Laboratory Animal Allergens and Zoonotic Diseases

University of Manitoba
Animal Care Occupational Health Program
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Objectives

At the end of this training you should

- Recognize the potential negative impact animal allergens[def1] and zoonotic diseases can have on the health of a worker and their ability to work in the animal care field.
- Develop a working knowledge of the Universal Precautions for Lab Animal Work (UPLAW) and how it pertains to your work with lab animals.
- Successfully complete a short written test to demonstrate your working knowledge of the UPLAW (attached).
- Effectively apply the protection principals of the UPLAW during your work with lab animals.

Allergy Basics

- Immune response to antigens which may be excessive, and cause harm or inconvenience to the host
- Response is to harmless antigens that would not pose a danger to the host if not for the allergic reaction
- Requires previous exposure for outward symptoms to occur

Allergic Reactions to Lab Animal Allergens

- Skin reactions[def2]
- Hay fever (allergic rhinitis)[def3]
- Lower respiratory tract reactions (asthma[def4])
- Anaphylactic shock (severe whole body reaction[def5])
- Symptoms can get progressively worse

http://icanhascheezburger.files.wordpress.com/2007/04/sneeze1.jpg

Animal Allergens

Antigenic particulates

- Fur
- Dander
- Urine (Major Urinary Protein)
- Saliva
- Serum proteins
- Tissues

Exposure route

- Carried in bedding dust
- Cage dumping
- Animal handling

Zoonosis

http://dogsloveforever.com/confirm-site-and-symptoms-before-buying-dog-prescriptions-online/

- Diseases transmitted from animals to humans.
- Not common in purpose bred lab animals.
- Persons at higher risk suffer from
  - defective immune systems
  - those who are under severe stress
  - have chronic illnesses
- Vaccines should be given to at risk workers where appropriate (rabies)
- Use of personal protective equipment discussed under in the UPLAW and effective hygiene should be effective in preventing hazardous exposure to most relevant zoonotic agents.

Zoonosis

- Special note: *Toxoplasmosis gondii* - Spread by the oocysts shed in cat feces. Human toxoplasmosis can result in spontaneous abortion, prematurity, stillbirth or congenital defects.
- Rabies is a risk from wild source mammals.
- Further information in Guide to the Care and Use of Experimental Animals Vol 1, 2nd Edn. Appendix VII gives a list zoonotic agents, their animal hosts and mode of transmission (appended)

Routes of Transmission or Exposure

- **Injection (contaminated sharps)**
- **Inhalation (airborne contaminants)**
- **Ingestion (eat lunch with dirty hands)**
- **Skin contact**
- **Mucous membranes (rub eyes with dirty fingers)**

Greatest Risk of Worker Exposure

Workers are at greatest risk for exposure to allergens, zoonotic agents and hazardous research compounds when:

- In animal holding rooms
- Directly handling animals
- Performing procedures on animals such as shaving, injection, urine collection and surgical procedures.
- Working with contaminated bedding, cage changing, cage dumping, etc.

S-10 Safe Work Practices 003 Universal Precautions for Lab Animal Work (UPLAW)

Aspects of UPLAW most relevant to workers on a day to day basis.

- Engineering controls
  - Used to contain allergens and other hazards
- Administrative controls (training)
  - Lab animal Allergen and Zoonosis training
- Personal protective equipment
  - Gloves, back fastening gown or lab coat as per facility policy and an N95 respirator.
- Hygiene
  - Hand washing
- Responsibility
  - Facilities at the U of M have statement of compliance that deal with implementation and non compliance by staff and facility users
  - Supervisors are required to provide required personal protective equipment
  - Workers are required to follow the safe work procedure
- Refer to the UPLAW appended to this document.

Personal Protective Equipment

Hands

- Gloves disposable – nitrile gloves offer puncture resistance and reduced risk of allergic reactions seen with latex
- Change often

Breathing

- N95 dust and mist respirators are filters will prevent workers from inhaling airborne allergens by excluding 95% of airborne particulates from the workers breathing zone. See illustration below.

