Report of the 2017 RSPCA/UFAW Rodent and Rabbit Welfare Group meeting

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Introduction

The RSPCA/UFAW Rodent (and now Rabbit) Welfare Group has held a one-day meeting every autumn for the last 24 years, so that its members can discuss current welfare research, exchange views on welfare issues and share experiences of the implementation of the 3Rs of replacement, reduction and refinement with respect to rodent and rabbit use. A key aim of the Group is to encourage people to think about the whole lifetime experience of laboratory rodents and rabbits, ensuring that every potential negative impact on their wellbeing is reviewed and minimised.

The 24th meeting was held at the Animal and Plant Health Inspectorate (APHA) Weybridge on 14 November 2017. The first session addressed meeting animals' needs and aiming for a 'good life', with the needs of female breeding rabbits as a case study. Three speakers gave presentations on breeding rabbit behaviour, a Home Office perspective on providing enrichment 'appropriate to the species', and refining housing, husbandry and care for these animals in practice. The second session, on rodent welfare, comprised an update on the National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs) Year of Laboratory Rodent Welfare, reducing stereotypic digging in gerbils, enabling group housing in rats with vascular access buttons, positive emotions in rats, and good practice for housing male mice. The day ended with a discussion session on speaking up for rodents within Animal Welfare and Ethical Review Body (AWERB) meetings and more generally. This report summarises the meeting and ends with a list of action points for readers to consider raising at their own establishments.

Behaviour and welfare needs of breeding rabbit does

Anne McBride, University of Southampton

The Home Office Code of Practice for housing and care stresses that the physiological and behavioural needs of animals should be restricted *only for the minimum necessary period of time and degree* (see below).[1] Achieving this and providing a good quality of life for any animal, requires a sound, up-to-date understanding of the physiological and behavioural requirements of the species, breed or strain and how these alter during the individual's life cycle. Although most commonly-used laboratory animals have been bred (and often inbred) in captivity for generations, wild-type behaviours are still innate – if animals are given the opportunity to express them. A classic example is the 'Ratlife' video,

in which inbred laboratory rats released into a naturalistic enclosure rapidly began to express many wild-type behaviours[2] and, there is evidence that naturalistic behaviour is also innate in domestic pigs[3] and laboratory mice.[4] Researching the behaviour of the wild-type species is therefore a good starting point for refining housing and care and this presentation considered the breeding rabbit doe as a case in point.

Understanding the behavioural needs of the pre- and post-parturient doe in the laboratory or any other breeding institution, means considering normal doe behaviour and that of the offspring in the wild, including how interactions between the doe and young change during early development, up to and beyond weaning.

Some basics: rabbits are herbivorous, grazing animals and are crepuscular and nocturnal, i.e. they are most active at dawn and dusk and during the night. In the wild, they are only above ground for around 30% of a 24 hour period and when it is dark, in the daytime they are in the dark below ground – quite a contrast to life in the laboratory. Rabbits are not especially 'domesticated', having been selected primarily for meat and fur and they comprise some 20% of the diet of over 20 species in their native Spain and Portugal.[5] The primary need to avoid being eaten underlies all rabbit behaviour, including the absentee parenting style.

Figure 1 shows a typical rabbit nest in the wild. Note the downward sloping tunnel, to help the blind-deaf nestling kits to re-locate the nest and their siblings and the earth plug which is used to completely stop the nest so that predators cannot see, hear or smell the kits. You (and your dog) have probably unknowingly walked past these stopped-up nests many times. The doe returns approximately every 24 hours for a few minutes to suckle the kits. The frequency of nursing can vary between days and individuals, as females may suckle several times a day. Other than that, she displays minimal parental caring behaviour while the young are in the nest.

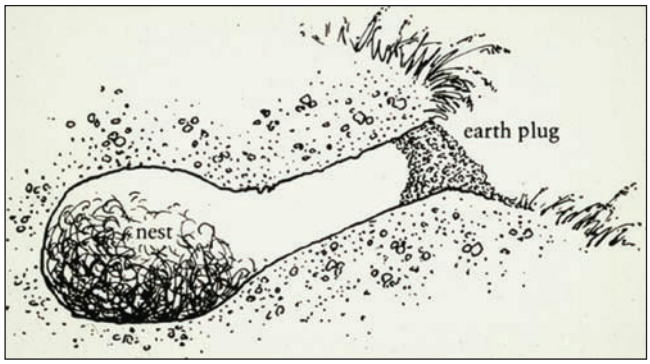

Figure 1. A wild rabbit nest with earth plug. Illustration by Guy Troughton in McBride, A. (1988). *Rabbits and Hares.* Whittet Books. Essex.

