Raccoons which are wild caught in Kentucky are likely to have raccoon roundworm, Baylisascaris procyonis, infections. Lyme disease is more likely to be transmitted to humans in the early spring and summer as transmission is typically via the bite of an immature tick or nymph rather than an adult.
<table>
<thead>
<tr>
<th>Infectious Agent and Reference Link</th>
<th>Resultant Disease or Common Name</th>
<th>Natural Host or Reservoir</th>
<th>Route of Transmission</th>
<th>Signs and Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arboviruses</td>
<td>West Nile Virus, Dengue Fever, Yellow Fever</td>
<td>Birds, Horses, Wide range of mammals</td>
<td>Insect Vector, tick or mosquito bite</td>
<td>Early symptoms are generally fever and flu-like illness</td>
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<tr>
<td>Bacillus Anthracis</td>
<td>Anthrax</td>
<td>Cattle, Sheep, Goats, Horses, Pigs</td>
<td>Handling products from infected animals or by breathing in anthrax spores from infected animal products (wool or hides). Eating undercooked meat from infected animals</td>
<td>•Cutaneous: small blister that develops into a painless skin ulcer with a black area in the center •Gastrointestinal: nausea, loss of appetite, bloody diarrhea, fever, bad stomach pain •Inhalation: flu-like symptoms, cough, chest discomfort, shortness of breath, tiredness and muscle aches</td>
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<tr>
<td>Bartonella henselae</td>
<td>Cat Scratch Disease</td>
<td>Cats, Dogs</td>
<td>Direct inoculation through scratch or bite</td>
<td>Lesion at inoculation site, more serious disease may result in fever, lymphadenopathy and progression to meningitis or encephalitis</td>
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<tr>
<td>Baylisascaris procyonis</td>
<td>Raccoon Roundworm</td>
<td>Raccoons</td>
<td>Ingestion of contaminated material</td>
<td>Nausea, Tiredness, Liver enlargement, Loss of coordination, Loss of muscle control, Blindness, Coma</td>
</tr>
<tr>
<td>Borrelia burgdorferi</td>
<td>Lyme Disease</td>
<td>Deer, Wild Rodents</td>
<td>Insect Vector, tick bite</td>
<td>“Bulls-eye” rash, fatigue, chills, fever, headache, muscle and joint aches</td>
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<tr>
<td>Brucella species</td>
<td>Brucellosis</td>
<td>cattle, swine, goats, sheep, deer, caribou, elk, dogs, coyotes</td>
<td>Ingestion, Inhalation, Direct Contact</td>
<td>Fever, headache, weakness, sweating, chills, arthralgia</td>
</tr>
<tr>
<td>Coxiella burnetii</td>
<td>Q Fever</td>
<td>Cattle, Sheep, Goats, Dogs, Cats, Other Mammals</td>
<td>Ingestion, Inhalation, Direct Contact</td>
<td>Acute disease: self-limited flu-like illness, atypical pneumonia and hepatitis, Chronic disease: endocarditis</td>
</tr>
<tr>
<td>Cryptosporidium species</td>
<td>&quot;Crypto&quot;</td>
<td>Large Vertebrate Host Range</td>
<td>Fecal-oral Transmission</td>
<td>Profuse, watery diarrhea, cramping, abdominal pain, weight loss, flatulence and malaise</td>
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</tbody>
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<tr>
<td><strong>Dermatophytes, including <em>Microsporum canis</em> [<a href="https://www.cdc.gov/fungal/diseases/ringworm/index.html">https://www.cdc.gov/fungal/diseases/ringworm/index.html</a>]</strong></td>
<td>Ringworm, Tinea</td>
<td>Dogs, Cats, other Mammals</td>
<td>Direct contact</td>
<td>Skin, hair or nail infections characterized by redness, scaling and cracking of skin, Hair loss</td>
</tr>
<tr>
<td><strong>Francisella tularensis [<a href="http://www.cdc.gov/Tularemia/">http://www.cdc.gov/Tularemia/</a>]</strong></td>
<td>Tularemia, Rabbit Fever</td>
<td>Rabbits, Birds, Wild Animals</td>
<td>Ingestion, Inhalation, Inoculation, Insect Bite</td>
<td>Ulcer at infection site, lymph node swelling, pain, fever</td>
</tr>
<tr>
<td><strong>Hantaviruses [<a href="http://www.cdc.gov/hantavirus/">http://www.cdc.gov/hantavirus/</a>]</strong></td>
<td>Hantavirus Pulmonary Syndrome, Hemorrhagic Fever with Renal Syndrome</td>
<td>Rodent Species</td>
<td>Inhalation of aerosolized secretions, waste or other contaminated material</td>
<td>Early symptoms: Flu-like Illness, Later symptoms are dependent on causative virus</td>
</tr>
<tr>
<td><strong>Hepatitis E Virus [<a href="http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/hepe-eng.php">http://www.phac-aspc.gc.ca/lab-bio/res/psds-ftss/hepe-eng.php</a>]</strong></td>
<td>Hepatitis</td>
<td>Rabbits and other animal species</td>
<td>Fecal-oral Transmission</td>
