One university's approach to controlling potential exposures to animal allergens in biomedical research

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BACKGROUND

On March 6, 2003, Environmental Health and Safety (EH&S) was advised that an incident had occurred in a research laboratory, wherein a researcher had become sick after possible exposure to rodent allergens. On the day that the researcher became ill, rats were brought into a room adjacent to the one where the affected individual worked, for procedures to be performed under the fume hood. EH&S was advised that the researcher who became ill had been experiencing allergic symptoms related to rodent exposures for some time, and that the Principal Investigator (PI) had typically excluded rodents from the laboratory by requiring his researchers who handled rodents to perform all animal procedures in the animal housing facilities on the first floor of the building.

EH&S was asked to evaluate this incident and to make recommendations to protect the health of the allergic individual and to investigate the potential adverse health consequences of rodent exposure to other researchers working in the building. EH&S was further advised that the allergic individual had gotten sick when rodents were brought to other laboratories located on the same floor, and not simply to the laboratory room adjacent to the one in which the allergic individual normally works.

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Background on Allergies to Research Animals

Allergies to research animal proteins shed in urine, saliva, and skin are a significant occupational risk for laboratory workers, potentially affecting one third of animal researchers.[1] "An estimated 10% of laboratory workers eventually develop occupation-related asthma."[2] Sensitivities to research animal allergens generally develop over months or years of occupational exposure, predominantly through inhalation of airborne allergens.

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For individuals in whom a Laboratory Animal Allergy (LAA) is suspected, diagnostic tests (medical examinations, skin tests or in vitro tests for specific antibodies, and lung function tests) may be performed to assess the potential for and severity of LAA.[3]

Once the presence of LAA is established, treatment should be directed toward removing the worker from continued exposure. Individuals who remain in the workplace with continued exposure for long durations after developing LAA are at risk of developing chronic, persistent asthma.[3]

It has been established that chronic exposure to relatively high and moderate concentrations of allergen greatly increases the rate of development of LAA. "Epidemiological studies have shown that the greater the exposure to animal allergens, the more likely one will become sensitized and have symptoms related to work."[4] Thus, allergen exposure reduction is the primary goal for all employees at risk.

A number of pharmacological treatments aimed at preventing or ameliorating allergic reactions in animal workers are available, however continued exposure of an allergic individual to animal allergens may result in deterioration of lung function. Therefore, pharmacological intervention may be useful for intermittently exposed individuals, but is not considered a viable option for chronically exposed laboratory workers or animal care handlers.

Immunotherapy, which "consists of administration of allergenic extracts to sensitive individuals to reduce their sensitivity", has been shown to produce some improvement against LAA in uncontrolled studies, but the use of immunotherapy for chronically exposed laboratory workers has not been established as a method for protecting exposed workers from deterioration of lung function.[3]

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Prevention of the development or progression of LAA is an important goal in animal research facilities. Steps taken to address this issue are geared toward minimizing exposure to animal allergens. These steps include pre-employment and periodic medical surveillance to identify at-risk animal researchers and handlers; facility design directed toward reductions in animal allergen loads; educating animal researchers and handlers regarding the risks of LAA exposure and alerting them to work practices which may limit exposure; judicious use of personal protective equipment (PPE); and evaluation and treatment of affected individuals.[5]

Evaluation of Building Ventilation

In response to the incident described above, EH&S examined the fume hood exhaust system in the building, and determined that the fume hoods were adequately exhausting from the building, and exhausted air was sufficiently removed from air intake ducts, so that no exhausted air reentered through the building ventilation system. EH&S then consulted with the university's ventilation engineer regarding the ventilation design in the building, who confirmed that the ambient air from all laboratories in the building was exhausted directly to the outside, and that no re-circulation of air was occurring.

Evaluation of the Exposed Individual

The affected researcher was interviewed by EH&S but declined an examination by an occupational health physician offered as part of the university medical monitoring program. He was notified by memorandum of the findings of the evaluation, and specific recommendations were made regarding work practices designed to prevent future allergen exposure.

DISCUSSION OF FINDINGS

Reduction of animal allergen exposure to researchers is an important goal for animal research facilities, and is accomplished primarily through isolation of animals from employees, to the extent possible, and minimizing exposures through appropriate ventilation, by implementing work practices that reduce animal allergen levels, by the use of appropriate personal protective equipment, and through identification of individuals at risk of developing LAA.

