OCCUPATIONAL HEALTH AND SAFETY HAZARDS IN THE RESEARCH ANIMAL HOUSES

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Hazard Categories

- 1. Bites, scratches
- 2. Allergens
- 3. Zoonosis
- 4. Protocol Related Hazards
- 5. General Safety Hazards

Bites, Scratches, Kicks

- Employees should be properly trained in animal handling, general restraint techniques, and environmental factors for the species they will work with. In addition, all staff should be familiar with first aid procedures specific to each species and the incident reporting process.

Restraint

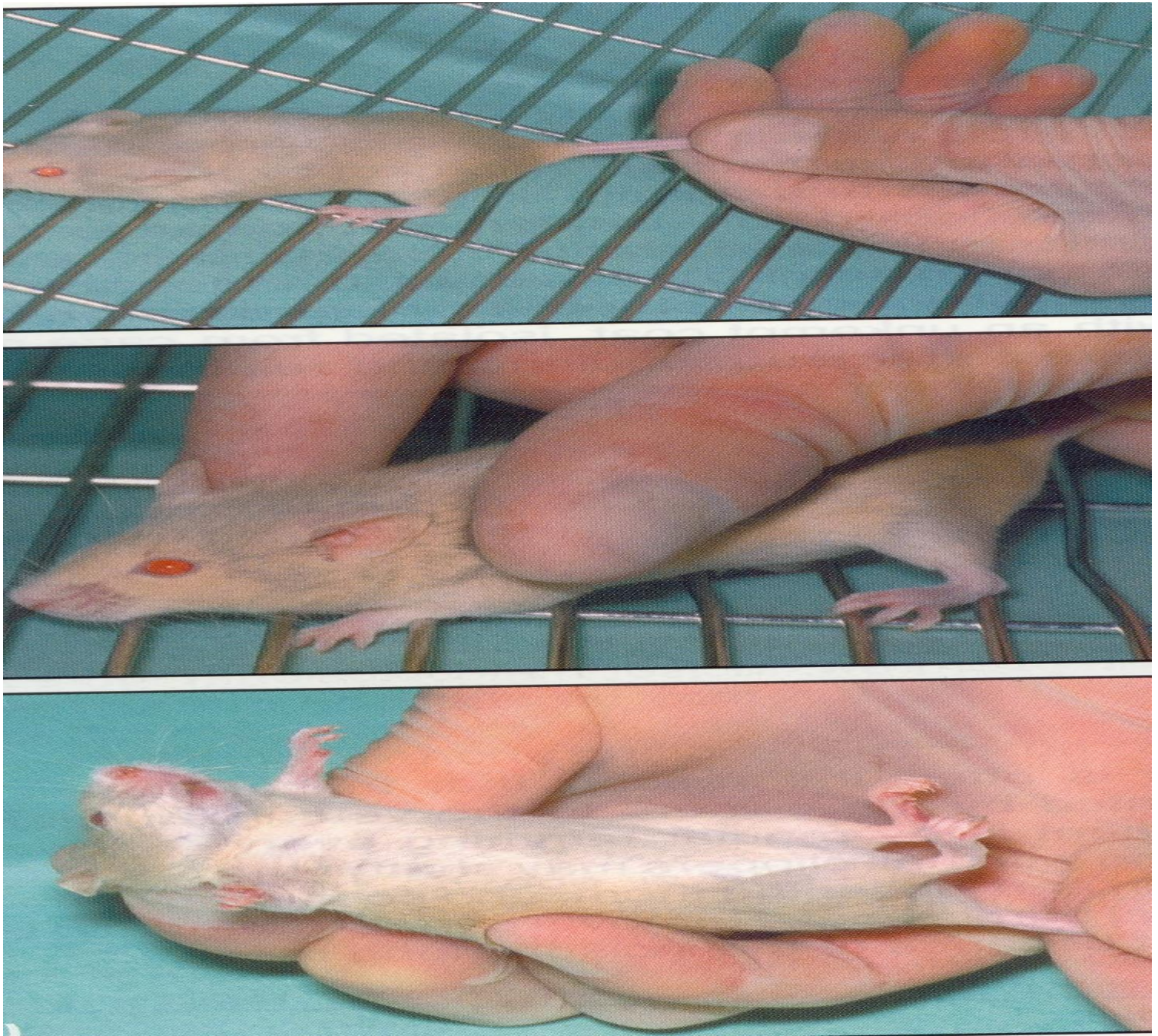
- Restraint - state of being controlled, confinement.
- Analgesia - loss of sensitivity to painful stimulation without loss of consciousness.
- Anesthesia - loss of feeling or sensation, which is often accompanied by loss of consciousness.