<td>Symptoms identical to acute viral hepatitis. Jaundice, malaise, anorexia, abdominal pain, nausea, fever, diarrhea, discolored stool and/or urine, and hepatomegaly</td>
</tr>
<tr>
<td><strong>Influenza Virus <a href="http://www.cdc.gov/flu/avianflu/">http://www.cdc.gov/flu/avianflu/</a> [<a href="http://www.cdc.gov/flu/swineflu/">http://www.cdc.gov/flu/swineflu/</a>]</strong></td>
<td>Avian Flu, Swine Flu</td>
<td>Swine, Domestic and wild avian species</td>
<td>Direct animal to human transmission is rare, respiration of aerosols or droplets, contact with contaminated surfaces</td>
<td>Fever, headache, myalgia, malaise, sore throat, non-productive cough, sneezing and nasal discharge</td>
</tr>
<tr>
<td><strong>Leptospira interrogans [<a href="http://www.cdc.gov/leptospirosis/">http://www.cdc.gov/leptospirosis/</a>]</strong></td>
<td>Leptospirosis</td>
<td>Domesticated animal including dogs, horses, cattle</td>
<td>Direct or indirect contact with urine or tissue of infected animals</td>
<td>Fever, headache, chills, severe malaise, vomiting, myalgia and conjunctival suffusion</td>
</tr>
<tr>
<td><strong>Lymphocytic Choriomeningitis Virus [<a href="https://www.cdc.gov/vhf/lcm/">https://www.cdc.gov/vhf/lcm/</a>]</strong></td>
<td>LCMV</td>
<td>Rodents, particularly Mus. musculus and Syrian hamsters</td>
<td>Contact with contaminated rodent waste or secretions</td>
<td>Flu-like illness, aseptic meningitis, encephalitis or meningoencephalitis</td>
</tr>
<tr>
<td><strong>Macacine herpesvirus 1 (formerly Cercopithecine herpesvirus 1 [CHV-1]) [<a href="http://www.cdc.gov/herpesbvirus/index.html">http://www.cdc.gov/herpesbvirus/index.html</a>]</strong></td>
<td>Herpes B Virus, Monkey B Virus, Herpesvirus Simiae</td>
<td>Macaques</td>
<td>Direct mucous membrane or wound contact with bodily fluids from infected macaques or contaminated surfaces</td>
<td>Fever, headache, and vesicular skin lesions at exposure site</td>
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| Monkeypox Virus
http://www.cdc.gov/ncidod/monkeypox/index.htm | Monkeypox | Arboreal squirrels, rodents | Direct mucous membrane or wound contact with bodily fluids from infected animals or contaminated surfaces | Initial flu-like illness followed by rash development |
| Mycobacterium tuberculosis
http://www.cdc.gov/tb/ | Tuberculosis, TB | Non-human primates | Inhalation of infectious aerosols, Direct contact with infected animals/tissues | Fatigue, fever, cough, chest pain |
| Orf Virus
https://www.cdc.gov/poxvirus/orf-virus/index.html | Sore Mouth, Contagious Ecthyma | Sheep, Goats | Direct skin contact with infected animal or contaminated surfaces | Painful sores at inoculation point |
| Rabies Virus
http://www.cdc.gov/rabies/ | Rabies | Wide mammalian host range, Dogs, Skunks, Raccoons, Bats | Bite of infected animal, Contact of infectious material (saliva) with mucous membrane or wound | Acute infection, progressive encephalomyelitis, typically fatal, initial symptoms resemble flu-like illness |
| Salmonella species
http://www.cdc.gov/salmonella/ | Salmonellosis | Domestic and wild animals, Birds, Pets - especially reptiles and turtles | Ingestion of contaminated food, Direct contact with infected animals, Fecal-oral | Acute gastroenteritis, abdominal pain, diarrhea, nausea, vomiting |
| Strongyloides species
https://www.cdc.gov/parasites/strongyloides/gen_info/faqs.html | Strongyloidiasis | Humans are typically infected with Strongyloides stercoralis | Contact with soil contaminated with free-living helminths | Generally asymptomatic, some have non-specific or generalized complaints |
| Toxocara canis, Toxocara cati
https://www.cdc.gov/parasites/toxocariasis/index.html | Toxocariasis, Roundworm | Dogs, cats serve as reservoirs | Ingestion of embryonated eggs from soil, dirty hands, raw vegetables, contact with infected animals | Generally asymptomatic, symptoms will depend and vary greatly depending on organ system affected |
Infectious Agent and Reference Link | Resultant Disease or Common Name | Natural Host or Reservoir | Route of Transmission | Signs and Symptoms
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*Toxoplasma gondii* [https://www.cdc.gov/parasites/toxoplasmosis/index.html](https://www.cdc.gov/parasites/toxoplasmosis/index.html) | Toxoplasmosis | Cats, Warm-blooded animals, Birds | Ingestion, inhalation, contact with infective oocysts, typically present in cat feces | Generally asymptomatic; Abortion, stillbirth and severe central nervous system involvement may be seen in congenital cases

