Report of the 2023 RSPCA/UFAW/IAT Rodent Welfare Group Meeting

MARINE BARNABÉ[1], KEN APPLEBEE[2,3], JANE HURST[4], VIKKI NEVILLE[5], TOM CHILDS[6], MIGUEL MARAVALL[7], JULIA BARTLETT[8], JANE TYSON[9], TINA O'MAHONY[10], HALEY DANIELS[11] and KERITH LUCHINS[12]

1 Animals in Science Department, RSPCA, Horsham RH12 1GY
2 Applebee Advisory, Hornchurch RM12 6RJ
3 College of Laboratory Animal Science & Technology, Rushden NN10 0SH
4 Institute of Infection, Veterinary and Ecological Sciences, University of Liverpool, Liverpool CH64 7TE
5 Bristol Veterinary School, Bristol BS40 5DU
6 Francis Crick Institute, London NW1 1AT
7 Sussex Neuroscience, School of Life Sciences, University of Sussex, Brighton BN1 9RH
8 School of Physiology, Pharmacology and Neuroscience, University of Bristol, Bristol BS8 1QU
9 Companion Animals Department, RSPCA, Horsham RH12 1GY
10 Institute of Animal Technology, Oxford OX2 7JL
11 University of York, York YO10 5DD
12 University of Chicago, United States of America

Correspondence: animalsinscience@rspca.org.uk

Introduction

The RSPCA/UFAW Rodent Welfare Group has held a one-day meeting every autumn for the last 30 years. This is to allow its members to discuss current welfare research, exchange views on welfare issues and share experiences of the implementation of the 3Rs for Replacement, Reduction, and Refinement with respect to rodent use.

This meeting was held in person at the Francis Crick Institute in London in October 2023 and allowed participants the opportunity to engage in face-to-face discussions throughout the day and as part of a group discussion session at the end of the day. The theme for the day was looking back and looking forward, and talks covered topics ranging from housing and husbandry to refinement in procedures, education, and learning from companion rat care. This report summarises the meeting and includes some action points for readers to consider raising at their own establishments.

Rodent husbandry: where have we come from – and where are we going?

Ken Applebee

Ken began his career in 1972 as a Junior Animal Technician at the Medical College of St Bartholomew's Hospital and resigned in 2020 after 10 years as the Director of Biological Services at King's College London. During his career, Ken witnessed many advances in rodent husbandry. In this presentation, he highlighted some of the major changes that have occurred over the last 20 years and made suggestions on new improvements to rodent welfare that could be implemented in the near future. He focussed particularly on ways in which Animal Technologists could support such improvements.

Caging

Ken spoke of the changes in rodent cage technology that had impacted both animal cages and the overall design and structure of animal facilities. The development of

individually ventilated cages (IVCs) in particular was important as it presented a new way of working. Ken also noted the changes in guidelines requiring more spacious cages (regarding floor area and height) for both mice and rats. Cage changing practices have also developed a great deal. Ken noted that in the 1980s, animals were housed with high density in rooms with low air changes and 2 or 3 cage changes per week. These practices have changed significantly with increasing awareness of the effects of cage changing on rodent welfare, particularly the link with aggression in male mice. Rodents are now primarily kept at lower stocking density in rooms with high air density (if using conventional open-top cages) or in IVCs. Most importantly, cages are cleaned out much less frequently, usually every 10 days, and are spot cleaned, both of which reduce disruption and aggression.

Enrichment

In the 1970s and 1980s, there was much less evidence supporting the welfare and scientific benefits of environmental enrichment. Household products such as shredded paper and tissues may have been provided, with treats such as sunflower seeds, rice grains and yoghurt. Today, there is an important industry producing specially designed enrichment items including tunnels, chew blocks, hides, and toys. The effects of providing environmental enrichment need to be scientifically evaluated to ensure they have a positive measurable impact on Animal Welfare – a useful resource for evaluating environmental enrichment was produced by the NC3Rs, RSPCA and IAT.

Handling

Finally, Ken mentioned the refinements made to rodent handling, including the use of tunnels or cupped hands to pick up mice. The importance of calm, non-aversive handling in all aspects of rodent husbandry has become increasingly recognised, leading to positive changes in the way mice and rats are picked up and held, including routine activities such as weighing.

Room for improvement

With regards to areas of potential improvement, Ken raised the issue of chronic cold stress experienced by laboratory mice. According to the UK Home Office guidelines, mice should be kept at a room temperature of 20-24°C, even though this is significantly below the thermoneutral zone of 26-34°C for these animals. This may be improved by providing sufficient nesting material to allow mice to control their environment and create adequate nests, which can reach temperatures of 30-32°C. This is particularly important for newborn pups who lack the ability to thermoregulate and are dependent on their mother and siblings for warmth.

