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THE Enrichment RECORD

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Mirrors and Stainless Steel Balls for Macaques: A Discussion by the Laboratory Animal Refinement and Enrichment Forum

The Importance of Data Collection to Social Housing

Let's Stay Together: Implications of Social Housing for Laboratory Pig Welfare and Management

Results of the GR8/RSPCA Global Survey on Effects of Enrichment on Data Quality

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WE'D LOVE TO HEAR FROM YOU!
We welcome your comments, observations and contributions to *The Enrichment Record*. Contributors include lab animal veterinarians, principal investigators, animal care staff, animal behaviorists, animal technologists and members of the bioscience community who promote the 4 Rs: reduction, replacement, refinement and respect.

Share your story ideas with Rhoda Weiner, *Editor* at *rmbw19@verizon.net*
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Please give credit where credit is due.
Outstanding animal care is truly a team effort, and we ask you to credit colleagues, published reports, articles, and other reference materials that have contributed to your enrichment article. Great ideas don't happen in a vacuum, and we encourage you to list all sources of inspiration.

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NC3Rs Award for Reduction of Animal Use

Dr. Gyorgy Fejer, Plymouth University School of Biomedical and Healthcare Sciences (UK), received an award from the National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs) for developing a mouse cell line that replaces live animals used in infectious disease research. His scientific paper, published in the journal *PNAS* Plus, describes a method to establish continuously growing macrophage cells in mice without chemical, genetic or viral intervention. Compared with cell harvesting from a live mouse, the difference is striking: approximately 300,000 lung macrophage cells can be obtained from one mouse, whereas Dr. Fejer and his team can obtain 20-30 million cells from a single tissue culture flask. These self-renewing cells can be used to better understand how the body fights infection and have already led to new insights into lung diseases and allergic conditions.

OUR READERS TELL US

I found *The Enrichment Record* fascinating. As a psychologist, I agree completely with what you are saying–the importance of social network, of positive interactions and emotional support, and how these factors affect growth and health and even brain chemistry. It's so interesting to see how you are able to apply this to mice as well as to primates (and canines)! The magazine is beautifully designed and well written. It's both a learning experience and fun to read.

Finy Josephine Hansen, PhD

The Enrichment Record
is a quarterly E-Zine/Forum for:

- Discussing environmental enrichment in the optimal care of laboratory animals
- Documenting best practices and approaches for addressing challenges of implementation & assessment at every level
- Sharing data on the impact of environmental enrichmenton the science
- Building the case for integrating enrichment into research design

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In Other Words

We are approaching our fifth year of publication and are planning a special 20th issue for July. The time is right for a serious look at environmental enrichment programs and publications since our launch with an eye on the people who care so deeply about progress in this arena.

Over the years, *The Enrichment Record* has grown in size, readership and community visibility. Articles published in *The ER* are being cited elsewhere. Our 4-part webinar series drew several thousand viewers from institutions around the world. **Bruce Kennedy**, past president of LAWTE, asked students in his lab animal management course at Cal Poly Pomona to write an essay after viewing one of the webinars as their final exam. His article on using webinars as a teaching resource will appear in the July issue. Another respected colleague will include material from past issues in his talk on EE at the Brazilian Laboratory Animal Medicine meeting being held in conjunction with the Latin American Lab Animal Association this month. We've also been involved in developing proposals for seminars at the 65th AALAS National meeting in San Antonio, October 19-23.

In this issue, we are pleased to provide an analysis of the GR8/RSPCA survey on "Effects of Enrichment on Data Quality." It raises some interesting points and should be a great conversation-starter.

Finally, we are so grateful to **Kristina Adams, MS** and her team for updating the AWIC Bibliography on "Social Housing of Laboratory Animals," originally compiled for the Symposium on Social Housing of Laboratory Animals held in Bethesda last August.

AWIC Bibliography on Social Housing

Jayne Mackta

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Article

Penny Hawkins, BSc, PhD

Deputy Head, Research Animals Department, RSPCA, UK

Results of the GR8/RSPCA Global Survey on Effects of Enrichment on Data Quality

BACKGROUND

In the last edition of *The Enrichment Record*, the article *'Facts and Demonstrations'* reviewed the reasons for inconsistencies in the provision of environmental enrichment for animals used in research and testing, including a discussion of beliefs that experimental variability will increase, or a confound will be introduced, affecting data quality (Hawkins 2014).

The article identified three main areas of concern relating to this:

1. The validity of the science within an individual project, if another variable is introduced;
2. Whether or not the data can be compared with those obtained from studies conducted without enrichment; and
3. An ethical issue—whether greater variability will necessitate an increase in animal numbers to ensure that results are significant, trading off refinement and reduction against one another.

Assumptions are frequently made about all three of these points, hence the title '*Facts and Demonstrations'*, which was taken from a quote by John Ruskin: "the work of science is to substitute facts for appearances, and demonstrations for impressions". The article discussed the scientific, practical and ethical bases for each of the above areas of concern, suggested some action points to support the provision of enrichment (and encourage wider reporting of husbandry refinements) and asked readers to participate in a survey to explore their views and beliefs relating to the effects of enrichment on data quality.

The introductory text to the survey set the context by stating that there is widespread support for the concepts that 'better welfare equals better science' and that enrichment can improve welfare. The text also explained that practices vary with respect to the provision of enrichment, the interpretation of results from animals with or without enrichment, and the way in which animal husbandry is reported in the literature. The intention of the survey was described as helping two stakeholders (GR8 and the RSPCA) to understand people's views, beliefs and practices, and to identify any training or resource needs that ought to be addressed with the aim of helping to improve both science and animal welfare.

"Unless enrichment is clearly defined ('enriched environment' means different things according to different institutions) it is quite impossible to be sure that responses are consistent." —Participant Comment

SURVEY RESULTS AND DISCUSSION

The survey ran between 6 January 2014 and 21 February 2014. It was publicized via *The Enrichment Record* article and by using online forums such as CompMed, LAREF and laboratory animal science-related user groups on LinkedIn. The aim was to encourage a wide range of respondents, holding a variety of attitudes towards enrichment and beliefs about its effects on data quality. With the aim of maximizing the number of responses, only the first three questions (on roles,

continued on page 6

 continued from page 5

establishment type and location) were mandatory, and people could then go on to answer as many or as few as they liked.

There were inevitably some flaws in the survey; for example, it was not possible to obtain a stratified sample of respondents. The limitations of online forms make it difficult to provide sufficient information to explain the context for each question in a way that will be meaningful to all and clarify the differences between the options. Supplementary text for each question was also kept brief, with the aim of maximizing drop-outs as people worked through the survey. The drop-out rate did prove to be low (at least 332 people answered every question), but some respondents perceived the text to be leading (6 comments in the free text box, one separate email), or not include sufficient information (3 comments), or they felt that important questions or options were missing (3 comments).

Notwithstanding the above, there are some useful outcomes that are relevant to the aims of the survey, and all of the above limitations have been taken into account when presenting and discussing the results below. As the survey results are not suitable for statistical analysis, they have been described and discussed concomitantly in the sections below, with conclusions (see page 12).

Respondent demographics

A total of 343 people responded to the survey. Tables 1 to 3 list their roles, establishment types and geographical locations.

Table 1. Roles of respondents to enrichment survey

(**NB**: the total in this table adds up to 473, as respondents could tick more than one role)

Role	Number of respondents
Researcher/scientist	112
Animal technologist or care staff	112
Veterinarian	85
Member of ethical or animal care and use committee	74
Other role within a facility conducting animal research or testing	33
Regulator	9
Other	48

Table 2. The kinds of establishment in which they work

Establishment type	Number of respondents
Academic/university	182 (53 %)
Industry—pharmaceutical establishment	51 (15 %)
Medical or veterinary research institute	41 (12 %)
Government agency	26 (8 %)
Industry—Contract Research Organisation	25 (7 %)
Other	18 (5 %)

Table 3. Their location (based on the United Nations world region listing)

World region	Number of respondents
North America	175 (51 %)
Europe	128 (37 %)
Canada	20 (6 %)
Australia/New Zealand	5
China	4
Latin America and the Caribbean	4
Africa	2
Asia (other than China, India or Japan)	2
India	1
Japan	1
Oceania (other than Australia/New Zealand)	0
Sub-saharan Africa	0

Individual countries that respondents chose to specify included Australia, Belgium, Brazil, Denmark, England, Finland, France, Hungary, Israel, Italy, Malawi, Netherlands, Portugal, Scotland, Spain, St Kitts, Switzerland, UK and Venezuela.