The kits can recognise their mother's scent at birth and about an hour before they are usually nursed they begin to rise to the top of the nest in preparation for suckling. The rest of the time, they huddle in the warm nest material and rotate between the centre and periphery of the group. They begin to eat solids (nest material) at 8 days, their eyes open fully at 10 days and they begin to explore the tunnel at around 13 days. The nest stop entrance is still tightly re-packed by the doe following every visit until around 18 days. After this time, the young begin to emerge and they are weaned about 24 days post-partum. They still associate very closely with adults, especially their mother, for several weeks. Natural rabbit society comprises mixed gender and age groups, to help achieve safety in numbers.

This is obviously very different indeed from the laboratory situation. Some ideas are set out in Table 1 for going further towards accommodating the physiological and behavioural needs of both does and kits in the laboratory setting. The suggestion relating to socialising the kits is based on studies that have shown handling at pre-weaning results in tamer, less fearful rabbits when individuals were several weeks older.[6,7] To reduce the risk of cannibalisation, it is advised that early handling is best done after the kits' eyes are open, and scent profiles are preserved by rubbing hands in the nest material and stroking the mother before touching the kits. If rabbits are then regularly handled and acclimatised to being picked up throughout their lives, anxiety will be reduced with benefits for the rabbits, staff and science.

...for does	...for kits	...for both
– Mental and mphysical stimulation; a good quality and quantity of space – Ability to choose between the company of other rabbits **or** to be alone. – Ability to completely get away from the kits, with no visual, auditory or olfactory contact. – Ability to have control over timing for access to the kits.	– Early socialisation with humans, to help reduce anxiety when adult. – Ability to rest in the dark, when not being nursed, for the first 18 days of life.	– An enclosed, dark nest box, accessed by a downward-sloping tunnel (this could have a door for observing the kits). – An entrance to the nest box that the doe could seal and open herself. – Electronic tags for individual does to access each nest box (to prevent double littering).

Table 1. Suggested refinements to breeding rabbit housing and husbandry

For further information on rabbit behaviour and potential refinements for breeding does, see references 5, 8 and 9 at the end of this report. Your Named Information Officer, Named Veterinary Surgeon,

Named Animal Care and Welfare Officer and AWERB should also be able to provide further information and help you promote discussion about meeting animals' needs, aim to provide a 'good life' in general for all the species in your care and further encourage understanding and empathy.[10]

Rabbit housing and enrichment 'appropriate to the species' – a view from the Home Office

Giles Paiba, Home Office Animals in Science Regulation Unit

The publication of the Home Office *Code of Practice for the Housing and Care of Animals Bred, Supplied or Used for Scientific Purposes*, in 2014,[1] set out the minimum requirements for housing and breeding rabbits used within the confines of the Animals (Scientific Procedures) Act (ASPA) 1986 (as amended). As mentioned above, there is a requirement that animals' physiological and behavioural needs be restricted only for the minimum necessary period of time and degree – but how do we interpret whether space is 'of sufficient complexity to allow expression of a wide range of normal behaviour' and how 'appropriate to the species' can accommodation really be in a laboratory setting?

The Code of Practice aims to:

- Promote good animal welfare through the provision of consistent, high quality care and accommodation;
- Support the generation of high quality, reliable scientific results through the reduction of environmental variables; and
- Implement the principles of the 3Rs through using the minimum number of animals and causing the minimum degree of pain, suffering, distress or lasting harm.

It includes both engineering standards and performance standards. An engineering standard is a defined measurable parameter, e.g. cage dimensions, temperature range or photoperiod.iA performance standard is an outcomes-based requirement, e.g. 'noise levels, including ultrasound, shall not adversely affect animal welfare'. Both engineering and performance standards are important. Engineering standards are the 'welfare safety net', which set clear expectations and are easy to verify with respect to compliance. Performance standards are helpful because it is not always possible to prescribe how outcomes should be achieved and they also allow for advances in science and our understanding of animal welfare needs.