The Animals in Science Regulation Unit (ASRU) Change Programme and the associated increased requirement for establishment self-regulation were also discussed. In this new system, Ken believes that issues may arise in establishments with poorly functioning Animal Welfare and Animal Welfare and Ethical Review Bodies (AWERBs) and inconsistent standards of Animal Welfare. For establishments to effectively self-regulate, the AWERB and animal care staff must be competent, diligent, and innovative. Finally, an increase in external scrutiny was noted. This was exemplified by the recent critical evaluation of the forced swim test by the Animals in Science Committee (ASC) and the fact that this test is no longer being performed at King's College London as of 2015.

Take-home messages and action points

– Think about the use of enrichment in your own establishment – is its implementation sufficiently driven by evidence? You may wish to take a look at the NC3Rs/RSPCA/IAT tool for evaluating environmental enrichment.

– Consider the handling methods you use with the animals in your care. If you would like to switch over to refined handling methods but are unsure of how to start, you could take the free, online refined mouse handling course offered by the NC3Rs.

Progress on refined mouse handling – has it made a difference?

Jane Hurst

Routine handling of animals in the laboratory is an essential but frequently ignored component of animal experiments and husbandry. It has considerable potential to influence anxiety and aversion to human approach and contact. Jane and colleagues showed that the tail method traditionally used to pick up mice consistently induces aversion and high anxiety (even with the animal's weight supported). Conversely, use of handling tunnels, scooping mice up on the open hand (cupping), or on a cage ladder leads to voluntary approach of the handler, low stress and anxiety, and improved tolerance of physical restraint. Now there is substantial evidence that these less aversive methods provide major refinements over tail handling for laboratory mice, uptake is spreading worldwide. However the time and effort required to achieve this level of engagement has been far greater than Jane ever imagined. In this presentation, she shared her experience with some of the major barriers that have slowed the uptake of refined handling within animal facilities and how progress has been achieved.

Having previously spent time working with wild rodents, Jane noted that laboratory mice showed very high levels of anxiety compared to their wild counterparts. This triggered an initial study to compare the use of four different methods to pick up mice.[1] The study design included animals of different strains and sexes and multiple human handlers. Results revealed that tail handled mice consistently showed greater aversion to handling as well as higher levels of stress and anxiety than mice handled using a tunnel or cupped hands. These differences were most notable when comparing tail and tunnel handling.

Since the publication of Jane's paper in Nature Methods in 2010, other research groups have independently published further evidence of the beneficial effects of non-aversive handling, showing strong consistency and reproducibility. Jane highlighted that the method of handling used in a study influences multiple aspects of the experiments. These effects are evidenced in multiple areas, including behavioural test results (including elevated maze and open field tests and exposure to a novel stimulus), breeding success, litter mortality, physiological stress responses (changes in corticosterone and blood glucose), and responses to specific procedures such as injections, anaesthesia and oral gavage. All papers published showed that tail-handled mice showed greater anxiety, a finding that was shown to be consistent across research labs, handlers, mouse strains and tests.

However although there is now substantial evidence to support the implementation of non-aversive handling methods, there are also significant barriers to adopting new practices. These include fear that changing to a different handling method will require additional time and training, incur financial costs, pose practical issues, or simply that it will make no difference to the research and so is not worth doing. Jane noted that the resources and training, including webinars and videos showing how to correctly handle the mice, provided by the NC3Rs had made a positive impact on encouraging researchers and technicians to adopt tunnel handling. Since its inception in 2016, the NC3Rs-based resource page dedicated to mouse handling has been accessed by users from 107 different countries and posters were translated into five languages and sent to over 400 institutions.

Jane also noted the essential role of champions – those who were initially sceptical but have experienced the benefits of non-aversive handling first-hand and are able to speak to and convince others facing similar issues. Animal Technologists may be particularly concerned about the practicalities of implementing novel animal handling protocols and may benefit from demonstrations by others who have successfully moved towards using tunnel handling and who can provide advice and support.

Take-home messages and action points

- Although scientific evidence is important, it is not enough. To effect change, it is essential to hear from those who have experienced the challenges and benefits of implementing refinements. These early adopters are invaluable in their roles as advocates for change.
- For faster implementation, focus on collaborating with other research groups and stakeholders.
- Enforcement through policy may be considered, although it should be positively framed as handling mice in the most appropriate, refined manner, rather than banning tail handling.

