

The Mouse Exchange: what can curiosity-driven public engagement activities contribute to dialogues about animal research?

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Introduction

The field of animal research has long been considered a controversial public engagement topic.¹ For many decades there has been a culture of fear from the activities of anti-vivisectionists,² though currently this threat is at a relatively low level.³ In turn, this fear has created a culture of secrecy about practices of animal experimentation.⁴ Steps to tackle the culture of secrecy, and to fulfil the ideals of transparent scientific experimentation, have encouraged the drive towards greater openness about animal experimentation. However, this goal has not yet been fully realised,⁵ in part because efforts to engage with publics typically take the form of a knowledge-deficit approach in which experts convey information to publics under the assumption that greater knowledge will lead to greater support. Furthermore, negative feelings towards animal research – which are not only the legacy of animal rights campaigns and activism,⁶ but also reflect a wider distrust in science and expertise⁷ – have restricted publics' willingness to engage with animal research. A new approach to public engagements with animal research is therefore needed to achieve improved openness.

This chapter introduces The Mouse Exchange (MX), a public engagement activity that we propose helps address some of these issues. The MX was designed as an activity that contributed to, enriched, and explored findings from Roe and Peres's research into the supply, breeding, and biobanking of research animals

(see Chapter 12).⁸ This research lent itself to creating an engagement activity that broadened the focus beyond the animals used in experimental procedures to include all animals whose lives are involved with UK research, and to also consider their lives from breeding to culling or euthanasia. Initially, we were keen to understand what questions or concerns people involved in animal research had about their area of work that would help us forge research questions. Consequently, we took inspiration from participatory research methodologies in a more-than-human world,⁹ and held a workshop at the Conference of the Institute of Animal Technologists in 2018. There, we gathered the thoughts of animal technologists – directly involved in animal breeding and care – about their understandings and experiences of the animal journey, to hear what they felt was important for them to know more about, and what they wished for others to know. This event helped us to frame, along with subsequent data collection, where the management of the production and use of animals continues to pose a challenge for animal research and those working with the industry.

The result of this development was a public engagement activity that approaches openness by shining a light on the making and supply of animals used in research, rather than on the experiment itself. Another key point of difference with traditional public engagement is that rather than provide information, we create a space where participants can experience becoming curious and creative. Through creative processes and informal conversations, the MX activity manages negative feelings like distrust, suspicion, and anxiety, which can be associated with animal research. Instead, the MX seeks to convey something of the emotional and ethical landscapes experienced by those working within animal research, which are complex and contingent.¹⁰ For example, the MX aims to offer participants a mixture of: scientific curiosity; the rewards from caring for animals; the consequence of being moved by animal harm; and hopes from medical research that uses animals. Together, participants and facilitators feel a way into this animal research nexus, primarily through the activities of their hands and fingers, working with familiar objects, repurposed.

The chapter begins by describing efforts to achieve openness in animal research, including via public engagement with, and criticism

of, this work. Drawing on these critiques, we conclude that openness is often narrowly framed, selective, and follows a problematic knowledge-deficit approach. We then set the scene by describing what the MX activity involves in practice, before discussing how we have been inspired by other performance art, and how MX facilitators generate talk during the activity. We then move to discuss particular aspects of the infrastructure around an MX Workshop – the biobank, the passport, the ear-punch, the Infinity Box, and the caging system – and what these can add to the activity. We conclude by reflecting on how the MX helps move beyond deficit-model approaches to public engagement around animal research, instead offering a valuable creative, curiosity-driven, participant-led approach.