  Local Anesthesia - loss of sensation to a section of the body.

  Surgical (General) Anesthesia - unconsciousness with adequate analgesia and muscle relaxation to allow surgical manipulation without struggling or pain perception by the patient.
- Sedation - mild degree of central depression in which the patient is awake but calm (used interchangeably with tranquilization).

Introduction to Syrian Hamsters

Restraint



Restraint

Restraint

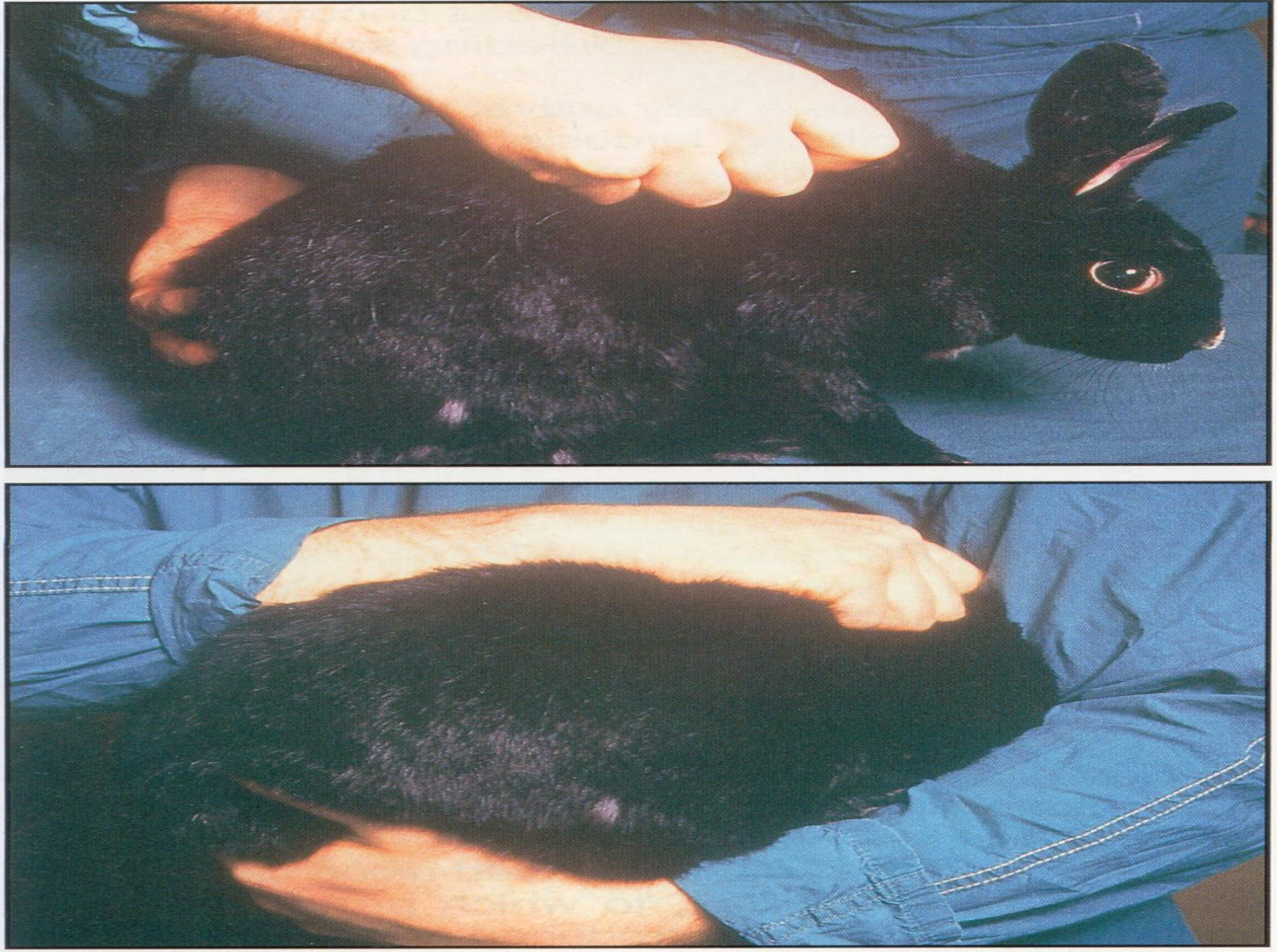


Figure 8.6 Handling techniques.

Allergens

- One of the most common health risks in the research animal setting is allergic reaction to lab animals.
- It is estimated that anywhere from 10% to 44% of animal care workers will develop allergic symptoms to the animals. In addition, an estimated 10% of workers will eventually develop occupation-related asthma.
- The risk of developing an allergy depends on many factors such as animal species contact, facility and ventilation design, and the employee's personal health status.
- For example, individuals with certain respiratory conditions or pre-existing allergies may be at higher risk of developing lab animal allergies and/or experiencing more severe allergic reactions.

Symptoms of allergic reaction

- Contact urticaria with symptoms such as skin redness, itchiness, welts or “hives”
- • Allergic conjunctivitis with symptoms such as sneezing, eye itchiness, clear nasal drainage, or nasal congestion
- • Allergic rhinitis with symptoms such as sneezing, nose itchiness, clear nasal drainage, nasal congestion
- • Asthma with symptoms such as cough, wheezing, chest tightness, or shortness of breath
- • Anaphylaxis with symptoms such as generalized itching, hives, throat tightness, eye or lip swelling, difficulty swallowing, hoarseness, shortness of breath, dizziness, fainting, nausea, vomiting, abdominal cramps, diarrhea