A mapping review of refinements to laboratory rat housing and husbandry

Vikki Neville

Refining the housing and husbandry of laboratory rats is an important goal. Indeed, standard laboratory rat housing may be deemed unacceptable according to several definitions of 'good' welfare. However the implementation of any refinement should have a strong evidence base, to ensure that the rats will genuinely benefit and to avoid wasting resources. There is a large existing body of work focussing on refinements to rat housing and husbandry and synthesising these data is therefore an important step before drawing conclusions. The aim of Vikki's work was to compile, assess and summarise previous research on refinements made to rat housing and husbandry and the resulting review was recently published in Lab Animal.[2]

Vikki and her team conducted a mapping review of studies investigating potential refinements of laboratory rat housing and husbandry to assess what refinements have, and have not, been studied and to briefly assess whether evidence supports any impact on rat welfare. The literature search was designed to cover three key focus areas: rats, welfare and housing/husbandry. The criteria for inclusion into this analysis were the publication language (English), the type of study (empirical), the species studied (*Rattus norvegicus*) and the experimental design (involving a change made to housing or husbandry that had the potential to be a refinement, and the inclusion of both treatment and control groups).

After screening and selection, a total of 1,017 studies were included in the analysis. The first of these studies was published in 1944 and the number of publications per year increased significantly over time. Overall, this body of work showed a strong bias towards using male rats only (60.2%) and it was noted that some studies (1.9%) did not even report the sex of the animals used. In addition, over half of studies (50.6%) did not mention the use of randomisation in their study design and very

few reported using blinding (14.1%) or provided sample size justification (3.8%). Randomisation, blinding, sample size and sex are all items listed in the ARRIVE guidelines Essential 10, meaning they should be included in all manuscripts as a basic minimum.[3] Without these, readers cannot effectively assess the reliability of the findings reported.

There were many refinements studied and a range of readouts used to assess the impact of these. Many refinements related to cage contents, followed by cage type and cage mate number, although the rationale for manipulations were often unclear. Vikki questioned what impact these additional enrichment items may have other than initially providing a novelty to the animals. In addition, potential refinements were often studied concurrently with others, making it difficult to tease apart the specific aspects that are most beneficial to rat welfare. Outcome measures were widely varied, spanning behaviour, physiology and neurophysiology. The most reported measure was body weight, followed by open field test results and elevated plus maze results. Some of the physiological indicators reported, such as heart rate, cortisol concentrations, and blood pressure, may rise in stressful situations, but can also increase in situations that are neutral or even rewarding, which complicates their interpretation in terms of welfare. These outcome measures may not provide reliable information about the impact of the housing and husbandry refinements.

Results from preference studies, such as choice, consumer demand and conditioned place preference tests, may be less ambiguous. Overall, preference studies showed that rats preferred having complex environments to perform different activities. This includes having multiple items in the cage, such as natural objects, chewable objects, shelters, a running wheel and a foraging device among others. Preference for size, bedding, and temperature was dependent on several factors, including sex, the number of animals in a cage, the photoperiod and particular behaviours, among others.

Take-home messages and action points

- Rats prefer complex environments that provide different areas to fulfil different functions.
- A one-size-fits-all approach to refinements is not appropriate because different refinements impact different rats in different ways.
- A complete overhaul of rat housing may be needed perhaps using a consultation process as has been done regarding pet rat housing.[4]
- Looking forward, future research should focus on refinements to transport, investigating controllable/predictable manipulations and using/validating reliable measures of welfare.

Improving efficiency and accuracy of Animal Welfare reporting through automation

Tom Childs

During this talk, Tom explored how automating (making a process operate automatically without the need for manual interference) certain processes at The Crick has improved the efficiency and accuracy of Animal Welfare reporting. This change was driven by the industry's high expectations surrounding swift, efficient and accurate reporting of Animal Welfare to ensure legal and ethical standards are met. The use of automation presents several benefits, including saving time and freeing up staff to perform other tasks, reducing opportunities for human error and increasing traceability and reliability of results. However there will always need to be a balance between efficient automated systems and competent, empathetic human observers.

Starting off small, Tom and his team identified processes that were repetitive, complex and time-consuming. A good candidate for automation was defined as a process that:

- involves data stored in an accessible format
- is logical, repeatable and scalable with high impact
- requires minimal human decision-making
- may be prone to human error and time-sensitive
- is tedious, repetitive or boring

With this knowledge, the team began mapping and automating jobs that would have the highest impact. This resulted in the automation of a number of processes but the most impactful project was the automation of Home Office returns. These reports are produced following a specific format and provide details of the number of procedures and animals used, and the nature and purpose of the procedures performed under the project licence. The Home Office returns process fulfilled all the criteria outlined above. In addition, these are subject to significant time pressure as the window for submitting returns is approximately 4 weeks, which makes this process stressful for staff members.