Body (cover or replace street clothes and prevent contamination)

- Greens (normally worn by husbandry staff)
- Lab coats or back fastening gowns according to facility policy
- Pants/clothing that covers the legs

Feet

- Full shoes (no sandals, flip flops or crocs!)

PPE is to prevent contamination from reaching your skin, mucous membranes (eyes, mouth, lungs) or personal clothing and should be used when there is a risk of exposure to lab animal allergens such as when entering rooms that house lab animals or performing procedures on lab animals.

Hygiene

- Wash your hands (soft soap best)
  - When entering and before leaving the animal holding room
  - Hand washing is the best contamination control method
- Food/beverages not allowed in animal holding facilities outside designated areas:
- Includes gum, water bottles and coffee cups

Definitions

1. Antigen (s) – "Any substance that can induce an immune response in humans or other animals is called an immunogen or antigen, and it is said to be immunogenic or antigenic. Typical antigens are components of microbes consisting of protein, carbohydrate, nucleic acid, lipid or combinations thereof, but any natural or synthetic substance can serve as an antigen." Sharon, J. Basic Immunology 1998 pp. 5.
2. Skin reaction (allergy) – "Contact urticaria ("Hives") is typically due to the application of an allergen (usually a protein or glycoprotein) directly onto the skin. A common example is the development of wheal and flare reactions that produce welts when a person's skin and the tail of a mouse or rat come into contact." Occupational Helath and Safety in the Care and Use of Research Animals, National Academy Press 1997 pp. 52.
3. Hay fever (also called allergic rhinitis) – "…the interaction of allergen with mast-cell-bound complementary IgE antibodies occurs in the nasal submucosa and in the conjunctival tissues giving rise to sneezing, mucus secretion and itchy, teary eyes." Sharon, J. Basic Immunology 1998 pp. 186.
4. Lower respiratory tract reactions (asthma) – "Allergens are inhaled and often components of pollen, fur of animals such as cats, or feces of dust mites. The interaction of allergen with mast-cell-bound complementary IgE antibodies occurs in the submucosa of the airways, resulting in increased mucus secretion, coughing and constriction of the airway that leads to difficulty in breathing and to wheezing (characteristic of asthma)." Sharon, J. Basic Immunology 1998 pp. 186.
5. Anaphylactic reactions (severe whole body reaction) – "… are triggered by the interaction of allergen with IgE antibodies on mast cells and basophils in many tissues and in the blood, …. Increased vascular permeability often causes swelling of the lips, tongue and larynx, thus making swallowing and breathing difficult. The smooth muscle contraction n the lungs results in constriction of the airways that furtherer impedes breathing, leading to an increase in the ratio of carbon dioxide to oxygen in the blood. This can result in loss of consciousness from an inadequate supply of oxygen to the brain. The widespread dilation of the capillaries and larger blood vessels causes a fall in blood pressure; a drastic fall in blood pressure (shock) is often fatal. This condition is called anaphylactic shock." Sharon, J. Basic Immunology 1998 pp. 186.

Schedule-10 Safe Work Practice Universal Precautions for Lab Animal Work

Animal Care Occupational Health University of Manitoba EHSO, Central Animal Care Services, Psychology Animal Holding Facility, Biological Sciences Animal Holding Facility, Richardson Centre For Functional Foods and Neutraceuticals Animal Holding Facility

Date January 8, 2010

Universal Precautions for Lab Animal Work

Purpose: To describe the safe work procedures required for the use of lab animals in University of Manitoba Animal Holding Facilities as pertains to lab animal allergens and agents of low or negligable hazard. These agents may or may not be controlled by the Workplace Hazardous Materials Information System. These precautionary measures are also identified in order to meet program requirements of the Canadian Council for Animal Care with regards to lab animal allergens.

