

Laboratory Animal Allergies: Overview of Causation and Prevention

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In sensitized individuals, exposure to laboratory animal allergens can cause symptoms ranging in severity from annoying to life-threatening. The author presents an overview of the pathology of LAA and discusses a number of methods that can be used to limit exposure to these allergens.

Laboratory animal allergy (LAA) and its prevention have recently received increased attention within the laboratory animal field. There is frequent discussion of the topic at forums, such as the annual American Association for Laboratory Animal Scientists (AALAS) meeting. Two recent issues of the *Institute for Laboratory Animal Research (ILAR) Journal* focused on this topic^{1,2}.

Control of laboratory animal allergens is becoming a central focus when designing or remodeling facilities. Occupational health and safety programs are focusing on awareness, preventive care, and treatment. About one third of people who work with laboratory animals experience some allergic symptoms due to contact with or inhalation of animal allergens³. Workers at risk of exposure include animal husbandry and veterinary technicians, researchers, veterinarians, students, and anyone else having contact with animals, their bedding, or their bodily fluids or feces^{3,4}. Although most people will experience symptoms such as runny nose, itchy eyes, or rash, ~10% of allergic workers will develop symptoms of more severe respiratory disease, such as asthma and upper airway hypersensitivity⁴. Allergic reactions can include anaphylaxis with potential shock or even death. Prevention of exposure to laboratory animal allergens can decrease or prevent these allergic symptoms¹.

Causation

Animal allergens, which are characterized by species, include small proteins that can be found in dander, hair, saliva, urine, feces, and serum. Several specific allergens have been isolated from mice (Mus m 1 and Mus m 2, albumin), rats (Rat n 1a and Rat n 1b, albumin, $\alpha_2\mu$ -globulin), guinea pigs (Cav p 1 and Cav p 2), rabbits (Ag 1 and Ag 2), cats (Fel d 1, albumin), and dogs (Can f 1 and Can f 20, albumin)¹. The most

common LAAs are to rat and mouse antigens. This is probably a direct result of the high number of these species represented in facilities. However, most laboratory animal species produce allergenic proteins.

People are exposed to antigens primarily through inhalation of small particles containing allergens. Exposure can also occur via direct skin and eye contact with animal dander, hair, urine, serum, or saliva. Another route of exposure is through an animal scratch or a bite. The first exposure to an antigen sensitizes the immune system to further exposures; later exposures are the events that precipitate an allergic reaction. Although no one knows what is the minimum level of allergen exposure required to elicit an allergic reaction, there is some evidence that frequent and long exposures with high concentrations of allergens are more likely to lead to the development of allergic reactions¹. A person who experiences other allergic reactions to such triggers as pets, food, pollen, or dust is at higher risk of developing LAAs¹. There may be a genetic predisposition to increased IgE antibody formation that would also be considered a risk factor¹. Smoking is considered a possible risk factor for animal allergy development, but a definite link has not been proven¹.

The onset of allergic symptoms such as sneezing, coughing, itching, watery eyes, or rash can be sudden or may be delayed for as long as 8 h after exposure⁴. If the reaction is delayed, diagnosing the cause of the symptoms becomes difficult. As a result, allergic symptoms are sometimes mistakenly attributed to an event that is not the actual trigger.

Clinical signs and history given by the patient often lead to provisional diagnosis of allergy. Skin sensitization tests may then be useful to identify or confirm the allergen or allergens involved in the reaction. Skin testing is not currently possible for all

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allergies associated with laboratory animal species. The specific antigens needed to do the skin sensitization test for some laboratory animal allergens are not readily available².

Preventive Measures

Methods of preventing laboratory animal allergen exposure include engineering controls, administrative controls, and personal protective equipment (PPE). Engineering controls are the first line of defense and include room and building ventilation and humidity control systems, local ventilation systems including safety hoods and vacuum systems, and building designs that enclose and separate animal use space from public and office space. Such engineering and architectural features help to contain allergens within the animal facility and minimize contamination of office or other public areas.

Administrative controls include limiting animal density within rooms, restricting access to animal areas, minimizing movement of animals through and particularly outside of the facility, and transporting animals in filter-top caging. Appropriate work practices, such as handling animals and bedding under local exhaust systems, rotating job assignments so that no individual is exposed to high levels of allergens for long periods of time, and training in the proper use and maintenance of cage dumping stations, cage wash equipment, and cage ventilation systems, are also administrative controls. Importantly, good personal hygiene through frequent glove changing and hand washing can limit hand-to-nose or hand-to-mouth transmission. Another important aspect of administrative control is the occupational health and safety program, including education about potential risks, as well as preplacement and periodic medical evaluations that may help to catch early symptoms of allergies before chronic conditions such as asthma develop.