In its first year, this initiative significantly reduced the workload of four staff members assisting project licence holders with their annual returns from a full month of hard, repetitive and complex work to just a couple of hours per lab. This was not achieved without some challenges, including issues with data storage, significant training requirements, initial lack of trust and resistance to change from users and staff, niche cases that did not fit the standard process and quite a few bugs! In addition to streamlining processes, this experience also allowed team members to develop IT skills, including coding and gave them the opportunity to gain experience with project management software. The outcome is a platform that users can access to

gain an aggregated overview of all data relating to an animal research project, broken down and organised into collapsible categories and sub-sections that can be searched. The database also allows users to record and keep track of actual severity, which has significantly reduced the number of errors in Home Office returns. The data is refreshed daily and can be exported to Excel, making it very user-friendly.

Since that first year, Tom and his team have introduced the use of a fully functional report to allow each individual animal to be reviewed and have expanded this report for niche cases, tools for auditing and more. In addition, the team has automated a mailing system to allow reporting of standard condition 18 reports and breaches, as well as producing daily reports for project licence holders and colony managers showing stock levels, single-housed animals, financial allocations and health issues, among others.

Tom hopes to inspire others to look at processes in their own workflows and create their own systems. The following points may help to begin this process:

- Identify processes that take a lot of time and effort. Which of these may be suitable for automation?
- Consider the pros and cons of automation. Is the time saved worth the significant time and resource investment?
- Clearly map out your process, starting with small, focussed and achievable goals.

Free exploration in a modular labyrinth: a novel open-source design for mouse experiments

Miguel Maravall

Brains evolved to guide animals' interactions with their environment. Animals in nature sense their surroundings by actively engaging with them and process the resulting signals according to their behavioural utility. Laboratory based neuroscience research has often focussed on achieving tight experimental control and high statistical power. These aims are necessary for rigorous and reproducible research but have traditionally only been attainable under restrictive conditions. These approaches can place animals in a non-natural behavioural state and induce severe stress. An opportunity for refinement is provided by new developments in machine vision and microelectronics, which can enable the tracking of motion and posture with unprecedented detail and allow experiments to unfold automatically depending on the animal's behaviour. This requires an architecture that can be easily adopted, altered and shared, and is based on cheap and readily available components.

In the presentation, Miguel introduced his team's new modular maze for mice, designed to interrogate sensing and decision-making in freely moving animals while providing precise experimental control and flexible protocols. This labyrinth follows previous contributions in that it is made of plastic that is opaque under visible illumination but transparent in the infrared range, allowing animals to be tracked as they move. Mice feel safe in an enclosed environment and can express their natural curiosity to explore. Partitions can slot in between posts and be replaced by panels incorporating different textures, gratings, or 3D-printed shapes, as well as reward ports. This allows flexible reconfiguration of the maze and creates associations between stimuli, locations and rewards. Tunnel crossings from the cage into the maze and entries into regions of interest can also be tracked. With these components, animals can encounter multiple stimuli as they move from the labyrinth's origin to any endpoint, permitting the experimenter to set up automated rules deciding whether the mouse will be rewarded.

Mice display high levels of motivation to explore and quickly learn to navigate the labyrinth. Fast navigational learning is achieved without fluid or food restriction or any other regulated procedure, as the animal's natural motivation to explore is leveraged. To encourage uptake of this system, Miguel and his team have set up a Github repository site for maze designs and code. These are openly shared and distributed as testing continues to enable quick, cheap and easy replication of the maze by others.

Take-home messages and action points

- Visit the repository comprising images, maps, and coding relating to the mouse mazes developed by Miguel's team.

Refinements of handling and dosing methods for rats and mice

Julia Bartlett

Many scientific procedures involving animals require the administration of test substances. This almost always entails each animal to be restrained, which is known to cause stress. Julia and her colleagues have developed and implemented several techniques to reduce the stress caused by all aspects of oral dosing, including handling, restraint and drug administration. This work forms part of the '3Hs' Initiative' (housing, handling and habituation), a holistic approach to refinement that considers the lifetime experience of laboratory animals to promote positive experiences and reduce cumulative suffering. Habituation is particularly important as it requires only a small-time commitment and yet has a significant impact on the animal, who is learning from every experience with the handler. By receiving positive reinforcement (a reward), the animal learns

to anticipate a positive experience. This reduces the stress associated with all subsequent handling, making procedures easier and saving time in the long term.

Oral dosing of rats and mice is commonly carried out using an oesophageal cannula. This procedure is distressing for the animals and requires physical restraint. There are also risks of adverse events including incorrect placement, tracheal dosing and oesophageal trauma. This method also requires the experimenter to have a personal licence, which can leave studies vulnerable to disruption associated with staff absences. An alternative approach is to use voluntary ingestion of test substances in palatable solutions. Julia's experience has shown that rats and mice readily take palatable solutions such as peanut butter, condensed milk and apple juice from a syringe. Drugs can be accurately administered in this way with much less stress for the animal and handler.