Attitudes towards enrichment

When asked whether they regarded the provision of environmental enrichment as a basic necessity for animals, 336 people responded 'yes' and 5 answered 'no'.

This question was not mandatory, but just two people did not answer it and the vast majority accepted that animals need enrichment. This was also borne out by the responses to a question on acceptance of scientific evidence relating to enrichment, which all 343 respondents answered (figure 1).

Figure 1. Responses to the question: '*In your view, is there adequate scientific evidence that animals benefit from enrichment?* '

In the figure below, over 95% of all 343 respondents agreed that there is scientific evidence that enrichment benefits at least some species, with 80% of all respondents choosing the option that did not include a caveat relating to different species. The survey also asked about people's beliefs relating to the effects of enrichment on data quality. Of the 341 respondents who replied to this question, 294 (86%) agreed that, in general, enrichment had a positive effect, 1 believed the effect was negative, 14 (4%) thought it made no difference and the remaining 32 (9%) did not know.

"I STRONGLY believe that reduced suffering in more animals is better than increased suffering in fewer animals." — Participant Comment

Broadly speaking, in light of this, the survey results should be considered as representative of those who accept the scientific basis and the need for enrichment, and generally believe that it improves the science, rather than derived from the entire population of people involved in animal research and testing. Presumably, potential respondents who were less supportive of enrichment may not have been motivated to fill out the survey form, and/or may be less likely to read *The Enrichment Record* and to subscribe to online fora on animal use.

The responses to a further question also suggest that most respondents worked in an environment that was supportive of husbandry refinements (figure 2).

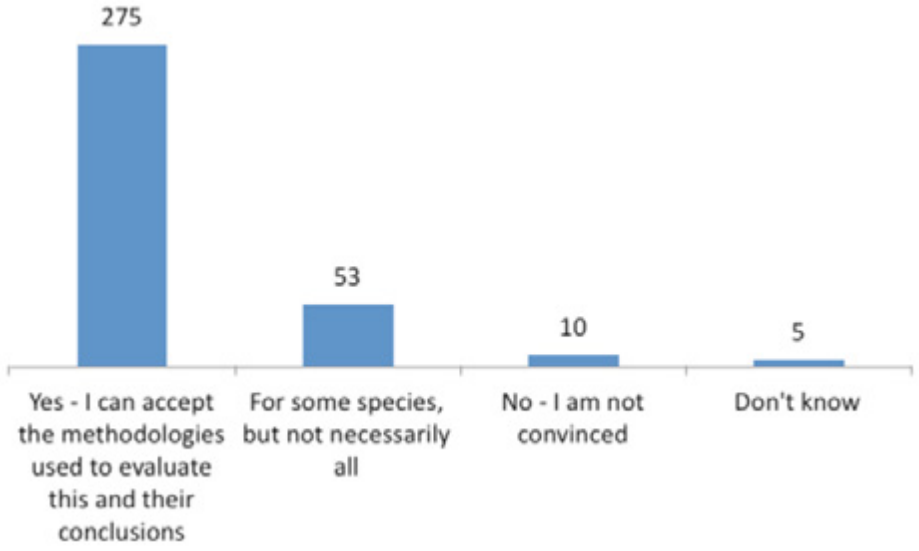
Figure 2. Responses to the question: '*Is enrichment provided for animals at your facility?*'

(see chart on page 8)

The two different responses 'only withheld if there is sound scientific justification' and 'sometimes' were included to allow respondents to clarify if, where enrichment was sometimes withheld, they knew whether there was a justifiable reason for this. Of the 339 respondents, 90% believed that enrichment

continued on page 8

Figure 1



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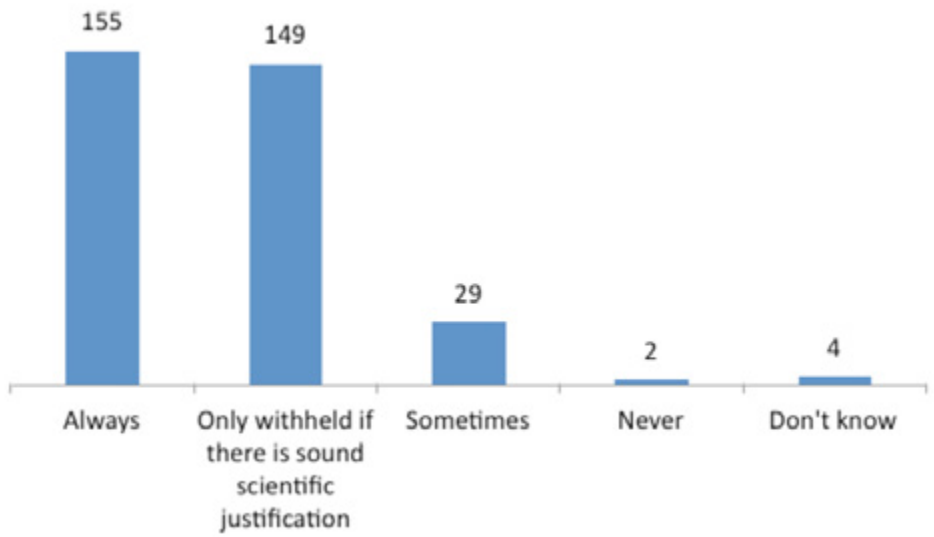
was always provided at their facility, or provided unless there was sound scientific justification otherwise.

Figure 2



Implementing enrichment in practice

The majority of respondents were supportive of enrichment, believed that it had scientific benefits, and worked in environments where its provision was the norm, but there were still some issues regarding untested assumptions about the effects of enrichment.

For example, 341 people responded to the question 'Have you ever withheld enrichment in the belief that data will be negatively affected, but not empirically evaluated this?', of whom 98 felt that it was not relevant to them. Of the remaining 243 respondents, 45 (18%) answered 'yes', whereas 187 (77%) had never made that assumption and 11 (5%) had done an evaluation study. This implies that even people who accept that environmental enrichment is a basic need will still sometimes withhold it on the basis of untested assumptions.

A further question aimed to establish whether people were prepared to challenge colleagues who wanted to withhold enrichment, including asking them for evidence to justify their decision. There were 341 responses to this question, 151 of which were 'not applicable to me'. The remainder of the responses are listed in table 4.

Table 4. Responses to the question: '*Have you ever challenged a colleague who wanted to withhold enrichment, and asked them for evidence to help justify this?*'

Response	Number of respondents
Yes—successfully (they did a pilot study, consulted the literature, or sought further advice)	119 (63%)
Yes—unsuccessfully (they did not change their mind and nobody backed me up)	42 (22%)
No—it was their choice and I didn't see it as an issue	18 (9%)
No—I didn't agree with them, but I knew it wouldn't get me anywhere	11 (6%)

The results suggest that 85% of respondents who felt that the question was relevant to them were prepared to challenge colleagues who made unfounded, negative assumptions about enrichment, with a success:failure rate of around 3:1. However, the remaining 15% were not motivated to raise the issue, either because they did not feel they would be listened to or they apparently did not see it as their place to do so.

Awareness of the literature and issues relating to implementation

As outlined in *The Enrichment Record* article which led to the survey, there is a growing literature setting out the effects of enrichment on data quality (e.g. Eskola et al. 1999, Baumans et al. 2003, Würbel et al. 2005, Mikkelsen et al. 2010, Toth et al. 2011). Various studies have found that enrichment has effects on variability or data quality that are significant, or that it has effects that are not significant, or that there are no detectable effects at all. This indicates that it is not possible to make sweeping assumptions about the effect of enrichment on variability, and it is important to ensure that any effects are properly evaluated and the results acted on appropriately (Hawkins 2014). The majority of respondents to the survey appeared to have a good level of awareness of the most suitable way to interpret and implement results of studies aiming to evaluate effects on data quality (table 5). Of the 332 people who answered, the majority gave the most appropriate response with respect to taking both welfare and science into account, with the aim of reducing suffering, optimizing translatability and ensuring animals are not wasted.