- People may be allergic to any animal species. The allergens are proteins that are excreted in animals' saliva, urine, and from various glands associated with the skin. The proteins tend to be sticky and become associated with the animal's hair and with particles of dander.

- The allergens are unique to each species of animal, so it is possible to be allergic to one species but not another. It is also possible to be allergic to multiple species

Minimize exposure to the allergens

- Engineering controls, such as biosafety cabinets or downdraft tables.
- Personal protective equipment, such gloves, gowns, hair/shoe covers, N95 respirator masks, and safety goggles.
- Work practices, such as opening cages in biosafety cabinets, handwashing/showering after
- handling animals, and keeping cages/work area clean.

Zoonosis

- The transmission of zoonotic disease in the laboratory-animal environment is uncommon because many laboratory species today are bred to be free of zoonosis and there is also ongoing veterinary screening of animals in the research setting which rapidly identifies any disease occurrence.
- Although a normal, healthy adult person may have only mild symptoms of a zoonotic disease, that person may unknowingly spread the disease to others, including family members, who may be susceptible to more serious consequences of infection, such as severe illness or death.

Susceptible persons

- Some individuals may be at increased risk for zoonotic infection due to personal health status, such as during pregnancy or with immune compromised conditions (e.g., long-term steroid use, cancer/cancer therapies, kidney/liver disease, removal of spleen, diabetes, AIDS/HIV infection).