Although this approach has previously been reported by several research groups, it is still not widely used and it is not clear if this is due to a lack of awareness or whether researchers have encountered problems using this approach. Animals may initially show neophobia but this can be overcome by introducing the new palatable substance gradually. Rodents may also develop conditioned aversion, which refers to the association of the aversive effects of a drug with the palatable solution in which it was administered. To reduce the potential for this to occur, Julia's team developed a modified protocol in which the palatable substance on its own is offered to the animal a few hours after the drug was administered. This reduces the negative association of the adverse effects of the drug with the treat substance. Using this approach, the team has been able to administer a wide range of psychiatric drugs without issue. This refined method reduces the distress caused to the animal during the substance administration procedure and eliminates the potential risks associated with oral gavage. Although the approach will not be compatible with all test substances, this method offers both welfare and scientific benefits.

Refinements have also been implemented for intraperitoneal injections, in which the animal is typically firmly restrained, causing stress for both animals and staff. Julia's team has modified their handling techniques for rats and mice to eliminate the need for scruffing in rats. By reducing physical restraint, the animal can relax abdominal muscles at the injection site, which reduces pain during the procedure. Animals are also less likely to bite when they are not restrained and show lower cortisone levels and overt behaviours (struggling, vocalising and defecation).[5] There is also no evidence of intestinal damage using this method.

Similarly, mouse scruffing was also refined to avoid pulling or touching the animal's tail, which is known to be aversive. Refined scruffing is done entirely on a VetBed or on the handler's arm using the animal's body but without touching the tail. Analysis of objective measures of affective state and the stress response (urination, vocalisation, struggling, aversion on release and defecation) showed that this method offers significant improvements in Animal Welfare.

Overall, the refinement techniques described here are easy and practical ways of reducing the stress caused by handling and dosing. Making refinements to these common procedures can improve the lifetime experience of the animal and reduce cumulative severity over time. Tail handling and oral gavage are no longer used in Julia's research lab, with benefits to both animals and the staff members working with them. These techniques have also been used by researchers with a range of prior experience and all have demonstrated competency within a short period of time. Implementing habituation into animal research protocols has important benefits for all aspects of animal handling and should be encouraged.

Take-home messages and action points

- Visit the 3Hs' Initiative website for detailed examples of how to implement these refinements in your own lab.
- Complete the 3Hs' online CPD course to test your knowledge and fulfil your CPD requirements.

What can carers of companion rodents and laboratory rodents learn from each other?

Jane Tyson

Several rodent species have been kept as companion animals for many years. They can be easily acquired from pet shops and many have a short life expectancy, often thought of as being good pets for children because they require little of the complex time, financial and care commitments of other animals. However this perception is far from the truth, which can lead to problems for owners and compromised welfare for pets when the difference between expectations and reality is realised. In this presentation, Jane described some of the recommendations provided to carers of companion rodents in relation to housing and the types of things they should be considering in their pets' environment to help meet their needs. Some of these may be transferable into the laboratory world to help improve the lives of rodents in these settings too.

Knowledge around pet rodents' needs, husbandry and housing is still limited and little research has been undertaken to investigate these. Much of the early housing guidance provided to pet owners was based

on information gleaned from research institutions and laboratories. There are few studies looking specifically at the welfare needs of pets and very little research has investigated their spatial requirements. Housing can frequently be a welfare concern as commercially available cages are often small and inadequate to allow animals to express their full behavioural repertoire and contain all the resources they may need. The RSPCA promotes a pragmatic outcomes-based approach to pet rodent housing, aiming to empower owners to provide these highly active and intelligent animals with the space and resources they require and to also enable them to fulfil their natural behavioural patterns.

Space

Enclosures should be large enough to comfortably accommodate all resources whilst ensuring all animals can comfortably perform all their natural behaviours. All individuals need to be able to perform the same behaviours at the same time to help minimise competition or monopolisation of resources so multiples of each item should be included within enclosures housing multiple animals. There should still be enough space for animals to move around and this should not be constrained by the quantity of resource provision. Environments need to be kept interesting as rodents are naturally inquisitive and enjoy exploring so will easily get bored in an unstimulating enclosure. If all resources do not comfortably fit in their cage and allow plenty of space for moving around, including running, jumping, climbing, the enclosure is not large enough.

Housing design

Many rodents enjoy using different levels. Vigilance is a natural anti-predator tactic, so rodents want a good view of their surroundings. To get the most benefit, they need to stand fully upright without touching the roof of their enclosure. As rodents are prey species, an anti-predatory tactic is simply to flee and hide. It is crucial all animals have access to their own safe, secure hiding place, with safe sleeping areas to rest undisturbed and plenty of nesting material. Providing various types of nesting material gives choice and helps them construct better nests. Of course, these can be bought commercially but cardboard boxes can also be used. Use hiding places with two entry points to prevent one animal trapping another inside or preventing access, and make sure there is at least one more hiding place than the number of animals.