Precautionary Statements: "Allergic reactions to animals are among the most common conditions that adversely affect the health of workers involved in the care and use of animals in research… The estimated prevalence of allergic symptoms in the general population of regularly exposed animal care workers ranges from 10% to 44% … An estimated 10% of laboratory workers eventually develop occupationa related asthma." (National Research Council). Workers with pre-existing allergies of any kind are at highest risk of developing lab animal allergies. Symptoms of laboratory animal allergies and sensitization to animal proteins may include contact urticaria, allergic conjunctivitis, allergic rhinitis, asthma, and anaphylaxis (see table 4.2 appended). Workers who experience lab animal allergy symptoms consistent with anaphylaxis should be reassigned to work that will eliminate their exposure to laboratory animal allergens.

Tasks related to lab animal exposure include but are not limited to cage cleaning, animal handling, shaving, injection, blood and urine collection, surgery and euthanasia.

Sources of lab animal allergens may include saliva, urine, dander, fur,

Policy: The threshold limit value for lab animal allergens has not been established however prevalence of sensitization among regularly exposed animal care workers is between 10% and 44%. This safe work procedure is to ensure that worker exposure to lab animal allergens is limited to the lowest

amount reasonably achievable while work is conducted in all The University of Manitoba labs and facilities. This procedure is also applicable for work with chemical and biological agents which are considered to be low or negligably hazardous.

Responsibility: Principal Investigators (supervisors) who work with lab animals or direct workers in their work with lab animals shall ensure that the requirements of this safe work procedure are met. This includes ensuring access to engineering controls, establishment of administrative procedures including training and the provision of all required personal protective equipment. Principal Investigators (supervisors) are also required to dispose of all hazardous waste in accordance with University of Manitoba Environmental Management and the relevant Animal Holding Facility Procedures. All workers operating under the supervision of a Principal Investigator or their designate (supervisor) shall adhere to the provisions of this safe work procedure as set out and provided by the Principal Investigator.

Practices:

Engineering Controls - Relative humidity levels from 54% to 77% can reduce airborne allergen levels. Animal holding rooms are ventilated at a rate of 15-20 air changes per hour. Ventilated hoods, fume hoods or work stations for emptying and cage cleaning with filtered recirculated or total exhaust should be used in areas where they are available.

Administrative Controls - Workers must be made aware of the risks associated with lab animal allergies and be instructed on the appropriate control measures they can take to protect themselves.

Required Personal Protective Equipment (PPE) - Workers must wear Non latex disposable gloves, lab coat (if permitted by facility policy) or back fastening gown and a fit tested N95 dust and mist respirator.
Recommended Personal Protective Equipment - When regulary performing work for long periods in an animal holding facilities workers may elect to wear designated work wear such as "greens" or "scrubs". Bonnet and/or protective eyewear.

Waste Packaging and Disposal - Waste bedding should be securely packaged in plastic bags and can be disposed in the landfill if no additional hazardous materials are present. Special waste disposal procedures if appliccable will be identified in the Animal Use Protocol Form Schedule 10 Risk Assessment.

Hygiene - Hand washing before and after animal handling is a vital component in ensuring animal health, preventing cross contamination the spread of animal allergens and hazardous materials used in research.

Appended: Table 4-2 Allergic Reactions to Laboratory-Animal Allergens copied from bibliographic reference 1.

Bibliography:

1. Occupational Health and Safety in the Care and Use of Research Animals, Committee on Occupationals Safety and Health in Research Animal Facilities, Institute of Laboratory Animals Resources Commission on Life Sciences, National Research Council. National Academy Press Washington, DC 1997