Rodent and lagomorphs Zoonotic disease

- Viruses: Lymphocytic choriomeningitis virus (LCMV), Hanta virus,
- Bacteria: Salmonella, Campylobacter (gastrointestinal diseases); *streptobacillus moniliformis* (rat bit fever); leptospirosis, Tularemia
- Fungi: dermatophytes (ringworm)
- Protozoans: *giardia*, *cryptosporidium*, *entomaeba* (gastrointestinal diseases); toxoplasma gondii (toxoplasmosis).
- Worms: *Hymenolepis spp* (tape worm)

- The vast majority of mice and rats used in research are bred in controlled environments under exacting microbiologic controls with frequent monitoring.
- These animals are generally free of any diseases transmissible to man.
- Wild caught rodents and rodents from facilities lacking standard practices may present a wide variety of zoonotic diseases.

(Rat bite fever, Haverhill fever)	products	in some animals	
Salmonellosis (most rodents)	• fecal-oral, ingestion of contaminated products	• malaise, dehydration, bloody diarrhea	• dehydration, vomiting, abdominal pain, nausea
Leptospirosis * (most rodents)	• direct contact with contaminated urine	• infertility, fever, anorexia, anemia	• headache, myalgia, conjunctivitis, nausea
Lymphocytic Choriomeningitis (LCM)	• exposure to saliva or urine from infected animals or to infected cell lines in the lab • fomites may play a role	• viremia, viuria, and chronic wasting disease	• subclinical infection, mild flu-like symptoms • viral meningitis and encephalitis (rare)
Hantavirus* (most rodents)	• exposure to aerosols, urine, and fecal material from infected animals • fomites may play a role	• subclinical	• fever, myalgia, petechiation, abdominal pain, headache
Dermatophytosis (Trichophyton mentagrophytes)	• direct contact	• circular raised erythematous lesion with hyperkeratosis and hair loss	• circular raised erythematous lesions with hyperkeratosis and hair loss
Ornythonysisus Bacoti (Tropical Rat Mite)	• direct contact with cage materials	• assymptomatic to moderate pruritis	• severe pruritis
Sarcoptes scabei (Guinea Pigs and Hamsters)	• direct contact with infected animal	• intense pruritus	• intense pruritus
Rodentolepsis nana	• direct or indirect life cycle, with cockroaches, grain beetle and fleas • autoinfection in human	• no external signs of infection	• catarrhal enteritis, diarrhea, emaciation and chronic weight loss may occur with heavy infestations
Pneumocystis carinii	• airborn	• Pneumonia in immunosuppressed humans.	• Pneumonia in immunosuppressed humans.

Lymphocytic Choriomeningitis Virus

- Etiology: LCM is a RNA virus of the arenavirus group. Incidence of infection and spontaneous disease is rare. Most reported human cases have been associated with infected hamsters.
- Transmission: In utero or perinatal infections (within 1 day post-partum) may produce a subclinical persistent infection or a chronic, progressive wasting disease.
- The virus is intermittently shed in urine and saliva with the concomitant production of antibody. If infected as young adults, antibody production and persistent viruria and viremia continue for up to 6 months.
- The natural reservoir for LCM is the wild rodent population. Transmission occurs via urine and saliva, traumatized skin, conjunctiva, respiratory passages, or congenital contamination.
- Clinical Signs: Usually there are no clinical signs. Wasting syndrome and death may occur in hamsters with persistent infections. Signs can include convulsions, decreased growth, and inactivity. Decreased reproduction has been reported in chronically infected females.