With respect to breeding rabbits, we recognise that, in nature, these animals live in a complex environment. It is important for rabbits to have a raised area for lookout and to enable hopping exercise which will increase hind limb weight-bearing strain, assist in maintaining bone strength and therefore reduce the likelihood of injuries. The Code includes engineering standards (size and 'optimum' height of the shelf) and performance standards (animals must be able to lie and sit and easily move underneath the step and be able to use the surface).

The Code of Practice specifically advises those breeding rabbits to ensure that the need for privacy of the nesting and parturient mother are considered. In reality, this would need the behavioural drivers and needs previously described by Dr McBride to be considered. Thus, although the provision of a nest box is not mandatory, it is assumed, in that the Code does provide minimum cage dimensions depending upon whether nest boxes lie inside or outside the enclosure housing the doe and her litter.

Refining housing, husbandry and care for breeding rabbits

Rita Rose, Envigo

Breeding rabbits – it should be simple ... right? In the wild absolutely but not so straightforward in a laboratory. Before embarking on a breeding programme, fundamental questions are needed to define the study objective or production colony needs and how you can aim to safely address both these and the needs of the animals you are responsible for.

Our company has establishments for animal supply as well as for Contract Research. Rabbits under our care may be part of a breeding colony to supply other establishments outside our company, or they may be used in a scientific study that required breeding as part of its objective, e.g. reproductive toxicology. To define good practice for housing and caring for our rabbits, we use information from different sectors including guidance for 'pet' rabbits, rescue settings and farmed rabbits. We also have an internal Rabbit Welfare Group which meets quarterly and reports to our AWERB.

Our protocol for breeding rabbits involves placing a nest box in with the doe a week before she is due to litter. This stays in the cage for 10 days post littering, then the whole cage is changed for a new, clean one without a nest box and with tray liner for the kits to sit on. We recognised that this system does not separate the doe and kits, as would be the case in the wild, and we wanted to identify a refinement. We have therefore been trialling a nest plate, which is made from stock board, with a lip that is high enough to keep the kits in one area until they are strong enough to hop over into the rest of the cage. We are monitoring breeding

success using the nest plates, and we are hoping to be able to reduce the colony size if litter productivity increases.

The NC3Rs' Year of Laboratory Rodent Welfare

Mark Prescott, NC3Rs

Mice and rats account for the majority of animals used in scientific procedures in the UK and globally. Throughout 2017, the NC3Rs highlighted opportunities to improve the welfare of laboratory rodents. By spotlighting recent advances in animal welfare science and technology, hosting workshops, events and data collection projects aimed at animal technologists and focusing on the adoption of good practice, we aimed to have a positive impact on the large number of rodents used in research.

Our Year of Laboratory Rodent Welfare included many different approaches to refine rodent use, including the development of technologies for automated, continuous recording of the behaviour of individual mice and rats socially housed in the home cage[11,12] and a novel, ultra-lightweight, low power device for electrophysiological recordings in unrestrained and untethered mice;[13] new research awards, for example to refine the capture and tracking of wild rodents for ecological studies; and publication of guidelines from our data sharing working groups on refining bile duct cannulation studies in rats[14] and rodent models of ischaemic stroke.[15]

In other key projects relating to the day-to-day welfare of rodents in the laboratory, we:

- Highlighted the work of our 2016 3Rs prize winner, Joanna Makowska, who demonstrated the importance of burrowing, climbing and standing upright for laboratory rats.[16] Despite generations of domestication, the laboratory rat retains innate behaviours that cannot be expressed in standard housing, such as rearing on the hind legs when exploring and socialising. Height restrictions in standard caging lead to muscle stiffness, which rats attempt to alleviate by lateral stretching. This is not only a welfare issue; it has been argued that laboratory rats are 'metabolically morbid' and therefore poor 'models' for human disease. Joanna Makowska, and her colleague Dan Weary, showed that young rats in large, enriched cages burrow around 30 times a day, climb around 75 times a day and stand upright around 180 times. Some facilities are now investing in larger caging or providing shared access to a 'play area' for rats.
- Promoted the concept of a play area in successful workshops at the Institute for Animal Technology Congress in 2017, in which we increased awareness of the innate needs and behaviours of laboratory rats using the Ratlife video[2] and stimulated discussion as to how more space and stimulation could be provided.
- Ran a mouse handling workshop, to support trainers, Named Training and Competency Officers and other named persons who wanted to move from picking up mice by the tail to using cupped hands or a tunnel instead. This has been demonstrated to reduce anxiety in mice with both animal welfare and scientific benefits and some establishments have successfully stopped handling by the tail.[17-20] The workshop aimed to explore potential barriers to using the refined handling methods and provide practical tips and solutions. A range of resources, including a video tutorial, poster, FAQs and downloadable video clips for in-house training were also made available on our website.
- Set up a crowdsourcing, multi-institute data collection project to identify prevalence, patterns and triggers of aggression in laboratory mice. This is commonly reported and can cause pain, distress and even death, so the welfare impact will clearly be significant if the causes can be better understood and used to identify practical solutions. Data were supplied by over 110 participants, from over 30 institutions within the UK and overseas and we will communicate preliminary findings in 2018.