Despite good engineering and administrative control programs, it may be necessary to augment these measures with PPE. Anyone with known animal allergies should use such equipment, and those who

are at risk of becoming exposed to animal allergens should also consider their use for preventive purposes^{3,4}. Although there is no regulation related to the levels of allergens that require protection, the risks associated with animal allergens suggest that employers provide protection to their staff. There should be consultation of federal, state, or local guidelines to determine the appropriate recommendations for each facility⁵. Once it has been decided that PPE is needed, regulations and guidelines for using PPE become specific and define safety standards for research facilities.

Protection of skin and hair from contact with animal allergens through the use of protective clothing is an effective means of prevention (Fig. 1). Use of dedicated clothing when in the facility also helps prevent the distribution of allergens outside of the facility into offices or public areas, or to the employee's home. For example, while in the animal facility one may wear a uniform or scrubs rather than street clothes, and a lab coat or disposable garments that can be shed at the facility door. Hair bonnets, shoe covers, and gloves are helpful in protecting contamination of skin and hair and, when shed at the facility door, prevent the dispersal of allergens to the outside. Nonlatex or nonpowdered latex gloves are preferable to powdered latex gloves because of the allergenic nature of latex. Eye protection can also be important to prevent exposure to allergens and the symptoms of itchy, watery eyes.

To protect people outside the facility from exposure to clothing contaminated with animal allergens, animal care staff members should leave work clothes inside the facility whenever possible. Allergen particles carried on clothing can be transported to offices and other public areas. Avoid potential exposure to family members by not taking work clothes home to be laundered. Hand washing or showering may also be beneficial when leaving the animal area.

The main source of exposure to allergens is through inhalation; therefore, respiratory protection is the most important step that can be taken to protect oneself

from LAAs². Wearing a properly fitted respirator mask of the appropriate type is essential to ensure that allergens are not being inhaled. The wearing of surgical masks can lead to a false sense of security; these provide little or no protection from laboratory animal antigens. Allergens can be carried on small particles that can enter from around the sides of loose-fitting surgical masks.

The National Institutes of Health recommends that employees with known allergies to animals wear National Institute of Occupational Safety and Health (NIOSH)-approved N-95 dust/mist respirators⁶ (Fig. 2). When properly fitted and worn correctly, these masks filter out at least 95% of the particles that are capable of transporting animal allergens. Half- or full-face HEPA-filtered masks or powered air-purifying respirators (PAPRs) are a useful but more expensive alternative. Variables such as hazard type and occupational situation, such as duration of use, temperature, and humidity, determine the choice of the type of respirator to be used. People who work in hot or humid conditions such as cage wash areas may prefer to use PAPR-ventilated hoods. The airflow provided by battery-operated motors provides a degree of cooling that other styles do not offer. Vision can also be improved, because there is less fogging of visual surfaces when the air-powered equipment is used. If respirators are required, then it is necessary to assure that they are worn and maintained properly. It is necessary to test for fit before using any of the face-conforming masks such as the dust/mist, half- and full-face respirators; these tests should also be an annual part of the facility respiratory health program. A fit test can be either qualitative or quantitative. Qualitative tests rely on the subject's ability to taste or smell a test substance while wearing the respirator. Quantitative tests measure the actual leakage of the test material around the respirator under a variety of conditions such as movement of the head up and down and right to left, talking, breathing deeply, or bending at the waist. Federal, state, and local regulations governing the use of res-



FIGURE 1. Wearing PPE such as dedicated clothing, eye protection, an N95 dust/mist respirator, a disposable lab coat, gloves, and shoe covers can help reduce exposure to animal allergens.



FIGURE 2. An N95 dust/mist respirator mask worn correctly fits tightly around the nose and mouth preventing the majority of allergens from entering the mask.

pirators must be followed if employees are required to wear respiratory protection as part of their job. The use of respiratory protection falls under OSHA regulations 29 CFR 1910.134 (ref. 5). The basic elements of a respirator program include the selection of an appropriate style of respirator to fit the need and type of work being done, medical evaluation of an individual for respiratory health before respirator use, fit testing of the individual for tight-fitting respirators, training in the use and maintenance of the respirator, inspection of nondisposable respirators, scheduled filter replacements, training for the hazards to which the individual will be exposed, and an evaluation and auditing system of the respirator program².

The success of an animal allergy prevention program depends on the combination of engineering and administrative

safety controls with adequate use of PPE. The employee must receive complete information about the risks of exposure to animal allergens as well as training to recognize the symptoms associated with animal allergies. The occupational health program of a facility should provide advice on the best means to prevent allergies and should make it easy for, and even encourage, a worker to report symptoms and receive treatment and advice on how to protect oneself better.

With administrative, engineering, and PPE controls in place, the final element of a successful program is management support. Management must assure that the equipment, practices, and training are appropriate for the risks encountered in the work place. This role is essential to the successful prevention of allergies to laboratory animals.

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