Francisella tularensis - Tularemia

- Circulates in rodents and lagomorphs
  - >250 animal species
  - Arthropod vectors include ticks, mosquitoes, deer flies
- Causes 6 different types of tularemia: ulceroglandular, glandular, oropharyngeal, gastrointestinal, oculoglandular, respiratory
  - Fever, malaise, lymphadenopathy
  - Lethal pulmonary infections; septicemia; plague-like disease
- Gram-negative facultative intracellular pathogen - primary target cell is mΦ
- Proliferates in various host organs and disrupts normal function; induces significant inflammatory response → disease

Salmonellosis

- There are 2500 known serotypes of Salmonella, but *S. enteritidis* and *S. typhimurium* are most frequent isolated from mice.
- Salmonella is most commonly associated with insufficient hygiene or inadequately cooked food during food preparation.
- Salmonella may be found in the feces of some pets, especially those with diarrhea, with reptiles most likely to harbor Salmonella. Handling these animals exposes humans to infection.

- In rodents could be asymptomatic or cause abortions in hamsters.
- Most common symptoms in humans include diarrhea, fever, and abdominal cramps. The illness could be self limiting, but in some instances the diarrhea may be severe that the patient needs to be hospitalized and treated promptly with antibiotics and fluid therapy.

Rat Bite Fever (Haverhill Fever)

- Rat Bite Fever is a disease condition caused by Strebtobacillus moniliformis, a comensal, G-negative, pleomorphic rod that can exist as non-pathogenic L phase variant in vivo, but it can revert to virulent bacillus form.
- Present in the upper respiratory tracts and oral cavities of **asymptomatic** rats, that can transmit it to mice.

Comparison of rat bite fevers.

Comparison of rat bite fevers.

Causal organism	*S. moniliformis*	*S. minus*
Shape of organism	Gram-negative rod with bulbous swellings	Gram-negative spirillum
Geographical distribution	World wide	Mainly Asia
Transmission route	Rat bite, scratch or mucosal contact; contaminated food in Haverhill fever)	Rat bite
Bite wound	Rapidly healing	Rapidly healing but development of chancre-like lesion at onset of symptoms
Onset of illness	Fever, chills, vomiting, headache	Fever, chills, vomiting
Regional signs	Mild lymphadenitis	Regional lymphangitis and lymphadenopathy
Fever		
Character	Irregularly relapsing	Regularly relapsing
Onset (average)	2–3 days	2–3 weeks
Arthritis	Common (49% of cases)	Rare
Rash		
Character	Morbilliform to purpuric	Macular, often confluent
%Affected	75%	50%
Untreated mortality	7–13%	6.5%
Diagnosis	Culture, molecular techniques	Microscopy; animal inoculation
First choice antibiotic	Penicillin	Penicillin
Complications	Endocarditis, myocarditis, pericarditis, pneumonitis, anemia, amnionitis, prostatitis, pancreatitis, diarrhoea and abscesses in various organs	Endocarditis (rare), myocarditis, meningitis, hepatitis, nephritis, splenomegaly

Symptoms of Rat Bite Fever

- Fever, myalgia, arthralgia, vomiting and headache typically occurs within 2--10 days of exposure and is usually followed by a maculopapular rash on the extremities.

Maculopapular rash

Hantavirus

Primary Species:

- Sin Nombre - HPS
- Hantaan - HFRS
- Puumala - Mild HFRS
- Seoul - Mild HFRS

Hantavirus Pulmonary Syndrome (HPS)

- Hantavirus pulmonary syndrome (HPS) is a deadly disease transmitted by infected rodents. Hanta virus is maintained in nature by a wide variety of wild rodents (Cotton rat and deer mice are important reservoirs for the virus).

Hantavirus Pulmonary Syndrome (HPS)

- Sin Nombre, or the "No Name Virus" was the cause of the "Four Corners" outbreak in 1993 (an area of the Southwest shared by New Mexico, Arizona, Colorado, and Utah. A number of previously healthy young adults suddenly developed acute respiratory symptoms; about half soon died)

Hantavirus Hemorrhagic Fever with Renal Syndrome (HFRS)

- Hantaan - HFRS is transmitted by Apodemus species.
- Puumala, carried by the bank vole (Clethrionomys glareolus) & Seoul, carried by rats of the genus Rattus, are both milder forms of HFRS. Disease is most commonly transmitted by rodent respiratory secretions, saliva, urine, and aerosolization of dried fecal matter.
- As far as disease implications in the laboratory setting, numerous cases have occurred in labs outside the U.S., and in personnel involved in field studies, but to date, no laboratory cases have been reported in the U.S.