Table 5. Responses to the question: '*Rats on an arthritis study are group housed and provided with extra nesting material—and the disease progression is different from rats individually housed with minimal nesting material. What is the right thing to do?*

Response	Number of respondents
Get advice from a statistician (unless you have the expertise) to see whether any changes need to be made to the experimental design; also see whether the results from these animals yield any fresh insights into the scientific question you are asking. Keep the new protocol unless there are pressing scientific reasons not to	275 (83%)
Assume that the data from group housed animals with extra nesting material is more relevant and transferable to the human condition, and continue with the new husbandry protocol	51 (15%)
Go back to individual housing and remove the extra nesting material—the results have to be comparable	6 (2%)

It is clearly essential to be aware of the literature on the effects of enrichment on variability, in order to help inform decisions in situations such as the hypothetical study in table 5. Knowledge of the literature is also important with respect to awareness of current good practice approaches to enrichment per se, as well as understanding and interpreting its effects. With this in mind, the survey asked whether respondents were aware of the literature on the effects of enrichment on data quality. A total of 342 people responded, of whom 228 (67%) were aware but had not reviewed it in depth, 96 (28%) were aware and followed it closely, and 18 (5%) were unaware. This indicates that the population of respondents already had an interest in the subject matter of the survey and a good level of awareness. The survey also asked how information on enrichment became available in respondents' facilities (figure 3).

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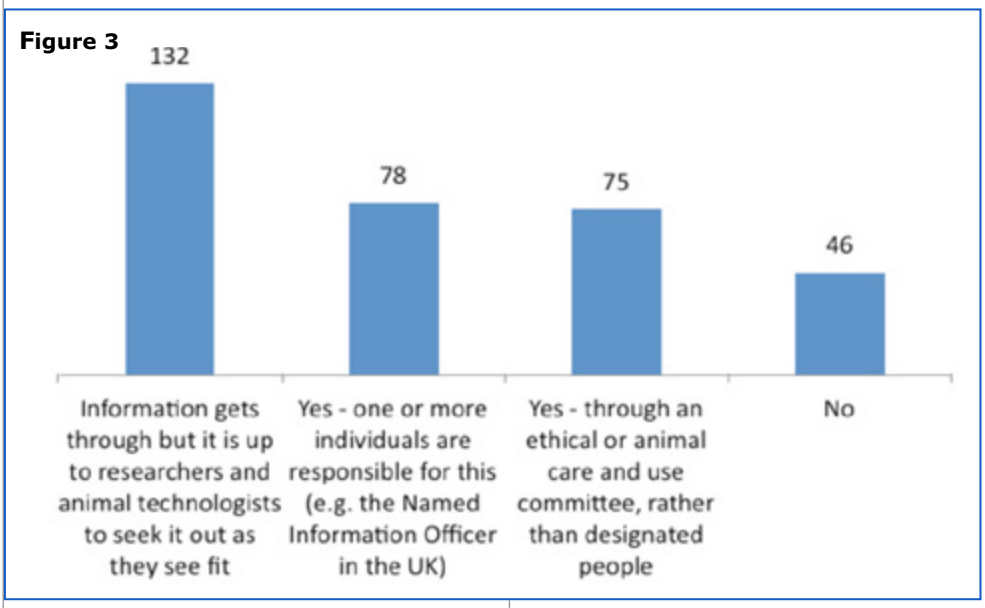
Figure 3. Responses to the question: '*Does your facility have a system for researching, retrieving and assessing new information on enrichment?*'



Of the 331 responses, almost half (46%) reported that there was a system for channeling new information on enrichment into the facility, in the form of one or more individuals or a committee. Publications and other communications on enrichment can easily be overlooked without such systems, for a number of reasons including low awareness of journals, discussion fora and meetings that feature enrichment, or an establishment culture that simply does not recognize the necessity of regular review of new information on enrichment. The lack of a formal system (or knowledge of such a system) indicated in the remaining responses is therefore a concern.

There can be a perception that the requirements of some regulatory bodies preclude husbandry refinements such as enrichment, e.g. in tests to generate safety assessment data. The survey asked a question to explore respondents' beliefs about this. A total of 337 people answered the question 'Animals on studies carried out for regulatory toxicology purposes cannot be provided with enrichment true or false?' Of these, 198 (59%) agreed with the option 'False—there is nothing in regulatory requirements that precludes husbandry refinements', 126 (37%) did not know and 13 (4%) agreed with the statement 'True—it will affect data and regulators (e.g. OECD) will not accept the results'. The low level of agreement with the 'true' option is encouraging and to be expected from the other answers given in the survey, and the number of 'do not knows' is not necessarily meaningful given that these respondents may not have been involved in animal use to fulfill regulatory requirements.

Reporting enrichment in publications

It is important to include information on animal housing, husbandry and care in publications; both to help disseminate and encourage good practice with respect to refinement, and to ensure all potential variables have been described so that the results can be adequately interpreted, compared with those from other facilities and replicated if necessary.

There are currently serious issues with the level of reporting in biomedical research papers (ILAR 2011, Kilkenny et al. 2009, Baker et al. 2014) and a number of reporting guidelines (e.g. ILAR 2011 and ARRIVE, Kilkenny et al. 2010) have been drawn up to help deal with this problem. The survey asked whether respondents included information about enrichment, including reasons for not providing it (if applicable) in materials and methods sections of their publications at the time of submission. There were 339 respondents to this question, 204 of whom felt it did not apply to them. Of the remainder, 107

(79%) selected the option 'Yes—this is important and relevant information', 20 (15%) selected 'No—it is irrelevant' and 8 (6%) selected 'No—the editor will tell me to remove it'.

It was surprising to see respondents (albeit a minority of 20 people) agree with the statement that enrichment is irrelevant with respect to materials and methods sections, especially when some of these must have agreed with the options that enrichment is a basic necessity and there is scientific evidence that at least some species benefit (just 5 people disagreed with each of these). However, the low level of agreement that information about enrichment was not included in the belief that the editor will instruct the author to remove it was more encouraging. Editorial policies with respect to information about animal use, ethics and the Three Rs are certainly improving (Osborne in press) but more challenge from authors is an essential component of the drive for further progress in reporting standards.

In response to concerns about the level of enforcement of the ARRIVE guidelines (e.g. Baker et al. 2014), the survey included a question about these. Of the 340 people who answered this, 189 felt that it was not applicable to them. The remaining responses are listed in Table 6.

Table 6. Responses to the question: *'Do you write up your papers according to the ARRIVE guidelines?'*

Response	Number of respondents
I hadn't heard of the ARRIVE guidelines	97 (64%)
Yes—in part, I adapt them on a case by case basis	33 (22%)
Yes—I follow them to the letter	18 (12%)
No—the editors of the journals will tell me to remove most of the information they require	2 (1.2%)
No—I think they require too much information	1 (0.6%)

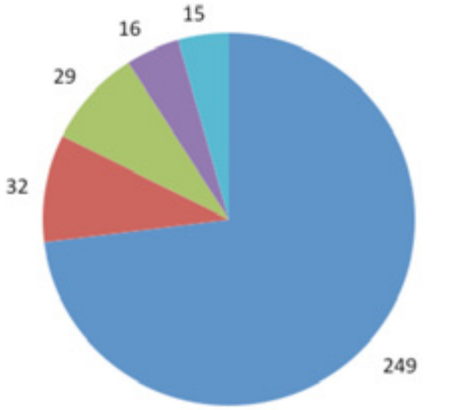
Given that the survey responses came from a number of regions, with half from the US, the level of awareness of the ARRIVE guidelines among this audience is good. With hindsight, it would have been better to include other options such as ILAR. The responses to the options asking to what extent people follow ARRIVE are of interest, with around a third following them to the letter and two thirds adapting them on a case-by-case basis. The ARRIVE guidelines are intended to be flexible, so either approach to implementing them can be appropriate *(http://www.NC3Rs.org.uk/ARRIVE)*.

Other questions

The three final questions in the survey were not directly concerned with beliefs about enrichment and its impact on data quality, but were included because they could provide some useful information relating to stakeholders' views on some topical issues.

One of these addressed the definition of 'refinement', as in the experience of both the RSPCA and GR8 this can sometimes be misinterpreted. The results are shown in figure 4.

Figure 4. Responses to the question: *'What does 'refinement' mean?'*



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Most people (249 of 341 respondents) agreed with the option that corresponds to the consensus definition of refinement, which expresses the concept in terms of its effect on the animal rather than the data. A smaller proportion of the respondents (13%) defined refinement in terms of improving the experimental protocol to obtain more, or more translatable, data. While there may be ethical advantages associated with both of these approaches—provided that no additional suffering is caused—it would be better for people to work to the correct and original definition of refinement that is centered on the animal's experience. Another related question asked directly about the relationship between the two 'Rs' of refinement and reduction. Answers from the 342 respondents are in table 7.