Housing provided should also be designed with the animal's individual needs in mind. It is useful to consider the biology and natural behaviours of the species. For example, some rodents like to climb while others like to jump. However every individual has their own preferences. Whilst each species may enjoy digging, an individual animal may have a particular preference over the type of litter they dig in. It is worth taking some time to identify an individual's preferences as this helps meet their needs in the best way.

Jane concluded her presentation by highlighting that although laboratory rodents live in very different environments to pets and are cared for in a different way, the fundamental needs of a laboratory animal are the same as those of a pet. Traditional cages for pet rodents are still widely available and well used, although these animals require more than a simple cage to satisfy their needs – they need plenty of enrichment and space. Pet owners are increasingly thinking about enclosures that are not simply off the shelf and making their own improvements. Small changes to housing and husbandry can make a big difference to Animal Welfare. Increasing space allowances and the complexity of the environment means rodents are more likely to explore and engage with their surroundings which will keep them physically and mentally active and help to improve their wellbeing. Jane also noted that safe, supervised time outside of the home cage is important to provide animals with opportunities to explore somewhere new. This is something that has been introduced in many laboratory settings as playpens. Finally, Jane highlighted the importance of interacting with these animals, as they can find positive interactions with us a rewarding experience and actively enjoy spending time with their human caretakers.

Take-home messages and action points

– Think about the differences in the ways lab and pet rodents are housed and cared for. Are there any practices for companion rodents that you could adapt? For more information, you can read the RSPCA Companion Animals resources on keeping pet rodents.

Educated animal care staff: intrinsic for Animal Welfare

Tina O'Mahony and Ken Applebee

From delivering endpoint assessments, to creating syllabuses and moderating coursework, IAT Education is committed to ensuring professional education standards are upheld in industries. IAT Education is the endpoint assessment organisation for multiple apprenticeships. In these programmes, the apprentice develops technical knowledge and real practical experience, along with the functional and personal skills required as an Animal Technician. These are acquired through a combination of learning in the workplace, formal off-the-job training and the opportunity to practise and embed new skills in a real-work context. An apprenticeship is a paid job where the employee learns and gains valuable workplace

experience. Alongside on-the-job training, apprentices spend at least 20% of their working hours off-the-job training. Apprentices must demonstrate competency in 3 areas throughout their apprenticeships: knowledge (facts and information), skills (the ability to do a task well) and behaviours (the way in which a person acts in response to a particular situation or stimulus, particularly with respect to others). Areas of competency include ensuring animals are provided with the appropriate amount and type of food; have access to clean, fresh water; are provided with species-appropriate enrichment activities for mental stimulation; and are housed in the correct environment. In addition, apprentices may be required to check an animal's health and take the appropriate action depending on the situation, manage breeding colonies and maintain strict records as required under the Animals (Scientific Procedures) Act 1986 (ASPA). With good training, apprentices can ensure good welfare for the animals they look after.

The IAT in consultation with CLAST has also developed a wide range of optional smaller higher education (HE) units that not only provide a route to ultimately attain a Level 6 qualification or first degree and IAT Fellowship but also lend themselves to continuing professional development (CPD). An example of this is the partnership between CLAST and the Advance Training Centre at MRC Harwell, which provides high-quality courses in their purpose built, state-of-the-art training facility. Individual training units are available on any different topics and fees will vary depending on the size, content and modes of delivery. More information can be found at https://clast.org.uk/

In this presentation, Tina noted the benefits of some of these courses not just for the learner and for rodent welfare but also for the employer. Some of these include:

- increased staff loyalty and sense of being valued by the company
- greater staff retention
- knowledge that staff are experts in Animal Welfare
- maintaining a Culture of Care

The wide range of modules meet CPD needs and can be incorporated into staff appraisals. With access to these training opportunities, staff members can develop confident public speaking and presentation skills, can prioritise and manage their time effectively and develop scientific writing skills for use in the company.

Take-home messages and action points

– Speak to your manager about completing some additional training or CPD courses in an area where you feel you could benefit from developing new skills. Visit https://clast.org.uk/ to see which courses may be of interest.

The psychological contract of Animal Technicians as 'dirty workers' in the biomedical research industry

Haley Daniels

The psychological contract is fundamental to the employment relationship. It can be argued that Animal Technicians in the biomedical research industry experience certain challenges associated with the dirty aspects of the role, which may potentially lead to a disruption or violation of the psychological contract. This disruption ultimately impacts on the employment relationship (the relationship between employee and employer). In this presentation, Haley provided an overview of her journey in this industry and her PhD research to date: an exploration of the psychological contract of Animal Technicians and how the dirtier tasks associated with the role they conduct influence the state of the psychological contract.