HPS Symptoms

- Early symptoms include fatigue, fever and muscle aches, especially in the large muscle groups-thighs, hips, back, and sometimes shoulders, headaches, dizziness, chills, and abdominal problems, such as nausea, vomiting, diarrhea, and abdominal pain.
- Four to 10 days after the initial phase of illness, patients experience coughing and shortness of breath, as the lungs fill with fluid.

Leptospirosis

- Leptospirosis is a bacterial disease that affects humans and animals. It is caused by bacteria of the genus *Leptospira*.

Leptospirosis - Source of Infection

- Many different kinds of animals carry the bacterium; they may become sick but sometimes have no symptoms.
- Leptospira organisms have been found in cattle, pigs, horses, dogs, rodents, and wild animals.

Leptospirosis - Mode of Transmission

- Humans become infected through contact with water, food, or soil containing urine from these infected animals. The disease is not known to be spread from person to person.

Leptospirosis - Symptoms

- Symptoms of leptospirosis include high fever, severe headache, chills, muscle aches, and vomiting, and may include jaundice (yellow skin and eyes), red eyes, abdominal pain, diarrhea, or a rash.
- If the disease is not treated, the patient could develop kidney damage, meningitis (inflammation of the membrane around the brain and spinal cord), liver failure, and respiratory distress. In rare cases death occurs.

Tape Worms

- Rodentolepsis nana (dwarf tapeworm) has a direct or indirect life cycle, with cockroaches, grain beetle and fleas as intermediate hosts. Humans are susceptible to infections with *R. nana*; since autoinfection can occur (direct life cycle), a heavy parasite load may quickly develop.

- Clinical Signs: Usually there are no external signs of infection. However, catarrhal enteritis, diarrhea, emaciation and chronic weight loss may occur with heavy infestations.

Fungi

- Pneumocystis carinii produces pneumonitis in immunosuppressed animals and can infect immunosuppressed humans.

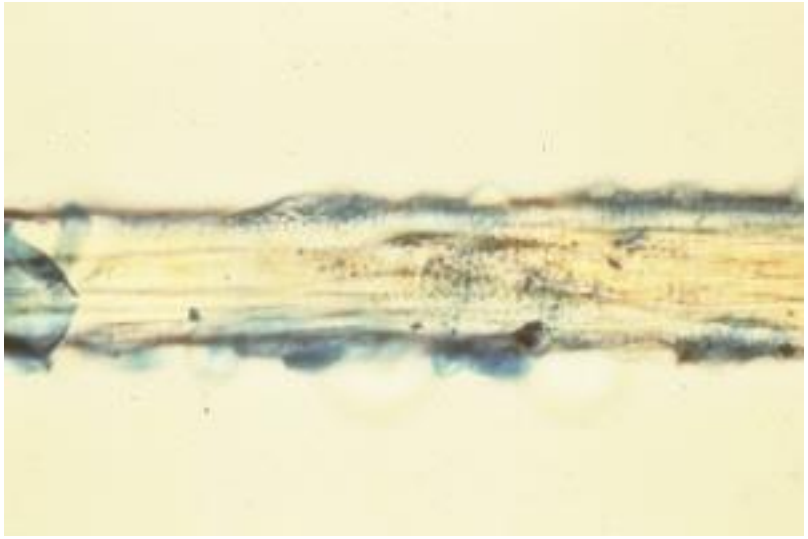
- Trichophyton mentagrophytes (ring worm) can be transmitted to humans with contact with animals.

