

**General information on risks associated with work in natural environments in Virginia, with a special focus on disease risks associated with working with wild vertebrate animals, including a partial catalog of potential human pathogens.**

**Prepared for distribution to users of the University of Virginia's (UVA) biological field stations: Mountain Lake Biological Station, Blandy Experimental Farm, and the Anheuser-Busch Coastal Research Center.**

**Part I: General Hazards**

Some level of risk is associated with any activity. This is especially true for activities under uncontrolled natural conditions in remote locations where immediate medical care may be unavailable, or where participants may be exposed to physical stresses or disease-bearing organisms. Although primary responsibility for accepting and addressing these risks must be assumed by you, as a participant in activities at field stations, the University of Virginia is providing this document to provide you with some information on the potential for exposure to hazards associated with working under natural field conditions in Virginia, including exposure to diseases transmitted from wildlife to humans (zoonoses). This document is structured to first provide general information and recommendations regarding general good practices when working at field stations. It then provides more specific information on risks related to exposure to wild vertebrate animals.

While working at a field station, you are exposed to a different set of "risks" than you are in an indoor working environment. Perhaps most obvious are the risks inherent in being "out-of-doors," and possibly far from professional medical help. Station users should prepare for environmental conditions and situations they might encounter on a camping, backpacking, or boating trip. Simple exposure to normal environmental conditions in Virginia may cause heat exhaustion or hypothermia in some individuals. Common sense preparation (adequate clothing, water and other supplies) can save your life when weather conditions change, you have an accident, or you become delayed or lost in the field. Similarly, making sure you have an extra supply of any medication you need is advisable (consult your physician as appropriate). Please consult your physician and inform the station staff if you have a special medical need or condition. This might include diabetes management, allergies to insect bites, asthma, chemotherapy or other medical conditions that could put you at special risk in the field. Each station has policies and site-specific guidelines for staying safe in the field. Become familiar with them. Also be sure to consult station recommendations with regard to appropriate clothing and out-door gear. Become familiar with common site-specific hazards such weather, geographic or aquatic dangers, poison ivy, poisonous snakes, etc. when you arrive or before by talking to station staff or through station-specific web sites. Accidents happen, but an educated responsible person can remain happy and safe working at any of UVA's field facilities through the exercise of foresight and common sense

## **Disease**

Disease and other hazards are not always obvious, and can impact different people in different ways. For example, immune compromised individuals may be at considerable risk of contracting a disease after exposure to ordinarily harmless organisms. Many normal and common microorganisms found in nature, or associated with wild animals, can be potential pathogens for humans. Below is a catalog of the more common conditions or organisms (found in Virginia) with potential to cause disease in humans. This list is not meant to be either inclusive or exclusive, and these organisms or conditions may or may not be found at any of the Universities biological field stations. If you have any questions about your personal risk, please seek the advise of a physician. Your physician has the option of calling the Center for Disease Control (CDC) or other resources to become better able to address your questions or concerns. For additional specific information you can contact the Director of the UVA Field Station you will be visiting.

### ***Water borne pathogens.***

Drinking from non-approved (especially 'surface') water sources can predispose you to coliform bacterial infections, giardiasis, amoebiasis, and other viral, parasitic and bacterial diseases. Such water sources may contain environmental contaminants such as heavy metals, pesticide or insecticide or herbicide compounds. Drinking seawater will dehydrate you sooner than not drinking at all. Bring an adequate supply of drinking water on all outings of any duration.

### ***Insect and Tick borne pathogens.***

Insects, particularly those that feed on human blood, can provide a vector for the transmission of diseases. For example, ticks may transmit Lyme disease and Rocky Mountain Spotted Fever and mosquitoes may transmit the West Nile Virus. For this reason, protective clothing and insect repellent is recommended, especially during seasons when insects are active. When returning from the field, you should do a thorough check of your body to assure that no ticks remain attached. Additionally, if you develop illness following work in an environment where you are exposed to insect pests, you should inform your physician, so that she or he can factor that into their diagnosis and treatment.