Secrecy, caution, and public communication styles

The Concordat on Openness in Animal Research¹¹ has impressed openness as an important tool to develop public communication about animal research, but the dimensions of animal research that have been communicated have been selective.¹² The trajectory of animal research in the UK is one of institutional moves away from secrecy and towards ‘openness’: transparency is utilised to achieve social legitimacy.¹³ Holmberg and Ideland’s¹⁴ study of public engagement strategies used by animal research institutions in Sweden identified two main problems, which we propose also apply to some extent in the UK. Firstly, there is a kind of ‘selective openness’,¹⁵ where individuals feel they should manage the disclosure of their work. This finding echoes the argument, made by Wendy Jarrett of Understanding Animal Research, that some researchers involved in discussions in advance of the inauguration of the Concordat on Openness in 2014 were fearful that providing information to ‘the public’ would expose them to attacks from animal rights extremists.¹⁶ Hence, the idea of doing public engagement can invoke fear and reticence from researchers. The history of controversy and the binary, adversarial nature of previous public communication could put members of the animal research community off from doing public engagement where they may be less in control of setting the terms and direction of conversations.

Secondly, Holmberg and Ideland find that those involved in animal research in Sweden align themselves with a deficit-model approach to public engagement, where the public feature as ‘uninformed and misled’.¹⁷ In practice, communication around animal research privileges a ‘scientific witnessing’¹⁸ over other possible ways of framing communication, which in a sense legitimates this controversial activity and prevents other ways of knowing and making sense of animal research. Recent evidence in the shape of a survey of the attitudes of Swiss animal researchers towards public engagement¹⁹ backs this argument: Roten found that 72% thought that ‘their main task was to educate the public’, and 80% believed that ‘if the public were more educated, it would be more positive toward science’. Conversely, 33% agreed or strongly agreed that ‘the public may lack scientific knowledge, but it possesses a lot of relevant common sense and good judgement’, and 19% similarly agreed that ‘the public should have a say in the regulation of scientific activities and applications’.²⁰ Altogether, then, the concept of openness has begun to be performed with limitations to its scope and potential because of the wider context.

In this context, efforts to be more open about animal research have been limited in important ways. Communications aimed at achieving openness often take the form of institutional websites, newspaper articles, or media stories about the potential benefits to humans of a new scientific finding that involved animals.²¹ While these communications counter the images and narratives about animal harms disseminated by animal rights organisations, they do not linger on what it was like for the animal taking part in the experiment, or how they live and are cared for in the laboratory. Consequently, these communications do little to eschew public anxiety about the experiment itself. A growing number of animal research institutions do, however, aim to give greater insight into life within the animal facility, via websites²² and YouTube videos.²³ Yet the type of information that is conveyed is often carefully curated. Barney Reed from the RSPCA has been a vocal critic of the oblique and inaccurate language used in institutional websites, which implies that standards of animal welfare are of no concern.²⁴

Furthermore, efforts to engage publics may focus too narrowly on ethical decision-making. Engaging laypeople in animal ethics committees²⁵ is a weak attempt to engage publics in animal research; these laypeople require expertise to be able to understand how to scrutinise paperwork, and there is no mechanism for the few people who hold these roles to disseminate their understanding more widely. Yet this approach is still advocated.²⁶ For example, this route is emphasised by a 2019 report on a two-day international expert workshop about how the current governance practices regarding openness and transparency could lead to better public engagement.²⁷

Building on these criticisms, we argue that this view of openness as an element of ethical, democratic research culture has propagated a narrow vision of what one could be open about in relation to animal research. Openness efforts tend to focus on ethical decision-making, rather than the more mundane task of putting ethics into practice, including across the breeding, supply, and care for laboratory animals, which are the focus in the MX. Focusing on these other elements of work in the research laboratory also serves to counter the risk of controversy associated with focusing on animals' experience in the experiment. Rather, in the MX we make the research mouse the primary object of interest, putting the science and the experiment into the background. Through the tasks that participants are invited to perform, the MX puts people into the shoes of those who are practically involved in caring for animals used in research, such as administrators, breeders, and animal care technicians. The MX also provides the opportunity, should participants wish to take it, to learn more about the wider social world around animal research beyond the experiment, which may be difficult to find out about. Furthermore, the structure of the MX, with its privileging of participant-led, un-scripted dialogue, enables questions to arise that may otherwise be excluded if researchers (or facilitators!) hold all the power in determining the content.