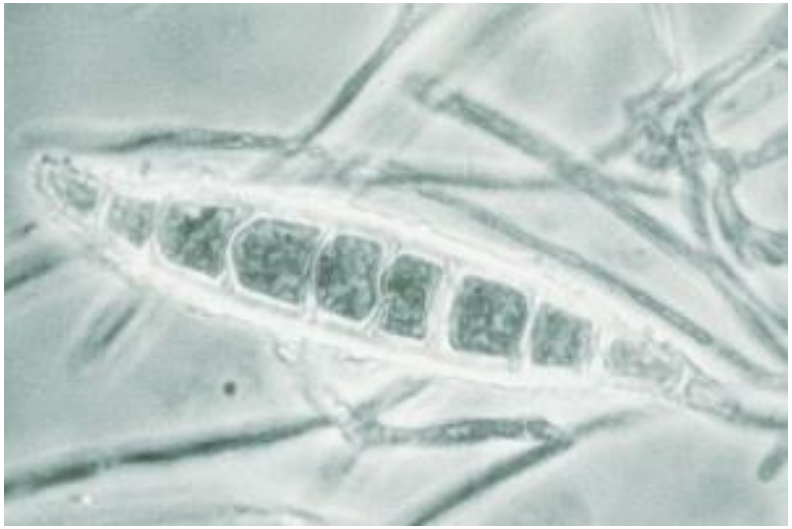
Dermatophytosis = Ringworm

- Patchy hair loss
  - Usually head and spread to paws and elsewhere
  - Dry, crusty, scalely
  - Pruritic
  - More common in pet rabbits
  - Zoonotic

Dermatophytosis

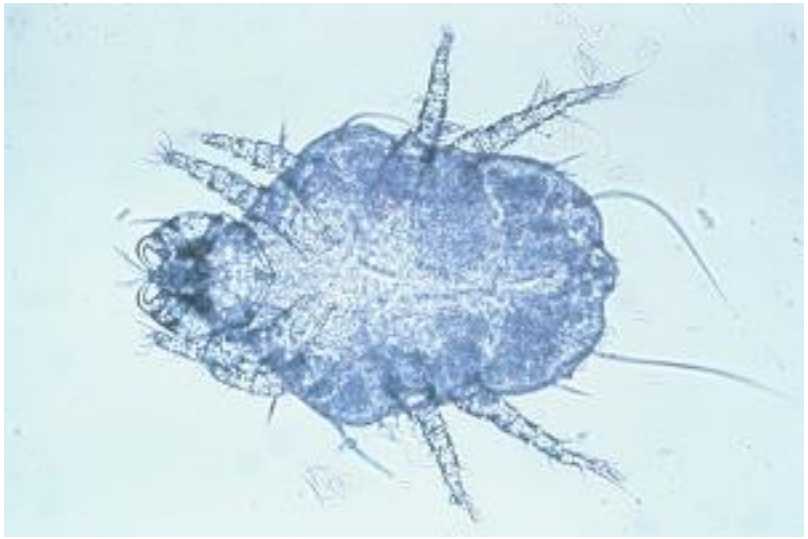
- Diagnosis
  - Skin scraping & 10% potassium hydroxide digestion
  - Culture isolation - *Trichophyton mentagrophytes* most common
- Treatment
  - Topical antifungal and oral Griseofulvin
  - Long treatment course





Cheyletiella parasitovorax

- Small, nonburrowing fur mite
- Most common on back, shoulders & abdomen
- Common in domestic rabbits
- Zoonotic



Protocol Related Hazards

Needlesticks

The Potential for Exposure to Fatal Zoonotic disease is natures' way of saying

DO NOT RECAP NEEDLES

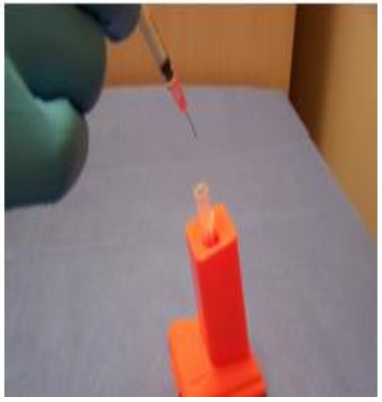
Needles, razor/scalpel blades, lancets, broken glassware, glass and hard plastic pipettes and pipette tips, and syringes with and without needles are considered to be sharps.