TABLE 4-2 Allergic Reactions to Laboratory-Animal Allergens

Disorder	Symptoms	Signs
Contact urticaria	Redness, itchiness of skin, welts, hives	Raised, circumscribed erythematous lesions
Allergic conjunctivitis	Sneezing, itchiness, clear nasal drainage, nasal congestion	Conjunctival vascular engorgement, cheminosis, clear discharge (usually bilateral)
Allergic rhinitis	Sneezing, itchiness, clear nasal drainage, nasal congestion	Pale or edematous nasal mucosa, clear rhinorrhea
Asthma	Cough, wheezing, chest tightness, shortness of breath	Decreased breath sounds, prolonged expiratory phase or wheezing, reversible airflow obstruction, airway hyperresponsiveness
Anaphylaxis	Generalized itching, hives, throat tightness, eye or lip swelling, difficulty in swallowing, hoarseness, shortness of breath, dizziness, fainting, nausea, vomiting, abdominal cramps, diarrhea	Flushing, urticaria, angioedema, stridor, wheezing, hypotension

Occupational Health and Safety in the Care and Use of Research Animals, Committee on Occupational Safety and Health in Research Animal Facilities, Institute of Laboratory Animals Resources Commission on Life Sciences, National Research Council. National Academy Press Washington, DC 1997

APPENDIX VII

ZOONOSES--EXPERIMENTAL ANIMALS TO MAN

A. BACTERIAL DISEASES:

Disease in Man	Causative Agent	Vertebrate Hosts[1]	Means of Spread	Vectors and Notes on Cycle
Anthrax Woolsorters disease	*Bacillus anthracis*	Farm animals wild and zoo animals	contact, inhalation, ingestion	Spores: long lived in soil
Brucellosis[2] Undulant Fever Malta Fever Zang's disease	*B.suis* *B.abortus* *B.melitensis* *B.ovis* *B.canis*	swine cattle, sheep, buffalo sheep, goats sheep dogs	contact and ingestion of milk, milk products, raw meat direct contact primarily with semen contact with infected semen, fetuses, fetal membranes and vaginal secretions	
Campylobacteriosis	*C.fetus* *C.jejuni*	cattle, sheep, pigs, dogs, non-human primates, poultry	ingestion	may survive inadequate heating
Chlamydiosis[3] Psittacosis	*Chlamydia* spp.	Psittacine birds, poultry, pigeons	inhalation	recovered nestlings
Colibacillosis[4]	*E.coli*	cattle, swine, poultry, misc. animals	ingestion	
Leptospirosis Weil's disease	*Leptospira* spp.	rodents, dogs, farm and wild animals	contact, urine contaminated soil and water	
Pasteurellosis	*P.multocida* *P.hemolytica* *P.pneumotropica*	cats, dogs, rabbits, misc. mammals, birds	contact, bite wounds, inhalation	
Plague	*Yersinia pestis*	rodents	contact, flea bites, inhalation	fleas
Pseudotuberculosis	*Yersinia pseudotuberculosis*	rodents, lagomorphs, pigeons, turkeys, canaries, wild birds	contact, contaminated food and water ingestion	
Rat Bite Fever	*S.moniliformis* *Spirillum minus*	rodents	rodent bites, ingestion	infected saliva
Salmonellosis	*Salmonella* spp.	farm animals, rodents, reptiles, amphibians, zoo and wild animals	ingestion, inhalation, contact	

Shigellosis Bacillary dysentery	*Shigella* spp.	non-human primates	contact, fecal contamination, ingestion	direct or by fomites
Tetanus[5]	*Cl.tetani*	dog, cat, equine spp.	bite wounds, contaminated puncture wounds	soil
Tuberculosis	*M.tuberculosis* *M.bovis* *M.avium*	non-human primates, cattle, dogs cattle, dogs poultry, swine, sheep	contact, ingestion, inhalation	Anthropozoonotic[6]
Tularemia Rabbit fever	*F.tularensis*	lagomorphs, wild rodents, birds, dogs	inhalation contact, tick and insect bites, ingestion of contaminated food and water	biting insects and ticks

B: RICKETTSIAL DISEASES:

Causative Agent	Diseases in Man	Common Vertebrate Hosts[1]	Means of Spread, Vectors, Cycle Notes
Coxiella[8]	Q fever	cattle, sheep, goats	inhalation, ingestion of contaminated raw milk, blood sucking anthropods, contact with amniotic fluid or placenta
R.akari	Rickettsial pox	wild mice, rats	mite bites: *A. sanguineus*
R.rickettsia	Rocky mountain spotted fever	wild rodents, rabbits, dogs	tick bites: *Dermacentor* spp., American dog tick
R.siberica	Asian tick fever	various wild rodents	tick bites: ticks themselves may act as reservoirs with tick to tick passage
R.typhi	Murine typhus	wild mice, rats	flea bites from rat fleas, rat to rat spread by lice, ingestion of contaminated food

C. ARBOVIRUS DISEASES:

Causative Agent	Diseases in Man	Common Vertebrate Hosts[1]	Means of Spread, Vectors, Cycle Notes
Asian arboviruses	various tickborne hemorrhagic fevers	wild rodents, hares, wild-caught monkeys	tick bites, sub-tropical climate conditions favour cycle
California encephalitis	California encephalitis	wild rabbits, rodents	natural cycle wild rabbits and rodents/ mosquito
Colorado tickborne virus	Colorado tick fever	ground squirrels, *Deromyscus* spp.	tick bite, tick/small rodent natural cycle
E.E.E.	Eastern equine encephalitis	horses, birds	mosquito bites: bird/mosquito/horse natural cycle

Powassan virus	Powassan encephalitis	wild rabbits, rodents	tick bites
S.L.E.	St. Louis encephalitis	birds	natural cycle bird/mosquito only
V.E.E.	Venezuelan equine encephalitis	horses	natural cycle horse/mosquito only
W.E.E.	Western equine encephalitis	horses, birds	mosquito bites: bird/mosquito/horse natural cycle

D. OTHER VIRUS DISEASES:

Causative Agent	Diseases in Man	Common Vertebrate Hosts[1]	Means of Spread, Vectors, Cycle Notes
Filovirus	Marburg disease Ebola hemorrhagic fever	African green monkey *Macaca* sp.	direct contact with monkey tissues
Hemorrhagic fever virus	S. American and Korean hemorrhagic fever	wild rodents *Mastomys ratalensis*	contact, contamination of food, etc., with rodent excreta; direct contact
Hepatitis virus	Hepatitis A	chimpanzees	contact, anthropozoonotic diseases[9]
Herpes simiae	Herpes B. encephalitis	rhesus; other Macaca	contact, bite wounds, Old World monkeys
L.C.M. virus	Lymphocytic Chorio--Meningitis	rodents; numerous other mammals	contact, inhalation; congenital transmission, tissue culture transmission
Rabies virus	Rabies	dogs, cats, bats and many others	bites; saliva contact, virus concentrate in saliva

E. FUNGAL AND PROTOZOAN DISEASES:

Causative Agent	Diseases in Man	Common Vertebrate Hosts[1]	Means of Spread, Vectors, Cycle Notes
Balantidium coli	Balantidiasis	non-human primates	ingestion by contamination of food or fomites
Coccidioides immitis	Coccidioidomycosis	cattle, dogs and occasionally other spp.	inhalation of air-borne spores; fungus present in desert soil
Entamoeba histolytica	Amebiasis Amebic dysentery	non-human primates, dogs	contamination of food, usually by man (natural host) to dogs
Giardia intestinalis	Giardiasis	non-human primates, dogs, beaver	man is main reservoir, ingestion of cysts in contaminated water or food
Histoplasma capsulatum	Histoplasmosis	dogs, other domestic and wild species	inhalation of fungi; may also grow in soil

Toxoplasma gondii	Toxoplasmosis	cats; occasionally other domestic and lab spp.	ingestion of oocysts from cats; inhalation infected meat; fetal transmission may occur
Trichophyton spp. *Microsporum* spp. Other dermatophytes	Ringworm, dermatomycosis	dog, cat, guinea pig, other rodents and farm animals, rabbits	direct contact, ringworm of man can be transmitted to animals and visa-versa; soil may be reservoir
Trypanasoma spp. *Plasmodium* spp. *Leishmania* spp.	Blood protozoan diseases	non-human primates, rodents, domestic and wild spp.	insect vectors--saliva transmission; some few species direct transmission