For information and updates on all these initiatives, see: nc3rs.org.uk/rodent-welfare-hub and nc3rs.org.uk/2017-year-laboratory-rodent-welfare

Reducing stereotypic digging in gerbils

John Mulley, Bangor University

The Mongolian gerbil (*Meriones unguiculatus*) is a diurnal inhabitant of semi desert and steppe habitats. It is a social species, usually living in a pair, with offspring and some helpers within a central burrow system that has multiple exits. Relatively few gerbils are used in the UK (236 procedures using 206 animals for the first time in 2016), in fields including research into diabetes, hearing, epilepsy, stroke, thermal regulation, parasitology and desert adaptation.

The lack of access to a tunnel system in standard laboratory housing and the inability to construct one, leads to stereotypical digging behaviour in many species of desert rodent, including the Mongolian gerbil. The situation is further exacerbated by the excessive chewing behaviour exhibited by gerbils, which renders many traditional forms of environmental enrichment unsuitable. The Home Office Code of Practice acknowledges that gerbils often develop stereotypical digging behaviour, suggesting a nest box with 'a separation wall and a tunnel entrance including

a bend/corner', a deep layer of litter for digging and nesting and a 'burrow substitute at least 20 cm long'.[1] However, in our experience this has not always been effective in ameliorating stereotypical digging and on occasion the gerbils have simply chewed the tunnels up or left the nest box because humidity levels were too high due to the angle in the entrance tunnel. In a study funded by UFAW, we set up a controlled behavioural study using unchewable, stainless steel tubes of different lengths, diameters and angles (made by a company that produces roll bars for cars). Ten-week-old gerbils were housed in single-sex groups of four and the analysis of video samples of the animals' behaviour was randomised and blinded. We defined 'stereotypical' digging as a bout of over 12 seconds. Following an initial increase in stereotypical digging, the level of digging decreased and we have also (anecdotally) noted that noise levels have decreased in the gerbil room with far fewer scrabbling sounds. The gerbils are now provided with stainless steel rat houses with open ends for ventilation, and 20 cm, 50 mm diameter stainless steel tubes with a 90˚ mandrel bend, as a low-cost and low-tech intervention which has reduced or entirely eliminated stereotypical digging (Figure 2).

Figure 2. Tunnel configuration for reducing stereotypical digging in gerbils. Photo: John Mulley

Enabling group housing in rats with vascular access buttons

Sam Izzard and Debbie Ridley, GSK

Dual cannulated rats with harnesses have previously been singly housed at our facility, due to concerns that animals would interfere with one another's cannulae, potentially causing distress and infection. We obviously wanted to avoid this on animal welfare grounds but singly housing rats is also undesirable from a welfare perspective, as they are social animals. Therefore we wanted to set up a vascular access button (VAB) system that would enable GSK to group house surgically prepared rats.

We trialled placing a VAB between the scapulae under general anaesthesia (with perioperative pain relief), monitoring body weight daily for the first 8 days post-surgery as part of our post-operative welfare assessment protocol. We found that animals gained weight more rapidly and steadily with the VABs than previous cohorts with the harnesses. They can be pair- or group-housed before and after each study, improving their welfare. The system was also successfully validated for pharmacokinetic steady state infusion studies, indicating that there were no issues with data quality when changing from harnesses to VABs. However, some issues were encountered, including swelling around the button site, animals scratching at the site, catheters coming away from the button pin and some movement from the tether when on study. These issues have been overcome by ensuring that the tethers are removed as soon as possible after the 1 hour infusion, trimming the rats' nails regularly and placing the cannulae on to the pins using silicone covered forceps.