Because there is no known "safe" level of animal allergens,[6] steps must be taken to generally reduce allergen levels to the extent possible. Further, because animal proteins are considered potent allergens, a significant reduction of exposure is advisable to reduce the rate of development of LAA.[7]

An evaluation of the ventilation in the building indicated that the Heating, Ventilation, & Air Conditioning (HVAC) system was adequately evacuating air contaminated with animal allergens, with no re-circulation from one laboratory to another. Thus, if animals are transported from the animal care facility on the first floor to research laboratories on the second floor in covered cages, animal allergens should not be shed in significant quantities in the hallways or laboratory areas other than those where animal procedures are carried out.

Various work practices have been implemented to reduce allergen levels to the researchers working with animals. In addition to the assorted work practices, animal researchers are encouraged to protect the general environment by isolating research animal work areas, using cage filter tops, working under fume hoods when possible, wearing gloves, wearing laboratory coats or scrubs that are designated for working with animals (not to be used for general laboratory work), and becoming aware of the risks associated with animal allergen exposure and additional work practices that can be applied to reduce animal allergen exposures to themselves and colleagues.

An increased effort to train researchers regarding the risks associated with animal contact was made. All animal handlers must be made aware that increased exposure may result in illness, and that they are responsible for minimizing allergen exposure to themselves and others. They should be advised what steps they can take to reduce allergen levels.

RECOMMENDATIONS

In keeping with the National Research Council (NRC) and the National Institute of Occupational Safety and Health (NIOSH) recommendations for minimizing animal allergen exposure to research animal workers, reasonable efforts to minimize animal allergen exposure should be taken. In particular, the following modifications and practices are recommended to reduce allergen concentrations to the researchers and other animal handlers.

Researchers:

- The use of filter-top animal cages for animals during transport between housing facilities and laboratories is required. Filter tops should be removed in the laboratories only when necessary and under a fume hood, if possible.
- A low animal density should be promoted–transport of the fewest number of animals needed at one time.
- Because animal proteins excreted in urine are often potent allergens, animals should be transferred to clean cages, if warranted, before moving them to the laboratories.
- Researchers working with animals in the animal housing facilities should wear laboratory coats, scrubs, disposable gloves, and other PPE as needed during animal handling work, but remove those before leaving this area.
- Workers who continue to experience symptoms should avoid allergen exposure altogether – this might require relocation to a building where no animal work is performed.

Health and Safety:

- A training program should be developed for researchers and animal handlers regarding the risks of animal allergies and steps for reduction of exposure to themselves and their coworkers.
- EH&S should periodically remind animal researchers and animal care workers of the potential for developing LAA "to promote an early diagnosis of allergy so that appropriate interventions can be made with

individual workers to prevent the development of serious disease."[8]

- EH&S will provide guidance to affected individuals by evaluating work practices and, if warranted, providing information toward medical intervention.
- The medical surveillance program should be re-evaluated to determine if further measures are warranted to protect researchers who may have symptoms indicative of LAA.

Animal Care Group:

- Because animal handlers are likely to have a relative high level of animal allergen exposure, diligence must be taken regarding surveillance of this population for development of allergic symptoms. Animal care workers who have noted new allergic symptoms when handling animals should be alerted by supervisors to the potential need for medical intervention, and advised to contact EH&S.
- When reasonable, measures should be undertaken to reduce allergen load, including lowering the animal density, use of ventilated filter-topped cages, and encouraging the use of appropriate PPE, possibly including the use of a particulate mask and working with proper ventilation controls.
- HEPA filtered cage bedding disposal systems must be utilized for all cage-bedding emptying activities.
- Animal Care staff who are required to wear respirators for protection, including particulate filtering masks, must participate in a formal respiratory protection program. Supervisors should direct staff to contact EH&S for information regarding the respiratory program.

CONCLUSION

Evaluation of building ventilation systems is an important tool in understanding how to protect researchers from developing occupationally acquired allergies. Additionally, the risk of developing LAA can be minimized through the implementation of careful work practices, PPE, engineering controls, and utilizing a strong medical surveillance program.

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