Dirty work involves physical, moral, or emotional taint. Some examples of professions considered to involve this include abattoir workers, sex workers, street workers, criminal lawyers, animal academics and researchers. These roles may be stigmatised, or even perceived as having a low status, which can in turn lead to social isolation and workers becoming disengaged and developing feelings of shame, guilt, fear and anger.

A psychological contract refers to a fair day's work for a fair day's pay. It is intangible and outside a written contract but it includes a mutual agreement between employer and employee of reciprocity and the expectation of loyalty and being treated well. This agreement governs the relationship between the employee/employer and may be transactional and/or relational in nature. The psychological contract begins during recruitment and can be disrupted, repaired, or renegotiated during its lifetime. Haley's research aims to explore how inputs, processes, and policies in the workplace can impact attitudes and behaviours. These can have significant consequences in the context of an animal facility in which the Animal Technician's role is already associated with critical pressures. These themes were explored by conducting interviews with 60 animal research professionals (technicians and managers).

The 5 obligations most important to individuals at both employee (Animal Technician) and employer (manager) level were trust, job security, personal safety, salary and fairness. Interviews further delved into whether these obligations were being met. Job security was viewed as the most important expectation or promise and was high (during COVID). Trust and honesty were good but could be improved. However fairness, loyalty and consultation were thought to be poor and obligations to provide emotional support and physical safety were not met at all.

Participants were asked about the way they viewed their psychological contract: whether it was relational (i.e. based on loyalty, trust and long-term goals) or transactional (i.e. based on short-term returns and benefits, such as earning a salary and training before moving on to another post). For the majority of participants (77%), the psychological contract was relational and they viewed animal research as their long-term career, with some participants stating:

> "I am still here, and I am still passionate about working with animals."

> "This is my life; I am committed to my team and the animals."

> "I cannot imagine doing anything else now."

However others had mixed feelings associated with their work, which they viewed through the lens of a transactional psychological contract. Some participants are quoted here:

> "I could not stay in the role as an Animal Technician long term, I need more than this, it is crap work for a crap salary."

> "I am leaving as I can not handle killing animals and I wanted to leave for 13 years. I do like looking after the animals and I have worked here now for a long time and it is hard. I recently worked 19 days in a row without a day off, we have to work 365 days a year including Christmas and bank holidays and it is too much."

Finally, interviewees were asked about potential stigma associated with the work of an Animal Technician and whether they considered this profession to be "dirty work". The overwhelming majority of participants (95%) felt that stigma still existed around the role and 80% viewed their job as dirty work. Furthermore, 46 of 60 interviewees felt that the psychological contract had been breached in their workplace, although 74% of them wanted to remain in the industry. The reasons for this included being committed to the animals in their care, perceived benefits to science, and commitment to their team and colleagues.

Haley's work has highlighted some of the issues facing staff working with animals in research institutions regarding the psychological contract. It has also shown that many Animal Technicians exist in a liminal state in which the psychological contract has been broken but is not being repaired, leaving people stuck in their institutions with no clear path to renegotiation or exit. For positive changes to occur, changes are needed at the individual, organisational and societal level to increase the visibility of Animal Technicians and acceptance of their work.

Take-home messages and action points

- Speak to your colleagues and/or manager if you ever feel that you are struggling with the emotional labour associated with your work.
- Visit the North American 3Rs Collaborative website for resources, webinars and tools to cope with compassion fatigue and the emotional burden of working as an Animal Technologist.

Replacing sentinel rodents with environmental health monitoring: why and how

Kerith Luchins

Research institutions are increasingly replacing their soiled bedding sentinel rodents with environmental health monitoring (EHM). This switch can facilitate full animal replacement, more accurate results and even reduce programme costs. However concerns remain about the strength of the scientific evidence behind this practice and options for racks that have cage-level filtration. In this presentation, Kerith discussed results of a systematic literature review, common challenges and solutions and resources for practical implementation of this replacement at their facility.

In 2016, a systematic review[6] evaluating the efficacy of soiled bedding sentinels was published. This review highlighted that, as of 2016, only 15 articles, conference presentations and posters had investigated the efficacy of soiled bedding sentinels and data available concluded that this practice was only effective in detecting 5 pathogens. Another systematic review was undertaken in 2022 by Kerith and the North American 3Rs Collaborative, in which 33 papers were included. EHM was shown to be superior to soiled bedding sentinels. It detected pathogens more often, regardless of the sampling method or pathogen type, and was highly effective in detecting 22 pathogens, including viruses, bacteria, fungus and parasites. There is a strong evidence base supporting the superiority of EHM over sentinels and it is therefore a scientific and ethical priority to replace the use of sentinels with EHM.