Table 7. Responses to the question: *'On principle, what should come first; reducing animal numbers or reducing suffering?'*

Response	Number of respondents
Reducing suffering, even if numbers increase	167 (49%)
I can't answer this 'on principle'; I can only apply to specific cases	147 (43%)
Reducing numbers, even if some individuals suffer more	18 (5%)
Don't know	10 (3%)

This question was included because the RSPCA and GR8 have both encountered confusion regarding this issue, as the pressure to reduce numbers can sometimes lead practitioners to believe that this is the ultimate goal when designing experimental protocols. However, the majority of respondents to the survey recognized that reduction is not necessarily the overriding aim, and that the suffering of the individual often comes first. This reflects the apparently good level of awareness of ethical and welfare issues among respondents.

Finally, the survey asked: *'Does the public have a right to know what members of the scientific community are doing to reduce suffering and improve welfare?'* Of the 341 respondents to this question, 319 (94%) agreed with the statement 'Yes—it is important to the public and openness is a good thing'. Of the remainder, 13 (4%) did not have a view, 5 (1%) felt that the public should trust the scientific community and 4 (1%)agreed with the option 'No—it just highlights the fact that animals can suffer and could cause more problems'. It was encouraging to see that respondents recognized the importance of good communication with the public, not least because the public directly or indirectly funds life science research and is concerned about laboratory animal welfare (Ipsos MORI 2012).

CONCLUSIONS

The responses to this survey indicate that these results represent the views of people who regard enrichment as a basic necessity for animals, accept the scientific evidence that animals benefit from its provision, believe that enrichment has a positive effect on data quality, and who work in an environment that is broadly supportive of providing enrichment for animals. They have a good level of awareness of the literature on the effects of enrichment, are prepared to encourage others to provide it, and recognize that it is relevant to the science and should be reported in publications. They understand the principle of refinement and recognize that the public has a right to know what they are doing to reduce suffering and improve welfare.

However, the responses identified four issues of concern that are likely to be more widespread in general, given that they arise among the respondents to the survey. These are:

1. Withholding environmental enrichment on the basis of untested assumptions about its impact on data quality
2. A lack of motivation to challenge colleagues who do not provide enrichment, or lack of support when raising the issue

3. Perceptions that enrichment is irrelevant to materials and methods sections of publications
4. Lack of a defined system (either via designated individual(s) or an ethical or animal care and use committee) for researching, retrieving and assessing new information on enrichment

These four issues are all addressed within the action points in the original *'Facts and Demonstrations'* article. However, on the basis of the survey results, some have particular implications for training providers (1-3), regulators (1,4) the ethical or animal care and use committee (1,2,4) and journal editors (3), as well as for researchers, veterinarians and animal technologists and care staff. It would be a very positive step for those undertaking all of these roles to consider whether any of the four concerns might apply to them, and whether they could do more with respect to all of the original action points—and both GR8 and the RSPCA will make sure our training (and other) initiatives also include a focus on these.

"I believe that in the future, failure to provide adequate enrichment and species appropriate housing for our research subjects will be viewed upon in the same way that the absence of a suitable program of veterinary care would be considered unacceptable today."—Participant Comment

ACKNOWLEDGEMENTS

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Article

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Let's Stay Together: Implications of Social Housing for Laboratory Pig Welfare and Management

The pig has become an increasingly popular test subject in biomedical research, due in large part to its physiological and anatomical similarities to humans. However, surprisingly little has been published on the general welfare needs of pigs used for laboratory research, and even fewer studies have focused on social housing of pigs used for such purposes.

Appropriately accommodating the pig's normal social behavior is an essential step in protecting its well-being in managed environments. Doing so is particularly important in laboratory settings in which distress due to social isolation and other factors can introduce unnecessary variability and induce physiological and behavioral coping mechanisms that can undermine the validity of research results. Further, addressing the social needs of pigs is a critical component of meeting our ethical obligation to provide the best possible quality of life for research animals.

Unfortunately, the housing of laboratory pigs often works against, rather than with, the ethology of the pig. Pigs are highly social animals prone to living in stable groupings of sows and their piglets or young bachelor boars. Only older boars tend to live alone in the wild (Ellegaard et al, 2010). Yet many pigs are routinely isolated for research purposes. While mixing of unfamiliar pigs typically leads to fighting, aggression is relatively rare once hierarchies are established, which usually occurs within 24-48 hours after introduction (Newberry and Wood-Gush, 1986; Stolba and Wood-gush, 1989; Ellegaard et al, 2010). Affiliative behaviors are prevalent in the pig's ethogram, with pigs frequently being seen grouping together when possible, nuzzling, and lying together. In fact, pigs are so highly motivated for social contact that they will perform operant tasks to gain access to each other (Mathews and Ladewig, 1994), and have been shown to choose social contact over access to bedding (Hemsworth et al., 2011). When singly housed, they often seek out conspecific contact, including lying against fencelines or pen sides that place them adjacent to each other.

Photo by Jill Davidson

Pigs appear to be fairly cognitively complex as well, which provides further impetus to ensure that all aspects of their well-being are addressed relative to their care. Memory, discrimination learning (conspecifics, odor, visual and location cues) and concept formation (Cerbulis, 1994; Mendl et al., 1997; Croney, 1999) have all been documented in the pig along with their capacity for social facilitation of learning (Stolba and Wood-Gush, 1989). Collectively, these data suggest that pigs are likely to need and benefit from social support; it probably is an important component of their behavioral and psychological well-being.

This theory is supported by the finding that isolated pigs show a chronic stress response compared to group housed pigs (Kanitz et al., 2004; Ruis et al., 2001). Social support may provide a stress "buffer" for animals that are having difficulty coping with the challenges of their environments, as may occur when they are socially isolated. For example, animals exposed to known stressors have been shown to have decreases in corticotropic-releasing hormone (CRH) (Bosch et al., 2009), adrenocorticotropic hormone (ACTH) (Hennesy et al., 2000) and glucocorticoid levels (Boissy et al., 1998; Ruis et al., 2001; Hennesy et al., 2009) when provided some form of social support. Moreover, providing familiar pen-mates as companions along with enrichment (a simulated udder) has been shown to decrease distress in piglets weaned early for experimental reasons (Jeppesen, 1982; Toscano and Lay, 2005; Widowski et al., 2005).

Determining what constitutes "social housing" in pigs, however, is not without controversy. For some, the definition extends to housing multiple pigs separately in a room where they may have only visual or olfactory access to each other. While this type of arrangement may serve to protect the pig from total isolation, it is unclear to what extent it adequately meets the pig's social needs.

For those considering housing pigs in pairs or larger groups, several factors must be considered. First, protecting wounds, surgical sites and sampling equipment, such as catheter lines can be complicated when pigs are housed together. There also can be risks associated with aggressive encounters which must be acknowledged. A plan should therefore be developed to introduce animals to each other so as to minimize aggression. Ensuring the stability of groups can help to facilitate harmonious interactions. The size of pen

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mates can also impact aggression and should be evaluated prior to introducing pigs to each other. Studies suggest that rather than housing pigs of similar weights together as is commonly done, disparate pair sizes may help to reduce both the severity and numbers of aggressive encounters when these occur (Arey et al., 1998; Anderson et al., 2000). Pigs that are asymmetrical in size or weight appear to establish relative social hierarchies more quickly than more evenly matched conspecifics (Arey et al.,1998), probably because they literally "size each other up" and elect not to engage in a battle they are unlikely to win if they perceive themselves to be physically outmatched.

In group housing, resource access and allocation must also be carefully scrutinized. Care must be taken to avoid inadvertently facilitating aggressive competition for resources (food, water, enrichment). Ensure that sufficient resources are provided for the number of animals housed together (consider, for example, the amount of feeder space or number of feeding stations allocated to the number of animals). All resources should be dispersed in such a manner that it is difficult for one or a few animals to commandeer them. If pigs are feed restricted, individual feeding may be necessary to avoid competitive aggression. When provided, the type of enrichment offered to group housed pigs should be well thought out. For example, bedding can be a very useful form of enrichment to pigs, affording them the opportunity to engage in behaviors they are highly motivated to perform, such as rooting, foraging and nest building. Given this, a relatively small amount of bedding may be perceived to be quite valuable to a pig, but depending on the type and amount provided, may be more difficult to commandeer than food or a toy. If toys are provided to pigs housed together, the extent to which cooperative use is possible should be considered.