[1] Only more common host species are listed.
[2] *Brucella abortus* has also been reported in bactrian and dromedary camels, alpacas, and caribou. *B.suis* has been reported in
African rodents, European hares (it is the reservoir). Brucellosis has also been reported in desert rats in the U.S. and in foxes
and mustelids in S. America.
[3] One case of cat to human transmission causing conjunctivitis.
[4] *E.coli* has many serotypes; those with capsular K antigen are especially pathogenic to man and animals. Some serotypes are
species specific. Man is the main reservoir of colibacillosis for humans with the route of infection the handling of human feces or
not washing hands after using the bathroom.
[5] Tetanus is not considered a true zoonoses.
[6] Man is the primary vertebrate host.
[7] In addition to the G.I. signs, this organism is associated with abortion in women.
[8] Organism concentrated in placenta and fetal membranes and fluids.
[9] Man is primary host. Measles (Rubeola) is another anthropozoonotic virus to non-human primates.

Reference

ACHA, P.N. and SZYFRES, B. Zoonoses and communicable diseases common to man and animals. Washington, DC: Scientific Publishers No. 503, World Health Organization, 1989.

Name:
E-mail:
Supervising PI or Animal Permit Holder:
Date:

Lab Animal Allergen and Zoonosis Training Competency Test

Introduction: The purpose of this test is to demonstrate your competent knowledge of the Safe Work Practice 003: Universal Precautions for Lab Animal Work and its application in animal holding facilities at the University of Manitoba. It is also meant to demonstrate very basic knowledge about zoonotic diseases and the role they play in the field of animal care and research.

Responsibility: **Each student must complete their own test and attain a passing mark of 70% or higher.** All information required to successfully complete this test is contained in the Lab Animal Allergen and Zoonosis training document found on line. Failure to successfully complete this test may limit your access to work in animal holding facilities at the University of Manitoba.

Please complete this test electronically (hand written submissions are not acceptable), print your answers, sign the test at the bottom and forward it to:

Animal Care Occupational Health Specialist
Environmental Health and Safety
University of Manitoba – Bannatyne Campus
P310 Pathology Building

TEST

1. What is an allergic response? /1

2. Give 3 examples of allergic responses or symptoms from exposure to lab animal allergens. /3

3. Give 4 examples of animal allergens. /4

4. What is a zoonotic disease? Pick only one. /1
    a. ☐ A disease you catch only at the zoo
    b. ☐ A disease transmitted from animals to humans
    c. ☐ Rabies
    d. ☐ Lyme disease

5. Identify one health factor which will increase your risk if you are exposed to zoonotic diseases. /1

6. Give five routes of exposure to allergens and zoonotic agents? /5

7. Give the three required pieces of personal protective equipment as described in the UPLAW. /3

8. What is the estimated prevalence of allergic symptoms in the general population of animal care workers? Pick only one. /1
    a. ☐ 5% to 25%
    b. ☐ 20% to 52%
    c. ☐ 10% to 44%
    d. ☐ 30% to 63%

9. What tasks are related to lab animal allergen exposure (list 4). /4

10. Who is responsible for providing you with the personal protective equipment you need to comply with the UPLAW? Select one. /1

    a. ☐ The worker
    b. ☐ The Environmental Health and Safety Office
    c. ☐ The worker supervisor
    d. ☐ The animal holding facility

11. What is the acceptable level of worker exposure to animal allergenic particulates identified in the UPLAW? Pick one. /1
    a. ☐ 1500 pt/m^3
    b. ☐ 2500pt/m^3
    c. ☐ Lowest amount reasonably achievable.
    d. ☐ Unlimited.

Tests must be completed by respondents submitting them for credit. Your signature below asserts that you have answered all questions above

Student Signature:_____

Score: _____%

/25