Next, Kerith and colleagues ran a survey[7] between 2021 and 2023 to explore the prevalence of EHM, factors influencing its use and possible barriers. Results showed that although many respondents still used a combination of EHM and sentinels, the exclusive use of EHM had increased from 7% in 2021 to 48% in 2023. The main barrier to implementing EHM reported was the type of caging and rack design used. This is because one EHM system (exhaust dust testing) can only be used in conjunction with an individually ventilated cage (IVC) system that has rack level filtration. However sentinel-free soiled bedding is another form of EHM

that can be used with any type of caging, providing a suitable alternative for all facilities. Another important factor was the cost associated with the implementation of EHM. However as EHM reduces the numbers of animals needed, costs associated with ordering, shipping, and keeping sentinel animals are avoided completely. Kerith and her team conducted a study[8] at the University of Chicago showing that the total annual cost of using EHM was 26% lower than that of using sentinels. The third most significant perceived barrier (16%) was the accuracy of EHM in detecting pathogens and participants mentioned concern over a lack of published data on EHM accuracy and reliability. Given the rapid increase in data and novel testing methods in the past few years, respondents listing accuracy as a barrier could be operating on an outdated view of the methods that encompass EHM. It is clear that recent publications have not become mainstream knowledge and Kerith hopes that the team's latest systematic literature review, due to be published soon, will change that. Accuracy was actually perceived as an advantage of EHM by 37% of respondents. Overall, the number of participants reporting that there are no barriers had increased from 18% in 2021 to 34% in 2023, indicating that many barriers were gradually being removed. It is also worth noting that the use of sentinels involves an additional emotional burden associated with the need to euthanise animals purely for health testing, which is unnecessary and can be removed when switching to EHM.

Take-home messages and action points

For those who are interested in switching to EHM, Kerith has included some tips here:

1. Determine your caging type, which dictates your options.
   - If you have IVC racks that exhaust at rack level (i.e. Allentown Inc, Tecniplast™) you can use exhaust dust testing.
   - Regardless of your caging/rack type, you can use sentinel-free soiled bedding.
2. Reach out to your diagnostic vendors to determine their EHM preferences.
3. Gather an internal advocacy group and get buy-in.
   - Analyse cost savings via cost analysis tool on our resource hub.
   - Use our editable slide deck to convince stakeholders.
   - Evaluate if current sanitation methods are acceptable.
4. Decide how to make the transition.
   - Consider a hybrid approach or change 100% to EHM.
   - See case studies on how two institutions converted on resource hub.
5. Develop materials and timeline for implementing EHM.
   - Our SOPs can help you start.

There are more resources available on the North American 3Rs Collaborative website, including steps to follow when making the switch and successful case studies. In conclusion, EHM presents many advantages: it is 3Rs compliant, increases accuracy, reduces labour and costs, and reduces emotional fatigue.

References

1. **Hurst, J.L. & West, R.S.** (2010). Taming anxiety in laboratory mice. *Nat. Methods* **7**, 825–826.
2. **Neville, V. *et al.*** (2023). A mapping review of refinements to laboratory rat housing and husbandry. *Lab Anim.* **52**, 63–74.
3. **Percie du Sert, N. *et al.*** (2020). Reporting animal research: Explanation and elaboration for the ARRIVE guidelines 2.0. *PLoS Biol.* **18**, e3000411.
4. **Neville, V., Hunter, K., Benato, L., Mendl, M. & Paul, E.S.** (2022). Developing guidelines for pet rat housing through expert consultation. *Vet. Rec.* **192**, e1839.
5. **Stuart, S.A. & Robinson, E.S.J.** (2015). Reducing the stress of drug administration: implications for the 3Rs. *Sci. Rep.* **5**, 14288.
6. **de Bruin, W.C.C., van de Ven, E.M.E. & Hooijmans, C.R.** (2016). Efficacy of Soiled Bedding Transfer for Transmission of Mouse and Rat Infections to Sentinels: A Systematic Review. *PLoS One* **11**, e0158410.
7. **Luchins, K.R. *et al.*** (2023). A Cross-sectional Survey on Rodent Environmental Health Monitoring Practices: Benchmarking, Associations, and Barriers. *J. Am. Assoc. Lab. Anim. Sci.* **62**, 64–73.
8. **Luchins, K.R., Bowers, C.J., Mailhiot, D., Theriault, B.R. & Langan, G.P.** (2020). Cost Comparison of Rodent Soiled Bedding Sentinel and Exhaust Air Dust Health-Monitoring Programs. *J. Am. Assoc. Lab. Anim. Sci.* **59**, 508–511.