Social compatibility of pigs sharing quarters is an essential consideration in ensuring their safety and well-being in groups. Pigs tend to form preferential social associations (Newberry and Wood-Gush, 1986; Stookey and Gonyou, 1998); thus housing them with incompatible companion(s) is potentially a stressor which could result in aggression and other undesirable behaviors. Purchasing and maintaining pigs in established groups with familiar and socially compatible peers may circumvent problems. The efficacy of social support provided by housing pigs together is also potentially impacted by the temperament of the pigs as well as their compatibility and familiarity with each other. In stress-susceptible strains, or those with a tendency toward high arousal or reactivity, both the previous experience and temperament of companions should be considerations for compatibility. In one study, familiar pigs were able to buffer each other's responses, but it was suggested that unfamiliar pigs might not be able to provide adequate social support, and might exacerbate stress responses (Dantzer, et al., 1980).

Age, gender and reproductive status are additional factors that must be accounted for in housing decisions. Social housing of boars can be particularly challenging in laboratory settings. Because older boars are solitary in the wild, they may be less tolerant of conspecifics than other pigs. Moreover, competition for resources in mature boars is far more likely to result in serious fights if group housed (Holtz, 2010). This can occur even when boars have been housed together harmoniously as juveniles. As alluded to previously, the genetic lines of pigs under consideration as pen-mates must be considered, as some strains, especially certain miniature swine, may have relatively low thresholds in regard to stimuli that trigger

aggression. If tusks are present, the risks of injury associated with fighting are obviously worsened. In addition, particularly in miniature pigs, sexually mature boars may mount each other (hierarchical rank is a factor). This behavior requires monitoring as low ranking pigs can be repeatedly mounted, potentially resulting in chronic stress and/or injury, which may require removing the lowest ranking animal(s) for safety reasons.

In those situations in which co-housing pigs presents risks to their well-being that are sufficient to require them to be housed singly, pigs should be kept in visual, olfactory and protected tactile contact with each other. In addition, the usefulness of alternatives to conspecific social housing may need to be considered. Some of these interventions include inter-specific social interactions and the provision of inanimate forms of enrichment that may provide an element of social support, such as mirrors.

Few studies appear to have examined the benefits and constraints of inter-species social support. Divincenti et al (2012) found that housing different species of macaques together provided appropriate social support without causing undue complications relative to managing aggression between animals or disrupting routine husbandry. Additional options for providing social support may include housing compatible animals of different genera within visual, olfactory, or tactile proximity to each other. For example, it is not uncommon in veterinary clinical settings to have sheep or goats housed in a room together or in adjacent pens. However, the potential benefits (and downsides) of doing so are often presumed, rather than documented. Further research is needed to examine these sorts of interactions as a form of social support for pigs kept for research purposes who may otherwise be isolated.

When single housing is necessary, the quantity and quality of caretaker interactions with pigs become even more important to their overall well-being. As a result, greater consideration is needed of the role human caretakers may play in providing social support for pigs kept in laboratory settings. Pigs often seek out positive social contact with caretakers and respond well to low stress handling. They are able to recognize, distinguish between and respond accordingly to familiar caretakers (Koba and Tanida, 2001). Their capacity to learn and remember negative as well as positive experiences, and to consequently suffer or cope, is evidenced by the alterations in their behavioral and physiological responses as a function of the quality of human-animal interactions they experience. Decrements in pig production, reproductive performance and willingness to approach humans after rough or inconsistent handling have been well documented (Hemsworth et al., 1987; 1989). For these reasons, aversive or inconsistent handling of pigs should be avoided. Although incorporating positive, low stress human-animal interactions as a matter of routine care requires time and planning, doing so is likely to pay off in regard to improved animal behavioral responses that facilitate data collection processes. In addition, minimizing handling distress and maximizing positive experiences with caretakers in laboratory pigs is a refinement that may remove a source of error and variability in their behavioral and physiological responses, which may consequently yield more robust data.

Inanimate forms of social support, such as televisions, audio and video-recordings and mirrors may also offer some benefits when social housing of pigs is not possible. Mirrors are often suggested to be useful forms of enrichment for isolated animals in research settings.

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Photo by Shelly DeBoer

Primates may use mirrors to view their reflections or activities outside pens (Lutz and Novak, 2005; Reinhardt, 2010) and at least one study suggests that the presence of a mirror attenuates stress responses in isolated sheep (Parrott et al., 1988). Pigs have been shown to be able to use mirrors to obtain environmental information (hidden food) (Broom et al., 2009). However, the extent to which mirrors offer useful social support for pigs is unclear. While mirrors may provide visual stimuli that may be somewhat enriching, they cannot provide auditory or tactile support, which are likely to be important to the pig given its natural history. The cognitive ability of a species for self-recognition would theoretically reduce the usefulness of a mirror as a form of social support. However, there is currently limited evidence that pigs have this capacity.

One recent experiment by DeBoer et al. (2013) evaluated pigs' preferences for different types of enrichment, including a mat, a mirror and another pig when alone and in the presence of a human. The mirror was chosen as often as a companion pig when a human approached the test pigs, suggesting that pigs may indeed perceive the mirror to provide some sort of social support. Further examination of the usefulness of mirrors as an alternative to conspecific social support for pigs is warranted given the need to protect the pig's overall well-being in laboratory settings.

Ultimately, it is the pig's perception of how well its needs are met that determines its level of well-being in biomedical and all other environments in which it may be kept. Therefore, any attempt to incorporate social support for the pig into its housing environment should include a holistic assessment of the chosen intervention on the pig's physical, behavioral and mental well-being outcomes.

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Article

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The Importance of Data Collection to Social Housing

Data collection can help facilitate the progress of social housing programs within individual institutions and in the industry as a whole. One benefit is that it provides the ability to address preconceived ideas ("myths") with facts. It can help facilities make programmatic decisions using actual data, and be used to systematically address operational concerns. It can also unveil best practices. Through data collection, improvements in animal well-being can be quantified to show progress towards animal welfare goals. Sharing the knowledge acquired from data collection at various facilities can be useful in helping other programs grow and flourish, thereby adding to the forward progression of the industry.

The introduction of the current version of the Animal Welfare Act in 1985 and enforcement from USDA's APHIS division was instrumental in moving programs forward. The addition of 9 CFR 3.81 to the Act in 1991 added a focus on the psychological well-being of primates, but how this was to be implemented in regards to social housing was ambiguous. In 1994, Viktor Reinhardt published results from a survey showing that 38% of primates housed indoors in a laboratory environment were being socially housed. In 2003, Baker, Bloomsmith, Crockett and Weed surveyed the levels of social housing again. Although overall social housing of primates across facilities was reported at 73%, primates housed indoors in research settings in social housing situations rated at 46%. With the changes to the *Guide* at the end of 2011 placing a much stronger emphasis on social housing, it would be interesting to survey where the industry is now.

At our primate quarantine facility in Houston, current social housing levels range between 95-98% of the population of cynomolgous macaques, with animals being housed in gang housing units, or in cages in pairs and/or trios. In the last five years, our facility has created nearly 5400 new pairs of animals (2737 pairs of females and 2623 pairs of males) and 676 trios of animals in indoor cages. This includes 583 sets of adult males (defined as greater than 5 kg and/or 5 years of age). This social housing would not have been possible without supportive management and data collection to help guide our decisions along the way as we made programmatic changes. One challenge was the concern that animals could not be socially housed during quarantine. Our veterinarians were able to look critically at how disease would spread within a group of animals in a quarantine room. With the understanding that the animals were shipped together for the entire transit time, and then examining the factors in disease transmission within a room, it was determined that the risks of being housed together in pairs was not greater than being housed next to each other within the same room. This risk assessment led to the current practice of socially housing the animals during their quarantine period.