In summary, our approach carefully tackles some of the ongoing challenges about engaging publics in animal research. It encourages a different culture of communication around animal research, a primary goal of the Animal Research Nexus Programme (AnNex). It proposes an alternative to the historical tendency for

communication to be framed as a debate between supporting and opposing ‘sides’.²⁸ We now describe what the MX activity involves.

Encountering The Mouse Exchange

‘Have you ever wondered where lab mice come from?’²⁹

‘Do you want to make a mouse?’³⁰

On the table are threads, scissors, and homely fabrics. Using these materials, we invite people to make a type of mouse that most of us have never seen: a research mouse. Through the collective work of the MX participants, research mice become day-time residents in unlikely places (see Figure 14.1).

Although details have changed over time as we iteratively developed the MX, the fundamentals have always been a set of tables with sewing equipment in the middle. At different events we have added our own enrichment for the mice to the activity. Beginning with cardboard houses and lab-grade treats sourced from colleagues, we progressed to try different things.



Figure 14.1 MX materials on tabletop (Source and copyright: University of Southampton).

We created a large mouse nest (Figure 14.2) on one occasion; on another, we wore lab coats. We have been in different contexts: university seminar rooms, academic conferences, science festivals, museums.

Allow us to set the scene. On a Saturday morning in November 2019, we are in a theatre. A table stands prepared with needlecraft materials – thread, felt of various colours, needles – and small white, black, or pink stuffed felt objects in the shape of pasties waiting to be picked up.

These felt objects represent the bodies of three of the most popular research mice strains: C57Black6 (black), BalbC (white), and nude (pink) mice (Figure 14.3). Passers-by and pre-registered



Figure 14.2 Mouse nest that mice and their makers can play with
(Source and copyright: Bentley Crudgington).



Figure 14.3 Stitched felt-fabric pasty-shaped bodies of the three strains of mice (Source and copyright: Bentley Crudgington).

participants are invited to take a seat to make a mouse. We brief the maker-participants on the basic plan to turn the felt pasty, now in their hands, into a laboratory mouse.

The invitation to make a mouse enables participants to play with developing a relationship with a research animal by making it. The process of making meanings and generating feelings begins with finding oneself caught up in a process of crafting and creativity as fingers and hands are put to work with fabric, needles, and thread. Participants get to experience the mouse taking shape by sewing on felt circles as ears, embroidering on a nose and eyes, sewing on strands of whiskers to the face and trimming them with scissors to a certain length and shape, and finally sewing on more thread, sometimes plaited, to make a tail. Within these moments, there is a shift at some point from thinking solely about how to do it, to feelings for and about the developing animal form as eyes, whiskers, tail, and ears are added. Through the act of creating, a sense of belonging and care develops for the thing forming in one's hands.

Crafting, like kneading bread,³¹ slows down time, as it forces mindful attention to be brought to what one is doing with one's hands, emptying the mind of other things. Consequently, crafting invites unstructured conversations and remarks. A conversation when crafting is necessarily broken by reaching for a pair of scissors, asking how to do something, and yet all the while the making of a research mouse is intimate to the participant's and facilitator's fingers. This physical engagement is important; it creates another means of relating to the issue that is not grounded in thought alone. Participants sit with us without knowing what the mouse will be; the meanings and values are built into the process. It is designed to enable all to take part, not just those with a pre-existing view. In the later versions of the MX, what kind of mouse they will make, and the origin of the mouse, is decided through the selection of a chance card; will they make a brand-new mutant, or a mouse held in a biorepository as frozen embryos?