### ***Exposure to Wild Vertebrate Animals.***

While many known infectious diseases are harbored by wildlife, this document will cover the most common ones and some simple and reasonable precautions that can be applied. In general, one can never be certain which wildlife species or individual animal may be harboring a human pathogen. The risk of acquiring zoonotic infection (i.e. disease through contact with animals) increases when handling animals, or their parts, secretions or excreta. Sometimes just visiting a species' environment can increase the risk for acquiring certain diseases. For example, some diseases are transmitted to humans by the bite of an infected tick, louse, flea or mosquito, which can pass an infection to humans from a wild or domestic animal that carries the disease. Therefore, it is prudent to take some reasonable precautions. Disposable gloves and respirators will be

available when working with species where special protections are warranted. Proper fit testing, instructions for respirator use, and other safety procedures will be provided as needed by project leaders or instructors. You may request equipment and training when handling animals or specimens. When you are done collecting specimens, it is prudent to wash your hands with soap and water at the first opportunity (especially before eating or drinking) to diminish the burden of organisms that may have contaminated them. Likewise, some insect-borne diseases can be acquired by direct contamination of a wound with infected animal blood or tissues without ever receiving an insect bite. It is worthwhile to clean wounds thoroughly as soon as possible upon returning from field trips. Apply insect repellent where mosquitoes and other biting insects are present. Wearing properly fitted HEPA cartridge full-face respirators prevents the spread of diseases acquired by breathing infectious particles (usually dust that contains dried excreta of wild mice such as Hantaviruses and Q-fever). The office of Environmental Health and Safety at the University of Virginia or on-site station staff or course instructors can assist anyone interested in fit testing full-face respirators.

## **Part II- Diseases associated with particular vertebrate groups, or their use in teaching and research**

This section provides specific information on disease risks associated with contact with specific vertebrate groups. As noted in Part I, this list is not meant to be inclusive, exclusive or exhaustive. These organisms or conditions may or may not be found at any of the University's biological field stations.

### ***Working with avian species:***

**West Nile virus (WNV)** is an endemic disease in Virginia, as is the case elsewhere in the US. Native American birds and even some mammalian species are assumed to be highly susceptible to this disease. The severity of disease seen in individual birds depends on many factors. Younger birds and those dying with neurological or other disease signs should not be touched. Anecdotal evidence suggests that virus transmission to humans can occur by handling dead bird carcasses or wastes; virus can also be present in the stool of live birds. Because birds sick or dying from the disease may have very high levels of the virus in their tissues, a post-mortem examination or museum skin preparation represent particularly high-risk procedures. Preserving tissues (i.e. 1 part tissue: 10 parts universal fixative [Haemo D, Fisher Scientific] by volume) overnight will inactivate the virus, allowing safe handling.

Of course, walking in the woods with WNV-laden mosquitoes is another potential risk. Liberal use of insect repellent after dark is a prudent safety precaution worth considering.

**New Castles' disease** is a viral disease with some virulent strains. Some New Castles disease strains do affect people, causing flu-like symptoms. Exposure, although unlikely, could occur from a wild bird exhibiting general debility, diarrhea, respiratory, or nervous system signs.

**Yersiniosis**-see under mammalian diseases below.

### ***Working with mammals:***

**Rabies** is endemic in wild unvaccinated carnivores and the incidence in the raccoon population of Virginia and Maryland is the highest in the country. Feral or potentially unvaccinated cats, dogs, and bats are also carriers in Virginia. Wild rodents, metatherians (opposums) and lagomorphs (rabbits) can also contract rabies. However, the raccoon is the wild animal that poses the greatest risk in Virginia. All other mammals are assumed to be susceptible, including humans. If you plan to work with high-risk species (eg. raccoons or bats), then you must receive vaccination against this disease. If you do not plan to work with these species, and will not handle them at all, then vaccination may not be needed, consult with your doctor. In working with lower risk species, vaccination may or not be warranted depending on the level of risk you consider acceptable. In any case, wear protection against injuries particularly mammalian animal bites. As soon as possible after receiving a bite from a mammal that breaks the skin clean and scrub the area with disinfectant, and soak for 30 minutes in disinfectant afterwards. This is the single most important prevention of contracting any disease from an animal bite. Report animal bizarre behaviors or encounters leading to unsuspected rabies exposure to station staff, who will notify local health department. In “true exposures,” where bite wounds are incurred by any abnormally behaving mammal, contact the local health department for immediate prophylactic vaccination. Eye protection should be worn if dissecting a mammal that may have died under unexplained circumstances.

**Rocky Mt. Spotted Fever** (*Rickettsia rickettsii*) is a disease requiring a tick vector for people to become infected. Human signs include: fever, headache and rash.