The next challenge was mitigating the risk of pairing older animals. From experience, juvenile animals were low risk, but pairing sub-adult and adult animals was considered riskier, because of the possibility of injury. We compared data on success rates of pair sets of different weight ranges, demonstrating 100% success rates at less than 3.5 kg in both sexes, 97% success rate for females and 96% success for males in the 3.5-5 kg weight range, and 100% successful (n=40) for females over 5 kg. The pairing success rate of adult

males at our facility was demonstrated to be around 83% (n=565). Seeing the actual numbers dispelled the fears of failure, and putting the actual numbers in context allowed the behavior staff to continue to attempt older and larger animal pairings with the support of the management and veterinary staff. (NB: At our facility, we chose to define success in pairing as the ability to live together throughout their time at our facility without fighting. Animals that were separated for fighting, whether or not injury was present, were determined to be unsuccessful as a pair or trio.)

Our goal has been to increase the success rate of pairing adult males, since this is the riskiest group to pair house. We looked at site data comparing three paradigms for pairing this subset: pairing animals of a greater weight range from each other, pairing under sedation, and pairing using temperament testing as criteria for partner selection. We found that when we looked at the data, pairing animals greater than 1 kg apart in weight was 20% more successful than close weight ranges. We compared a small set of pairings who were paired under sedation versus another set that were paired when awake, and also found a 20% increase in success for those who were sedated and allowed to wake up together, with no change in rate of injury. Temperament testing was an informal part of our behavior program, and we compared scores of past pairings of adult males and outcomes of pairing attempts. We then used the temperament tests to guide pairing males prospectively. The average success rate of these pairings (n=109 pairs) was 91%, which is higher than our baseline of 83%. We decided that although these were all useful strategies, we were going to focus on developing the temperament testing system out of the three paradigms.

One of the best uses of data collection in regards to social housing at our facility was the ability to use measures of psychological well-being to prove the payoffs of social housing from an animal welfare perspective. Since the inception of our current Behavior Management Program, we have been tracking rates of abnormal behavior and hair loss (alopecia). As we increased our levels of social housing, the rates of alopecia fell by 75% within our colony, and the severity of cases followed the same trajectory. The rates of abnormal behavior initially fell by 90%, and were eventually practically eliminated. This proves, at least in this case, there was a noticeable payoff in animal welfare as a result of social housing.

Essentially, within our site we were able to use data collection as a tool to address preconceived myths, implement procedural changes, identify best practices, and establish a body of evidence to support the concept that social housing results in increased psychological well-being. As we all look towards the future of lab animal housing, and of primates in particular, the author is hopeful that sharing this information, and the information garnered from other facilities who have published their social housing information, will help propel our industry forward.

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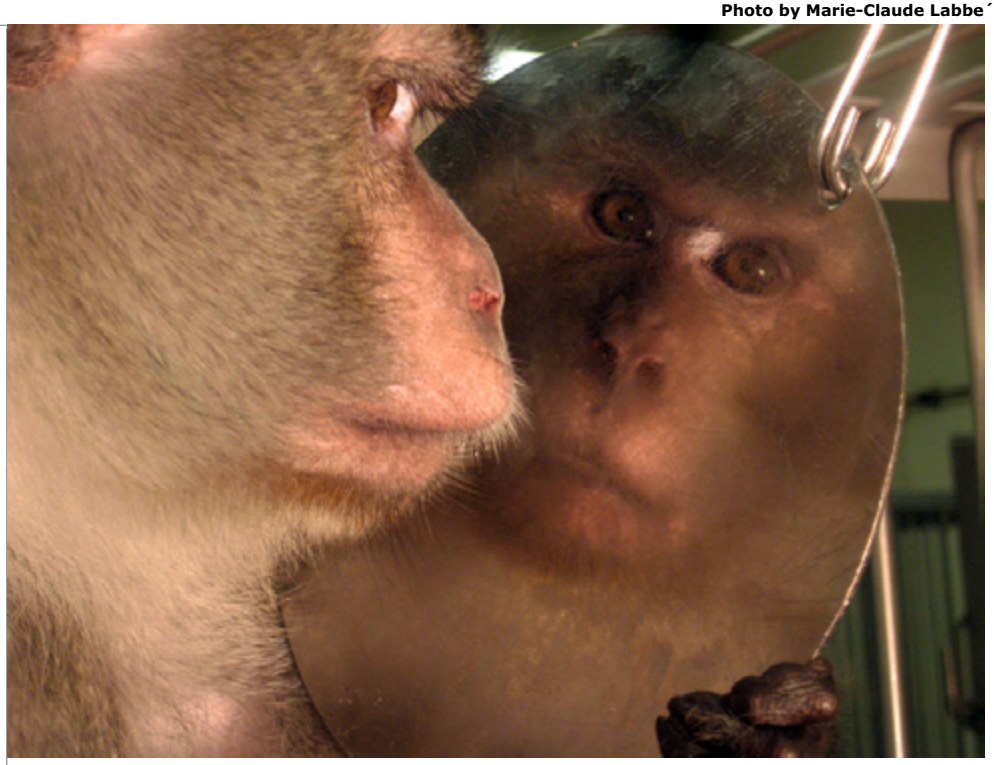
Mirrors and Stainless Steel Balls for Macaques: A Discussion

Photo by Marie-Claude Labbe´



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Viktor Reinhardt
Moderator, LAREF

I'm curious... how many of you hang nonhuman primate enrichment mirrors on the inside or on the outside of the animals' cages?

We have all our mirrors hung on the outside with C-clamps that are crimped to secure them on the cage wall. When we started using tunnels and procedure boxes, the mirrors became an obstruction for some techs; now they want to have the mirrors moved to the inside of the cage. I feel this could create a hazard and compromise the true intent behind the provision of a mirror: giving the animal the ability to see around his or her environment. Inside the cage, the mirror could be in the way of the squeeze-back where it can get stuck or damaged, possibly causing injuries to the animal. These stainless steel mirrors are very thin and bend easily. (Harriet)

We hang the mirrors with short chains outside onto the cage front so that they cannot interfere with the squeeze mechanism. (Jennie, Marcie, Renee, Kate, Jodi)

We also attach them with short chains both on the inside or on the outside of the cage front without ever having any interference problems with the squeeze mechanism. Often we hand the mirrors directly to our macaques to use them just as they want. (Jenny)

We have decided to leave the mirrors on the outside of the cage but (a) move them down about 3 inches from their original position at the front of the cage and (b) reduce their size from a diameter of 8 inches to 4 inches. This solution should make everyone happy, but most of all our monkeys. (Harriet)

It is a strict rule at our facility to fix the mirrors also on the outside of the front panel on chains that have no more than 3 links. This makes it impossible for the macaques to maneuver

and pull the mirrors—along with a part of the chain—inside and inadvertently block the squeeze mechanism by pushing a mirror behind the bars of the squeeze-back. I love the way the animals manipulate the mirrors to view their surroundings. Also, we have used the reflective balls. Some of our cynos love them, others are indifferent. (Genevieve)

We also hang the stainless steel mirrors on the outside of the cage, and, in addition, give the monkeys reflective balls to use inside their cages. They seem to enjoy both enrichment items very much! (Angelika, Kaile)

Our animals also get the reflective ball—a hit or miss—and a full size mirror placed on the opposite wall of the room. One of our boys loves to look at himself over and over again. He is one of the animals who make use of the reflective ball, so perhaps he's just vain. (Kaile)

Who is the supplier of these (stainless steel) balls? (Erik) We get them from Bio-Serv: *http://www.bio-serv.com/product/K3560.html*

Some of the monkeys have become so attached to the balls that they take them along when they are brought to the lab. (Angelika)

Very cool.
For those of you who have experience with the Stainless Steel Balls, can you tell me:

(1) What is the life span of a ball?

(2) Does it dent easily?

(3) If dented, does rust occur?

(4) How much does it weigh? If an animal were to drop a ball from an upper perch on another monkey who sits or walks below, could it injure this monkey? A Challenger Ball won't easily render a monkey unconscious, but a metal ball? I don't know.