All these materials must be accumulated immediately into an approved sharps container.

Hypodermic needles and syringes used in the laboratory animal facility and posing a definite puncture hazard must be placed into approved red plastic sharps containers for disposal.

Recapping Needles

- **Unless *absolutely necessary*, needles should never be recapped.** If recapping is required, you should use one of the single-handed technique shown here.



Chemical Hazards

Chemicals and reagents
Anesthetics
Cleaning and disinfectant agents
Study related chemicals

Formaldehyde (Formalin, Paraformaldehyde, etc.)

Formaldehyde is a gas available as a saturated 37% solution in water (Formalin) and as a 4% solution in 10% Neutral Buffered Formalin. Formaldehyde can be used as both a general sterilantand as a cross-linking fixation agent for tissue.

Formaldehyde is:

- Toxic
- Potential Cancer Hazard
- Readily absorbed through skin
- Volatile
- Extreme eye irritant

Anesthetic Agents

Isoflurane

- Isoflurane is a stable, non-explosive inhalation anesthetic.
- There are few significant side effects, except for anesthesia and, at high doses, death.
- May cause damage to the cardiovascular system and central nervous system.

Halothane

- Halothane is a stable, non-explosive inhalation anesthetic.
- Possible carcinogen, mutagen
- Target Organs: Central Nervous system, cardiovascular system.

Nitrous oxide and Carbon dioxide

These gases are routinely used for anesthesia, immobilization, or euthanasia.

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Ether

Explosive and flammable
Irritating to mucous membranes
Slow induction of anesthesia

General Safety Hazards

Sterilants, Disinfectants, and Cleaning Agents

Strong alkalis and acids are used for cage cleaning.
Quaternary ammonium agents are present in nearly all animal rooms.
Chlorine-based disinfectants may be used in instances where quaternary ammonium compounds are less effective. Never mix chlorine bleach and ammonia together. It creates a toxic gas.
Iodine, alcohol, and chlorhexidine compounds are used in surgical skin disinfection and occasionally for general disinfection.
Ethylene oxide gas, glutaraldehye, and activated hydrogen peroxide compounds are used as sterilants for heat sensitive material.

Working With Chemicals, Inhalants and Potential Allergen Risk Factors

- Use a downdraft table, laminar flow work station, biological safety cabinet, or a chemical fume hood, whenever possible.
- Be certain that the sash is positioned at the recommended safe height and do NOT disable the alarm. It is alarming because the sash height is not correct for safe operation.
- When working with inhalation anesthetics, a scavenging system is required

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Respiratory Protection

NIOSH approved N-95 respirators offer the least amount of protection but are often a comfortable and effective alternative for many individuals with allergies. The mask must have a double strap and the best have an efficiency rating of 95, an exhalation valve, and an adjustable noseclip.

Surgical masks, are not designed to protect the wearer from allergens. They are designed to protect the animals and surgical sites from being contaminated.

Personnel with allergies should be especially careful not to transport allergens to areas where they may be later inadvertently exposed (lab, office, lounge, home, etc.) The use of disposable laboratory wear or dedicated laboratory wear while in the animal facility is recommended.

Personal Hygiene

- ALWAYS wear gloves, lab coat or disposable gown (or other PPE as required) when working with or around animals and equipment to prevent possible exposure or biocontamination
- Wash your hands thoroughly after handling animals, biologics and equipment, or use hand sanitizers

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Reducing Risks Requires Your Participation

Understand the risks

Alter your procedures and practices to reduce the risk

Wear the appropriate Personnel Protective Equipment to reduce your risk from the hazard

Make sure everyone is fully trained