Having successfully overcome these issues, this model is now our first choice for surgically cannulated rats (Figure 3).

Figure 3. Group housed rats with vascular access buttons. Photo: GSK

Expression of positive emotions in rats

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Animal welfare research has traditionally focussed on preventing or reducing negative experiences but more recently attention has also been given to promoting positive emotions.[21] Therefore, it is crucial to develop objective methods to detect and quantify positive emotions in animals. We conducted two studies with rats which aimed (i) to identify facial indicators of positive emotions and (ii) to measure positive emotional contagion between rats (where one individual's emotions and related behaviours directly trigger similar emotions and behaviours in others).

Facial indicators of positive emotions

Previous studies have identified rodent facial expressions which specifically occur in situations likely to induce negative emotional states (e.g. pain, aggression and fear). This study aimed to investigate whether rats exhibit specific facial expressions of positive emotions during play with humans.

Fifteen adolescent male Lister Hooded rats were individually subjected to a 2 minute Positive Treatment (PT) and a 2 minute mildly aversive Contrast Treatment (CT) over two consecutive days. PT consisted of playful manual tickling administered by the experimenter, while CT consisted of exposure to intermittent bursts of white noise. A positive emotional state is indicated by 50-kHz ultrasonic vocalisations (USVs). Vocalisations at this frequency were recorded to check whether rats had different emotional states in PT and CT. High-speed photos of the rats' faces in a profile or three-quarters view were taken during both treatments. Novel qualitative and quantitative measures, and also the established Rat Grimace Scale,[22] were used to detect fine changes in facial expression. Photos were scored by an experimenter who was blinded to which treatment the animals had received.

The number of positive vocalisations was significantly greater in PT than CT, indicating that the experience of being tickled was positive in comparison with the exposure to white noise. We found that Ear Colour (0-2 scale) was significantly pinker in PT than in CT, and Ear Angle was wider (ears more relaxed) in PT compared to CT (Figure 4). However, other quantitative and qualitative facial measures, which included Eyeball height/width Ratio, Eyebrow height/width Ratio, Eyebrow Angle, visibility of the Nictitating Membrane, and the Rat Grimace Scale, did not show significant differences between treatments.

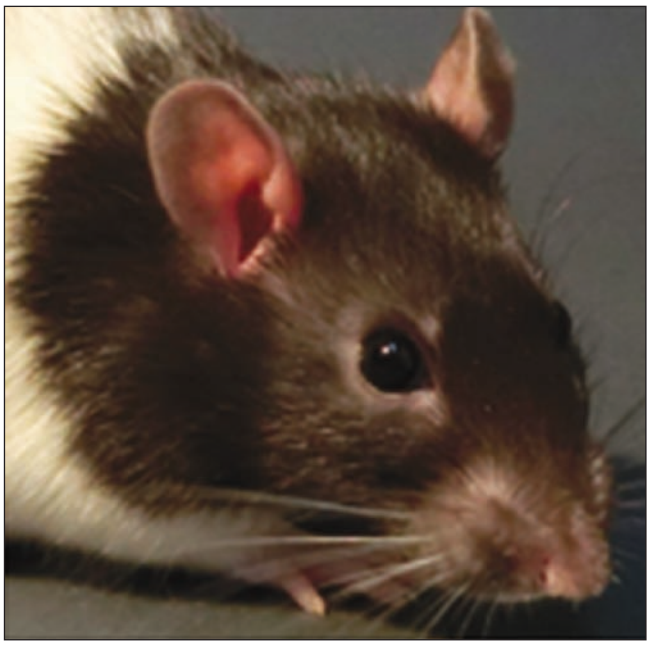

Figure 4. A rat experiencing positive emotions. Note the ear angle and colour. Please see reference 23 for further information and picture credits.

This study contributes to the exploration of positive emotions and thus better welfare, in rats as it identified potential indicators of positive facial expression resulting from a positive experience. Pinker Ear Colour and wider Ear Angle, both accompanied by the emission of positive vocalisations, may reflect internal physiological changes associated with positive emotional arousal and muscle relaxation, respectively.[23]

Positive emotional contagion

This study investigated positive emotional contagion by exploring the effects of positive treatments received by one rat on the behaviour and vocalisations of the rest of their social group. We are currently preparing a publication on this for another journal, so will just give a summary here.