(5) Does the Stainless Steel Ball lose its reflectiveness easily? (Erik)

Our reflective balls do get dents but there is no rust. They are not heavy. I often see our pair-housed macaques throwing the balls around, and when a ball happens to bonk another partner, we never noticed injuries resulting from these little accidents. These Stainless Steel Balls can get quite dull looking but a good cleaning makes them shiny again. I think they are great enrichment items for monkeys. (Jenny)

The Stainless Steel Ball does get a bit dented and scratched but cleans up easily (no rust). I'm not sure of the exact weight, but it is lighter than the Challenger Ball for sure. It is filled with a bit of sand, so it makes for interesting rolling and shaking. I like the fact that the ball gives the monks control over where they use their toy. This is particularly important for timid monks who want to sit in the back corner and look around, often too scared to come up front to a hanging mirror. (Karena)

I currently have an adult male rhesus who loves his reflective ball so much he tries to take it everywhere with him. I ran into problems with this obsession when he would bring the ball along with him into his training chair and hold it very attentively with his feet. He was so distracted by his toy that he was no longer able to concentrate on the computer task he works with. We finally had to attach the Stainless Steel Ball with a chain to the inside of the cage so he can cuddle with it in his home cage, but he can no longer take it with him to the training chair. When he is on vacation, we give him the free ball so that he can carry it

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around and do with it whatever he pleases. (Erica)

We also had a male rhesus who was very attached to his reflective ball. It was rather cute; he would take it to the corner of the cage with his biscuits and eat with it. After we found a compatible cagemate for him, his obsession for the ball abated. (Kaile)

My guys LOVE both their mirrors and their reflective balls! They use them not only as reflective objects but also as interesting and entertaining toys. (Evelyn)

Does anyone working with vervets have experience with these balls? I'm thinking they would love them, but before ordering a few, I would like to know if my assumption is correct. (Kelsey)

We have given them to vervets and, yes, they use them just as frequently as the other NHP species. One of the vervets would often hold his ball up in the air for the others of the room to see, as if it were his magic crystal ball. He is very amusing, to say the least. We've had these Stainless Steel Balls for a couple of years, and have only had one crack. I think they are a good investment, considering their usefulness and durability. (Russell)

We had a funny moment when the husbandry techs caught myself and the facility manager playing with a Stainless Steel Ball while looking into it and walking down the hall. It was super fun! Needless to say, they had a lot of jokes about having to remind us which primates the enrichment was for. (Jeannine)

We currently use mirrors attached on the outside of the cages but the NHPs will pull them into the cages if they can, depending on the cage model and its placement. Our mirrors are only reflective on one side, which we purposely chose so that the NHPs could kind of turn the mirror off if they no longer want to see its reflection. I have not used reflective balls, partly because they can't be turned off.

Has anyone found that NHPs get irritated or frightened by being constantly exposed to a reflecting surface? (Stefanie)

I had this concern when I worked at a facility where it was standard practice to place a large mirror 24/7 on the opposite wall of macaques who had no visual contact with other conspecifics. This procedure didn't sit well with me, because unlike a mirror on a chain or a reflective ball, there was really no way for the monkeys to escape their reflection. Gradually we phased out that practice. Sometimes I think that we get so concerned with making sure that the monkeys have visual contact that we forget that they occasionally need a break from it. (Genevieve)

This has also been a long-standing worry of mine based upon my observations of macaques attacking their images reflecting from cage walls. However, I've gradually relaxed about this; over many thousands of monkey-observation hours, I've never seen animals who had issues with mirrors on chains. (Kate)

We've used mirrors on chains for 17 years and have never had an issue. After all, the animals don't HAVE to look in such a mirror if they don't want to do so. When watching our animals, I get the impression that they really enjoy it when they can manipulate those mirrors and attentively look at the reflections, perhaps not so much their own but the reflection from areas of the room that they could otherwise not see. (Polly)

Photos by Polly Schultz

I received the steel balls from Bio-Serv a few days ago; WOW, what an awesome toy for the macaques! They absolutely love playing with them. The individual in these photos is Eve, a young adult cyno. She carries the ball with her everywhere and does so many things with it. She pushes it around, tosses it in the air, holds it high up and watches her reflection, shakes it to feel the sand inside swish around—I know that's what she is doing because I did it too before I gave the ball to her :0)—and she appears to use it like a bowling ball, and watches how it wobbles back and forth while it's rolling. Then she lays on her back and playfully lifts it up and down with her hands and feet like she's weight lifting. So much fun watching all of them enjoy this new toy! (Polly)

Anthony Ferraro, AAS, Veterinary Science Technology, CMAR, RLATG
Environmental Enrichment Specialist, Boehringer Ingelheim Pharmaceuticals

We're using animals for our benefit and it's important to provide an environment that meets their behavioral needs. It's an ethical thing—we owe it to them for giving us the tools to advance our knowledge. Networking, publishing and implementing everything you know about environmental enrichment improves the lives of the animals we care for!

Scientist, author, lecturer, volunteer for the Danbury Animal Welfare Society, and passionate pit bull educator, Anthony Ferraro is totally dedicated to enriching the lives of research animals. Recipient of the 2008 SNEAALAS Award for Enhancement or Improvement of Animal Welfare, he has loved animals since he was a child. Always fascinated by nature and biology, he first learned about the field of Veterinary Science while in high school and found the perfect educational environment at State University of New York, College of Technology at Delhi.

At SUNY Delhi, the only vet tech program in the country with an in-house primate colony, Anthony developed an instant passion for primates. Kenneth Pyle, Associate Professor of Veterinary Science Technology, inspired him to pursue a career in the field of animal research.

Although enrichment was still a blossoming field in 2000, Anthony gravitated toward animal welfare issues. In his first job, at a small animal research facility, he applied his knowledge with the goal of creating a state of the art enrichment program.

Anthony Ferraro and his rescued pit bull, Enzo.

In his current position as Scientist II, Anthony is responsible for the psychological well-being of all animals used in R&D. He serves as a liaison between the veterinary staff, the animal care staff, the IACUC, and the research staff to accommodate the environmental enrichment plan for multiple species of animals. He initiates routine behavioral and physical assessment of canines and nonhuman primates and devises and implements modifications to enhance animal well-being—while allowing research requirements to be met.

In addition, Anthony serves as the lead of the BIPI environmental enrichment apprentice team, contributes to writing policies, protocols, SOPs, and special programs for the care of lab animals, provides training to other personnel on effective methods of interacting with nonhuman primates, and is the developer and expert on a GLP validated Electronic Haircoat Assessment System.

"Every species has a different behavioral repertoire," Anthony says, "and my job is to ensure that each animal has the appropriate environment to thrive in. This is very important, not only for animal welfare but because animals that are psychologically well balanced yield better experimental data."

Anthony is looking forward to Boehringer's new building on their Connecticut campus where the canine and NHP vivaria are beyond state-of-the-art. "This building exemplifies the concept of environmental enrichment," he says. "Animal living spaces are well beyond minimal requirements, group housing is a priority, and there is an abundance of vertical space and natural lighting." The canine wing is expected to be populated this summer and the primate wing by the end of the year.

The new facility is truly an enriched environment for animals and staff. The design facilitates cooperation and communication so that veterinary, animal care, and research staff—"key people who lead the charge into uncharted territory"—all work together.

Prior to his current position, Anthony served at Boehringer Ingelheim as Scientist I, Senior Laboratory Technician and Summer Intern. He also served at Acorda Therapeutics as an Animal Care Technician.

Thoughts on the Future of Environmental Enrichment

Anthony is optimistic that current attitudes will continue to evolve and that behavioral management (including environmental enrichment, positive reinforcement training, and socialization) will be accepted as a necessary and integral part of all animal care programs. Environmental enrichment will become the norm!

"In a sense," Anthony says, "it is misleading to talk about adding environmental enrichment to a program. EE is not an 'extra'—it is essential. Environmental enrichment should be at the core of all programs, ensuring that animals' lives are better, needs are met, workers are more satisfied, and the human-animal connection is positive."

When not dedicated to animal welfare, whether at work, or at the Danbury Animal Welfare Society, he enjoys traveling (including his recent honeymoon in Italy), listening to music, and riding his Harley. Anthony and his wife, Luciana, who is a Senior Laboratory Technologist at BI, also enjoy spending time with their rescued pets: Silvio, a Norwegian Forest Cat, and Enzo the pit bull.

There's an old saying that "You can't dance at two weddings at once." You also can't attend all the meetings and conferences taking place that offer the latest information in the field of laboratory animal science. Meeting Up will provide summaries of panels, workshops and symposia covering topics relevant to Environmental Enrichment. If you want more information about any of the presentations described or want to contact the presenters, let us know and we will be happy to connect you: *info@theenrichmentrecord.com*

Massachusetts Society for Medical Research Enrichment Symposium

March 6, 2014
Newton, MA

Joan Flanagan, PhD

"All Creatures Big and Small"—MSMR's 6th annual all-day Enrichment Symposium—had a record high of over 190 attendees and 14 vendor exhibitors!