At the outset the MX was devised by thinking with Roe and Buser's 'becoming ecological citizen' methodology (BEC).³² This approach was developed with artist Dr Paul Hurley,³³ who is part of the MX team and has contributed to its creative life. The original application of BEC was to food, which made it possible to engage very directly with its materiality, and to draw on participants' extensive embodied and other knowledges of food. In contrast, the MX had the added difficulty of overcoming the absence of actual laboratory mice, and existing knowledge of mice in research. The methodology involves taking two steps towards creating a space for engagement. Firstly, it involves 'facilitating sensory experiences that enable the agential qualities of [object of concern] to shape knowledge making'.³⁴ This is why the rich sensory experience of sewing a colourful, soft felt mouse is at the centre of the activity. Secondly, it aims 'to create a space where people can perform, or relate differently, in unusual manners to [the object of concern]'.³⁵ In this case, our object of concern is research mice. Hence, we turn to creating a comfortable space of curiosity coupled with a crafting activity to invite people into a relationship with research mice.

The crafting materials scattered on the table afford the transformation of curiosity into the deeply political act of creating a body and advocating for an animal's care through its documentation via

the mouse passport. In the next section we discuss the nature and style of generating table talk through the activity and how MX facilitators can work against the knowledge-deficit model.

Facilitating The Mouse Exchange

The MX toolkit³⁶ provides guidance about the materials needed to set up an MX event and a guide for facilitators about how to set up the space and hold conversations that meet the aims of the MX. We encourage others to download the toolkit and to run their own MX. In this section we discuss in depth the thinking behind why the MX is facilitated in the way it is, and what type of participatory experience we are aiming for.

Participants assemble and take a seat at a table with felt-crafting materials laid out. At the table, hierarchies and power imbalances can be set aside. This conception of the table is informed by queer feminist performance artist Lois Weaver's work *The Long Table*, an 'experimental open public forum that is a hybrid performance-installation-roundtable-discussion-dinner-party designed to facilitate dialogue through the gathering together of people'.³⁷ It empowers by literally tabling or gathering excluded and included voices to speak on difficult and conflicting subjects in their own terms; certain responses or degrees of knowledge are not discarded as unacceptable. The table bridges the private domestic setting and the connected, yet distant, public domain. The MX table is a hospitable place for experimenting around what might legitimately be discussed. Participants come and go from it, and with that, experiences and viewpoints both overlap and differ.

As people assemble and take a seat, we are curious about what might have attracted these people to come to the table. Is it the appeal of making something of their own? The appeal of sewing, or an activity that can occupy their children and offer a rest for a little while? Or is it part of an educational experience, and if so, how will their expectations of learning be challenged by how the workshop is structured?

The materials laid out on the table are both familiar materials and unrecognisable objects – soft, felt pasties, a 'thing'³⁸ that can be

assembled into becoming a research mouse. The pasties are taken into the hands of participants who are invited to add ears and a face to make a soft-toy research mouse. The conversation is initiated at this point; the facilitator does not have to direct but can let those gathered around the table make a mouse with their hands while engaging in curious chatter. Requests to please pass the scissors, thread, or the felt support conviviality and contact between participants. The practice of sewing together encourages an atmosphere with a mixture of talk about how to do something (sew a mouse nose) alongside reflections on the object taking shape in their hands, and issues related to the origins and lives of research mice. This approach works with Deleuze's statement that 'something in the world forces us to think', to talk, to feel.³⁹ Conversations happen simultaneously alongside the making. In this way the MX is not an output, but a process.

Instructions of what to do are conveyed through conversation and observation as there are no written instructions. Facilitators have an important role in shaping the conversation, ambiance, feelings, and thinking around the MX table by recognising that thought and talk are generated in relation to the context. To this end, participants should feel empowered to lead their own knowledge-creation, co-authoring content with those around them. Beyond a couple of opening questions from the facilitator – 'have you ever met a mouse?' or 'where do you think laboratory mice come from?' – participants should always take the lead when exploring the topic and directing what is, and what is not, spoken about. This approach is in opposition to a traditional public engagement audience member who is cast as needing to learn something to address their knowledge deficit.⁴⁰ Collectively, conversations do not crystallise but keep changing, since the outputs of knowledge and meaning making processes are not decided in advance. What takes place in the MX is the outcome of the work that participants and facilitators collectively perform and consent to.