**Lyme disease** (*Borrelia burghdorferi*) is a spirochaetal bacteria of deer, white footed mice, and possibly other species that is passed by pin head-sized (or smaller) ticks of the genus *Ixodes*, or occasionally by direct contact with the infected vertebrate. You must have a tick drinking your blood for at least 16 hours to contract the disease. Removal of tick before this length of time is preventative. A reddish halo (bull’s eye ring around the bite) forms approximately 2-12 weeks following a tick bite, and is often the only early sign recognized. After this, systemic illness may develop including: heart inflammation with arrhythmia, arthritis & nervous system disease including peripheral nerve dysfunction.

**Sarcoptic mange** (*Sarcoptes scabiei*) mites are directly transferred by contact, and result in a spreading scabby exuding and intensely itchy skin lesion, infested with microscopic mites.

**Roundworms** (*Baylisascaris procyonis* & *B. columnaris*) are carried by skunks and raccoons. Contact with feces can pass the sticky and environmentally durable eggs to humans. Contracting this disease occurs by accidental ingestion of the eggs (e.g. in the absence of hand washing or gloves). Infection of humans can lead to larval parasite migration to the central nervous system.

**Babesia** (caused by the intracellular parasite *Babesia microti*) is a flu-like illness that usually lasts for 1 or 2 weeks, and may cause a self-limiting hemolytic disease

transmitted by tick bite, (the deer tick commonly). Individuals who have had to have their spleen removed for any reason develop a very serious disease compared to others.

**Tularemia** (caused by *Franciella tularensis*) is a severe bacterial disease carried by rodents and lagomorphs (rabbits) that is readily transmissible to humans. The disease is most commonly associated with water sources. There is also some suggestion that it can be transmitted by mosquitoes and other biting arthropods. Field dissection of infected animals is a common cause of exposure, as is contact with contaminated food, water or hands in the eyes. Also, the organism is unusual in that it can penetrate intact undamaged skin. In humans and other species, the agent rapidly grows in the blood, produces high fever, and can lead to death if it goes undiagnosed and untreated.

**West Nile virus** has been associated with die-offs in squirrels in several parts of the US. It is assumed to affect other mammals as well, particularly other sciurid rodents. (see the disease risk and other information under **Avians** above).

**Yersiniosis** (caused mainly by *Y. enterocolitica* in people) is an organism carried by wild birds and mammals that concentrates in water bodies under conditions of cold wet weather. Individuals drinking from that water source can be exposed to very high doses. The agent causes diarrhea, enlarged lymph nodes in the gastrointestinal tract and an appendicitis-like syndrome.

***Working with reptiles:***

All reptiles (herbivore, omnivore or carnivore) can carry the *Salmonella* species of bacteria. Contact with reptiles has been directly implicated in human Salmonellosis outbreaks. Reptiles carrying the pathogenic agent typically exhibit no signs of illness themselves. Washing hands after handling, (or avoiding contact with reptiles if you have children under 5 years of age, are pregnant, or if you are immunocompromised) are typical CDC recommendations. Hand-washing after handling is prudent. Cleaning potentially soiled reptile utensils, capture tools or housing accoutrements in human food preparation areas is to be avoided.

***Working with fish and aquatic amphibians:***

Aquatic species can carry pathogenic bacteria such as *Klebsiella* and other gram negative and gram positive bacteria, although these rarely lead to human infections under normal conditions. In addition, *Edwardsiella tarda* and atypical *Mycobacteria* species, carried by aquatic species are known human pathogens.

**APPENDIX: -disease agents known to be harbored by vertebrate host species in the state of Virginia (not all vertebrate hosts are found at all field stations).**

This list was created to be used to aid researchers, teachers and students in assessing their own risk of disease exposure, associated with handling a specific vertebrate species. It does not represent all animal species that might be contacted in a field situation or every conceivable disease that could be carried.

White Footed Mice (Peromyscus sp.)