Dr. James C. Ha, University of Washington, was the keynote speaker. He presented a vibrant talk on animal behavioral principles, temperament, environmental influences (learned experiences) and technological improvements in the realm of animal enrichment used within multiple settings from home care pets, to zoos and laboratories. He reviewed a meta-analysis performed by his lab on quantifiable published enrichment studies. Acknowledging that our animal community performs many meaningful enrichment studies, Dr. Ha stressed the need to raise this awareness and fill gaps in the literature by publishing more to improve overall enrichment methodologies for all animals.

Dr. Kathleen Pritchett-Corning (Harvard Medical School) and **Dr. Sandra Ayers** (Tufts) stressed the importance of animal caretakers needing to "think like the species." Dr. Pritchett-Corning presented on murine enrichment and the importance of understanding if the enrichment being utilized is or is not a benefit for the animal's welfare and the scientific objective. She stressed that enrichment for one model does not fit all, and that enrichment is not a cure-all; it should be relevant to the species. It is also critically important to work with investigators to meet scientific needs. Dr. Ayers talked about the behavioral aspects of large animals as a function of their vision. She explained overhead and side vision, low acuity, red-green color blindness as well UV capabilities. Her data show that by understanding natural behaviors due to vision, investigators can implement even small changes that will lead to major improvements to the animals' well-being.

Natalie Bratcher, from AbbVie, described the company's dog adoption and socialization programs. She detailed the process for establishing and managing an adoption program and explained how the program has evolved. It is a very rewarding experience not only for the dogs but for the company employees as well. Employees who don't work directly with animals really enjoy participating through the "in-reach" program, which provides a better understanding of the role of animals in research. Most importantly, the program benefits the well-being of the dogs, who are adopted as pets within the animal community.

Christian Lawrence from Boston Children's Hospital delivered a spectacular talk describing novel and exciting approaches that provide welfare and enrichment for zebra fish. He noted that the 8th edition of the *Guide* mandates processes be developed for aquatics (including zebra fish) enrichment and welfare. Enrichment is currently a hot topic for the rapidly growing zebra fish field (now the second most commonly used animal model after the mouse). He described many different types of fish behaviors ("piping", acute stress response, aggression, mating and breeding behaviors) and how his research lab has implemented changes for the massive zebra fish program at his institution. His advice: know the natural habitat of your species; it can help improve your program. Pay attention to the behavior; figure out what the behavior means and manage it; or develop a hypothesis, test it, and use the data to manage your fish colonies.

For the first time, we welcomed **Kim Kezer** to speak on the behavioral conditioning program at the Zoo of New England (ZNE). The ZNE has 51 different species and 129 training programs for the well-being of their animals. Using videos, she demonstrated that training animals has allowed for manual administration of different medical procedures like ultrasound and blood pressure and blood collection without the use of anesthesia.

Sandra Ayres (Tufts), **Bonnie Bowell** (Boehinger Ingelheim Pharmaceuticals), **Lauren Maxwell** (Massachusetts General Hospital) and **Sue Rubino** (Pfizer) demonstrated the impact of positive reinforcement in primates. **Terri Bright** (MSPCA/Angell Animal Medical Center) focused on the use of negative reinforcement in canines. All presented wonderful videos of how to apply their training concepts to meet the study and operational objectives while improving the animals' well-being at the same time. Last but not least, **Alison Weller** (University of Toronto Mississauga) and **Kimberly Pham** (Novartis) offered compelling talks describing how technical staff have operationally managed the well-being and enrichment programs for the more problematic laboratory species used within their facilities.

Upcoming Meetings

REGIONAL ENVIRONMENTAL ENRICHMENT CONFERENCE
April 27-30, 2014
Royal Zoological Society of Scotland Edinburgh Zoo
http://sabionetwork.files.wordpress.com/2014/02/5th-reec-uk-ireland.pdf

PRIMATE FOOD AND FLUID CONTROL WORKSHOP: SHARING KNOWLEDGE ON TRAINING METHODS TO REFINE THE USE AND CARE OF THESE ANIMALS.
Sponsored by Animal Concepts in collaboration with BPRC
May 23-24, 2014
Biomedical Primate Research Centre (BPRC), The Netherlands

For more information and registration, please visit:
http://www.animalconcepts.eu/styled-4/styled-12/styled-14/index.html

ASSOCIATION OF ZOOS & AQUARIUMS (AZA) AND INTERNATIONAL MARINE ANIMAL TRAINER'S ASSOCIATION (IMATA) ANNUAL CONFERENCE
September 12-18, 2014
Orlando, FLA
http://www.aza.org/annualconference/

Please send notification of your Upcoming Meetings to Rhoda Weiner at *rmbw19@verizon.net*

Resources

Environmental Enrichment for Nonhuman Primates Resource Guide
The Animal Welfare Information Center (AWIC) at the National Agriculture Library (NAL) has updated its publication, *Environmental Enrichment for Nonhuman Primates Resource Guide*. Last revised in June, 2006, the document now covers literature published from 1999 to January 2014.
http://www.nal.usda.gov/awic/pubs/Primates2009/primates.shtml

SPECIAL SUPPLEMENT

AWIC Bibliography on Social Housing

Social Housing of Laboratory Animals: Selected Citations
Updated February 2014
Compiled by USDA, NAL, Animal Welfare Information Center (AWIC)
Kristina Adams, MS
Tim Allen, MS
D'Anna Jensen, BS, LATG
Cynthia Smith, MS

This reference list was compiled for the Symposium on Social Housing of Laboratory Animals held in Bethesda, MD on August 22-23, 2013. It is provided as a starting point from which to find relevant information on social housing of various animal species housed in laboratories. It is by no means a complete list. Species covered: nonhuman primates, dogs, pigs, rabbits and rodents.

Contact the AWIC staff if you would like a more detailed search performed.
E-mail: *awic@ars.usda.gov* • Phone: (301) 504-6212
Web site: *http://awic.nal.usda.gov*

Please provide a photo of your favorite foraging device, manipulanda, puzzle feeder, etc., along with a brief narrative. List the species that it is intended for, describe how the device is used, and include a short statement on the durability, cost, pros and cons. How much time is invested in preparation, and how does that compare with the time invested by the animals? If you have performed any behavioral evaluations and a cost analysis, include that as well.

Please send your ideas to: Genevieve Andrews-Kelly at genandr@aol.com

Thank you!

Swine Foraging Device

Claire Matherly, ALAT
Veterinary Technician II, Huntingdon Life Sciences

Pigs are intelligent social creatures that benefit from creative enrichment. In our experience, after a while pigs become disinterested in the same stimuli; therefore, enrichment devices should be rotated to maintain their interest. There is a variety of enrichment that we can choose from—physical, social, sensory and nutritional. The type of enrichment implemented can be restricted by cost, which is why it is important to be imaginative and resourceful!

We have found that the most enriching devices are those that keep the animals entertained for the longest period of time, which brings me to the "Hanging PVC rooting tube!" It is a large PVC tube with several large holes cut into the tube in order to dispense treats. The size we use is 2 feet in length by 6 inches in diameter. However, you can pick and choose your sizes depending on the size of the pigs.

This device offers the animals physical and nutritional enrichment. Not only does it provide the opportunity for a long foraging period, but it is also durable, safe, and can withstand high temperatures in order to be properly sanitized…and the pigs love it! The set-up is quick and easy as well. There are two metal chains on each side of the tube to hang inside of the pen. You can fill the tube with their favorite treats: strawberries, apples, bananas, etc!

In short, pigs love to root and demolish things, and have fun doing it! That's why this enrichment device works great, due to its durability and long lasting ability. It can also be enriching for our cynomolgus macaques, since the smaller version works great for foraging. The most important thing when creating new enrichment devices/ideas is to have fun with it and be creative; the best ideas come from your imagination.

The Enrichment Record

***The Enrichment Record* is a quarterly E-Zine created by the Laboratory Animal Research Community as an online forum for:**

- Discussing environmental enrichment in the optimal care of laboratory animals
- Documenting best practices
- Sharing data on the impact of environmental enrichment on the science
- Building the case for integrating enrichment into research design

Help us to involve a broad audience: administrators, attending veterinarians, veterinary technicians, animal caretakers, animal behaviorists, and of course, principal investigators. Together we can move enrichment onto the agenda of every animal researcher. In other words, improved animal care translates into better science, and we all benefit.

Join the conversation today.
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