**Procedure**

- Know the signs and symptoms of the likely zoonotic diseases present in the animal species with which you will be working.
- Know who to contact in the event of a suspected exposure or illness:
  - Follow the same procedure you would for other occupational injuries or exposures, [http://ehs.uky.edu/docs/pdf/ohs_lab_exposure_protocol_0001.pdf](http://ehs.uky.edu/docs/pdf/ohs_lab_exposure_protocol_0001.pdf).
- Take precautions to prevent biting or physical injury when handling live animals:
  - These may include chemical or physical restraints or personal protective equipment such as bite-resistant gloves.
- Depending on the route of transmission and likelihood of zoonotic disease presence determine the appropriate personal protective equipment:
  - Consultations with knowledgeable veterinarians and/or biosafety professionals can be helpful in determining this information.
  - Examples of appropriate PPE may be:
    - Gloves when handling animals with suspected Salmonella infections.
    - Face shields and respiratory protection when handling non-human primates with suspected Herpes B virus infections.
- Receive appropriate vaccinations based on animal species being handled:
  - An example of appropriate vaccination would be receipt of rabies vaccine prior to handling of field collected raccoon specimens.
- Utilize appropriate transport containers and storage methods for potentially infectious specimens collected in the field or animal research facilities.
- Decontaminate reusable equipment and properly dispose of materials which may have been in contact with infectious animals or specimens.

**References**


Centers for Disease Control and Prevention, A-Z Index,
http://www.cdc.gov/

National Center for Emerging and Zoonotic Infectious Disease,
http://www.cdc.gov/ncezid/