Adolescent male Lister Hooded rats were housed in groups of three and one rat per group received either positive or control treatments as follows. The 'treated' rat was taken to a separate room for 2 minutes where

they were either manually tickled by the experimenter, given chocolate rewards or placed in the treatment arena without further action (control condition). USVs at 50 kHz and play events in the home cage – attempted nape contacts to initiate play, and solitary scampering – were counted before and after the treatment by an experimenter who was 'blinded' to the treatments the rats had received.

Our results provided some evidence of short-term positive emotional contagion from one individual receiving a positive treatment to its social group. Positively treated rats appeared to promote emotional contagion by becoming the target of more play initiations by untreated rats, and by also inducing (after tickling) more play between untreated rats.[24]

To group or not to group? Good practice for housing male mice

Sarah Kappel, University of Bristol; Penny Hawkins, RSPCA; Michael T Mendl, University of Bristol

It is widely recommended to group house male mice because mice are 'social animals' but male mice do not naturally share territories. Laboratory mice were derived from *Mus musculus*, a species that forms territories inhabited by a small group of individuals including one dominant male, several females, pups and juveniles before these disperse. Territory size varies with food availability and population density e.g. from a few square metres close to human dwellings to several square kilometres in natural habitats. Dominant males are highly intolerant of intruders and the introduction of a strange mouse provokes aggressive behaviour in the territory holder.[4,25] Although laboratory mice have been bred in captivity for many generations, wild-type behaviours can still be innate,[4] as discussed by McBride earlier in this report.

We can assume that a male mouse, given the opportunity to choose, would prefer to be housed with a group of females with enough space to drive away juvenile male offspring- which is obviously impractical in the average laboratory. Given that the male mouse is pre-adapted to live with other mice, is living with other males the best alternative to a natural group composition? To try to answer this question, we conducted a review of the literature on mouse husbandry, behaviour and welfare with a survey of current practice for housing male mice, which has been published elsewhere.[26]

Our key findings were:

– Most survey respondents (120 of 147 people) believe that male mice naturally prefer to live with other mice and that male mice should, ideally, be group housed with other males in the laboratory (123 of 147). If males were singly housed, this was mostly due to aggression (122 responses) or for scientific reasons (100).
– The literature review found that individual housing allows males to have their own territory and eliminates injurious aggression and stressful social defeat – but being housed alone causes social deprivation. Group housing fulfils the need to be with other animals but injurious aggression between male mice can be a serious animal welfare issue.
– **Even without aggression, not all animals within a group will be in a state of positive welfare.** Many male mice may be negatively affected by the stress of repeated social defeat and subordination. Both single and group housing therefore raise concerns about welfare and also research validity.
– On the basis of current Codes of Practice,[1] responses to our survey and the economic implications of single vs. group housing, there is strong motivation to group house male mice and facilities will continue to do so. For example, of 147 survey respondents, 99 reported that it was general practice post-'weaning' to group house male mice, just 4 stated that these were routinely singly housed and 44 stated that both housing conditions were applied.[26]
– The current literature does suggest that it is, generally speaking, preferable from an animal welfare perspective to house male laboratory mice in groups. We suggest that group housing for male mice is the 'less worse' approach but do not positively endorse this practice because male mice would naturally prefer to live with a group of females, not other males.
– However, whether group- or single-housing is better (or less worse) in any given situation is highly context-dependent according to strain, age, social position, life experiences and housing and husbandry protocols. It is important to evaluate what is preferable in each case from animal welfare and ethical perspectives, using the literature and current good practice for housing male mice and ensure that this is discussed within the facility, e.g. by the AWERB, with input from named persons.
– It is possible to reduce the risk of aggression in groups of male mice via thoughtful housing, husbandry and care (see also the NC3Rs project on mouse aggression, above in this report). The literature and our survey, reports measures. including transferring some nesting material (not litter) from used to clean cages;[27] providing enrichment that can be manipulated (e.g. nesting material) as opposed to solid shelters;[28] housing in groups of three[29] and choosing less aggressive strains, if this is compatible with the research objective.