1. Hantaviruses – transmitted through feces or urine, resistant to drying
  - a. Sin Nombre – fever, headache, cough, vomiting, muscle soreness
  - b. Hantavirus Pulmonary Syndrome also called Four Corners Disease, flu-like symptoms, nausea, vomiting, and gastrointestinal pain followed by acute respiratory distress
  - c. Seoul virus – hemorrhagic renal syndrome, milder degree of bleeding and liver dysfunction. Fivephases: (1) febrile phase, (2) hypotensive phase, (3) oliguric phase, (4) diuretic phase and (5) convalescent phase
2. Lyme's Disease (*Borrelia burgdorferi*) – transmitted by tick bite (*Ixodes dammini* – deer tick commonly) or direct exposure. Three forms of the disease in humans are described: 1. mild heart inflammation with electrical conduction abnormalities, 2. neurologic disease, peripheral nerve dysfunction, and 3. classic form--the target lesion or bull's eye appearance of redness of the skin at the bite wound
3. *Sarcoptic scabei* – mange mites directly transferred by contact, intensely itchy skin lesion infested with microscopic mites
4. *Babesia microti* – a flu-like illness that usually lasts for 1 or 2 weeks, self-limiting hemolytic disease transmitted by tick bite, deer tick commonly
5. *Rickettsia rickettsii* – rocky mountain spotted fever, transmitted by tick bite symptoms are fever, headache and rash

Spiny Mice (*Acomys cahirinus*)

1. *Streptobacillus moniliformis* – rat bit fever or Haverhill Fever, transmitted by bite wound, normal inhabitant of *Acomys* oral cavity. Symptoms most commonly associated with this disease are joint infection and pain near the site of the bite wound.
2. *Bartonella elizabethae* and *Bartonella birtlesii* –arthropod transmitted but the vectors for these have not been identified. Symptoms are locally enlarged lymphnodes that abcess most commonly.
3. *Cryptosporidium parvum* – protozoal organism causing a self-limiting diarrhea.
4. West Nile virus – mosquito transmitted flu-like symptoms in most people, potential encephalitis in elderly and immune deficient people.

Wood mouse (*Apodemus sylvaticus*)

1. Tularemia – Rabbit fever, caused by the bacteria *Francisella tularensis*, pneumonia or localized abcessed lymph nodes
2. Lyme disease
3. Cryptosporidiosis
4. *Coxiella burnetti* – Q fever, highly infectious organism causes pneumonia
5. *Rickettsia typhi* and *Rickettsia prowazecki* – murine typhus and scrub typhus caused by contacting the organism in the infected feces of mouse fleas or lice, respectively.
6. *Yersinia pseudotuberculosis*- bacterium causing intestinal infection causes appendicitis
7. *Trichophyton mentagrophytes* – ringworm, fungal infection of skin and hair
8. Emmonsia– fungus the causative agent of Adiasporosis, infection generally of bone
9. *Bartonella birtlesii*

Voles (*Microtis* sp.)

1. *Babesia microti*
2. Lyme disease
3. Hantaviruses – Puumala
4. Leptospirosis – bacteria infection of liver and kidney caused by contacting contaminated urine or drinking water
5. Tularemia
6. Emmonsia
7. Hantavirus Pulmonary Syndrome

Vole (*Clethrionomys* sp)

1. Hantavirus – Puumala and hemorrhagic fever with renal syndrome
2. *Trichophyton mentagrophytes*
3. Tularemia
4. Cryptosporidiosis
5. Emmonsia
6. Lyme disease

7. *Brucella abortus* – Maltese fever, a bacterium causing relapsing fever with dementia
8. *Campylobacter* sp – gram negative bacteria causing self-limiting diarrhea

Raccoon (*Procyon lotor*)

1. **Rabies** – Flavivirus causing hydrophobia, very common in Virginia raccoon population transmitted by bite or raccoon saliva contamination of an open wound, vaccine for humans is available
2. *Baylisascaris procyonis* – nematode parasite very common in raccoon's transmitted by ingesting food contaminated with raccoon excrement
3. Leptospirosis
4. *Giardia lamblia* – protozoan causing diarrhea associated with ingesting food or water contaminated by excrement
5. *Trypanosoma cruzi* – American trypanosomiasis, seen in the southwest US associated with ingesting food contaminated with excrement from the “kissing” bug (Reduviidae beetles) that have acquired the infection from a mammalian source
6. *Rickettsia rickettsii*
7. *Salmonella* sp - bacteria causing severe diarrhea and abdominal cramping
8. Lyme disease

Turtles, lizards, snakes

1. *Salmonella* sp,

Amphibians

1. *Mycobacterium* sp. localized proliferative skin lesion or nodules in the internal organs (nonspecific)
2. *Salmonella* sp