To conclude, it is not possible to house male mice in the laboratory in a way that is compatible with their natural behaviour, nor is it possible to make sweeping statements regarding good practice for housing *all* male mice. There is still much to learn about the behaviour of different mouse strains and how this is affected by housing, husbandry and care, life stage, and previous experiences.[26]

The discussion session

The meeting ended with a discussion session which aimed to explore how participants felt able to raise the priority given to rodent welfare within their facilities and to initiate or become involved with, ethical debates around rodent use. In addition to general discussion topics addressing whether the species identified as 'special' by the ASPA (dogs, cats, equidae and primates) genuinely deserve greater consideration and which species participants would consider to be 'special' and why. We also asked participants how they had spoken up for rodents within their establishments (Figure 5; answers were presented as tick-boxes in a Turning Point slide and people could select as many as applied).

Most of the 80 participants had made colleagues think more about harms to rodents and had brought new information about rodent behaviour, biology and welfare to their attention (top two bars in Figure 5). Fewer had discussed these issues directly with researchers or participated in the AWERB and raising ethical issues scored lowest – although around two-thirds of the audience had been able to do this. The discussion was helpful and it was encouraging to see that participants felt able to raise welfare and ethical issues.

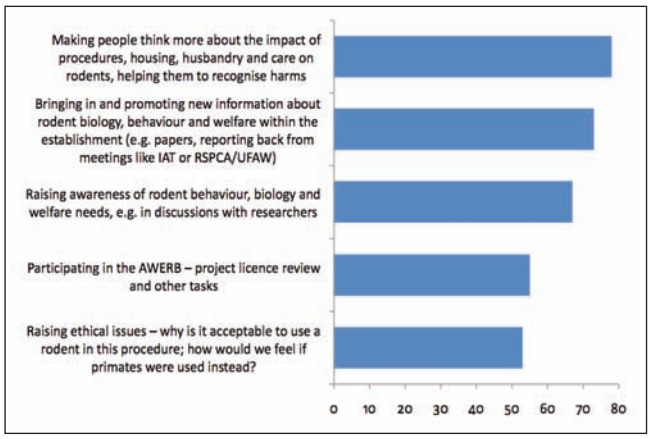

Figure 5. Responses to the question 'Who has challenged assumptions about rodents and spoken up for them, and how?' The histogram shows the number of respondents who had achieved each action.

List of action points based on all of the presentations and discussions:

1. Find out more – or refresh your knowledge – about the wild-type behaviour of the species you care for. Could more be done to facilitate positive, natural behaviours? You might like to ask for a discussion or workshop at your establishment, involving individuals and bodies such as your Home Office inspector, named persons, researchers, AWERB and internal species-specific or Three Rs groups.
2. Look at the NC3Rs Rodent Welfare Hub (nc3rs.org.uk/rodent-welfare-hub) and see whether you can use it to further refine housing, husbandry and care, procedures and welfare assessment for rodents.
3. Do not allow stereotypical behaviour to become 'normalised' (i.e. an accepted aspect of standard housing). Investigate the literature, talk to colleagues in other institutions to see what steps are suggested to reduce such behaviours, and ask for support in researching and trialling ways of reducing or eliminating any outbreaks.
4. If you care for gerbils and are concerned about stereotypical digging behaviour, ask to trial the shelter and tunnel system described in this report.
5. If social animals are routinely housed individually because of concerns about externalised ports or instrumentation, research the literature for ways of refining procedures, approaches or husbandry to enable group housing.
6. Promote the concept of encouraging positive welfare and emotions for the animals in your care, as well as reducing suffering. You might like to share the link to this article with colleagues: news.nationalgeographic.com/2016/12/happy-rats-facial-expression-animals-emotion/
7. Read the full paper on male mouse housing and pass it on to colleagues. You may also wish to use the paper to suggest to your establishment that it reviews its practice, e.g. beginning with a discussion by the AWERB.
8. Commit to promoting knowledge of rodent biology, behaviour and welfare amongst colleagues, as in Figure 4 and to raising ethical issues associated with rodent use within your AWERB and more generally. If your AWERB is looking for topics as part of its 'forum for discussion' function, suggest a rodent-related topic like those set out in the 'discussion session' section of this report.

Acknowledgements

Thank you to all the speakers and delegates for the talks and discussions. We are also grateful to APHA for providing the meeting venue.

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