Space is made for talk, but it does not have to be forthcoming. Facilitators are asked to let go of the need to control responses; rather, they should focus on supporting participants to not only become makers of mice but to make space for those who choose to take the opportunity to reflect and learn. Consequently, it is

important to not talk at participants but respond to expressions of curiosity. The learning objectives are not a set of facts, figures, or ethical guidelines but just to sew a mouse and complete its passport. Participants are not in an audience on receive mode. Indeed, participants may opt to stay in their established habits of thinking, perhaps knowing little about research animal origins and lives, and it is then up to them whether they ask questions or share thoughts about the materials or anything else as they make a mouse. Participants may talk about the lives of mice they have encountered and move to the life of a research mouse if and when they are comfortable.

Finding ways to collectively enable participants to hold an interest in the lives of laboratory animals is important because it allows them to engage in the process of, rather than the products from, animals being used in science. In the MX, we achieve this by avoiding the head-on discussion of animal research as an ‘object-issue’⁴¹ to instead bring attention to the research mouse, its origins, and how to care for it. Animal research as an ‘object-issue’ has a rich patterning of emotions, disruptions, disagreements, and agreements that extend around it. Acknowledging this, the MX registers a need to support the inclusion of the multiplicity of affective, emotional, rational, historical, and ethical engagements that participants may have with animal research. Indeed, we found that making something tactile and tangible enables feelings towards the animal to develop; it equally allows issues and themes that arose in conversation to evolve into more meaningful concerns, rather than abstracted facts. Experience has shown that holding a felt research animal in one’s hands, and completing a mouse passport, has taken participants through a process that can change their stake in animal research. Feelings surrounding the life experience of the mouse can be made and expressed that exceed objective facts about the research animal industry, its animal welfare standards, and binding ethical principles.

Along the way, we have, so far, held conversations that include: cats bringing in mice; imaginations of wild mice being captured for research (a common assumption when participants had never been asked to think about the subject before); identification of mouse models for a son’s genetic condition; childhood memories of

needlework; and feeling squeamish about mice. We have observed children playing with the felt mice in a display area decorated with enrichment used in lab mice cages, and we have learnt a lot about how to manage conversations to give people confidence to articulate what they are thinking and feeling, nurturing their attachment to the mouse they are making. Each time it is different, inflected by the occasion and the people who pass by. As a process, it is prone to evolution and mutation. We have identified new needs and developed other experiments that are adapted to new situations and new questions. The MX will also, we hope, find new tables, new participants, as a different set of facilitators learn how to set up and run their own MX, using the MX toolkit.⁴²

The Mouse Exchange Infrastructure

We found curiosity was inspired by the infrastructure around making mice as we built more into the MX performance. For example, people were curious about the different colours of the mice and the different ways that mice could be sourced from a biobank or live colony, and what these different practices involved.

The biobank was enrolled into the performance when participants were invited to collect cold, ‘frozen’ embryos (in reality, the soft pasty-shaped mouse forms are kept next to a plastic ice pack) from our coolbox (the kind that is more commonly taken on a picnic), which performed as our biobank. Waiting for the embryos to warm up on the pretend heat pad creates a pause where we can begin to talk about the way mouse strains circulate within the animal research community, and to think about freezing down strains as a form of animal welfare.

Once the mouse is made, we ask mouse makers to complete a passport (Figure 14.4) for their mouse. This encourages participants to articulate and reflect on their participation and helps both to make meanings more concrete and to evaluate their experience. Drawing on the structure and purpose of the mouse passports recommended for genetically altered animals,⁴³ which commonly travel with mice, the passport enables makers to detail their mouse’s specific care needs, which vary from strain to strain.

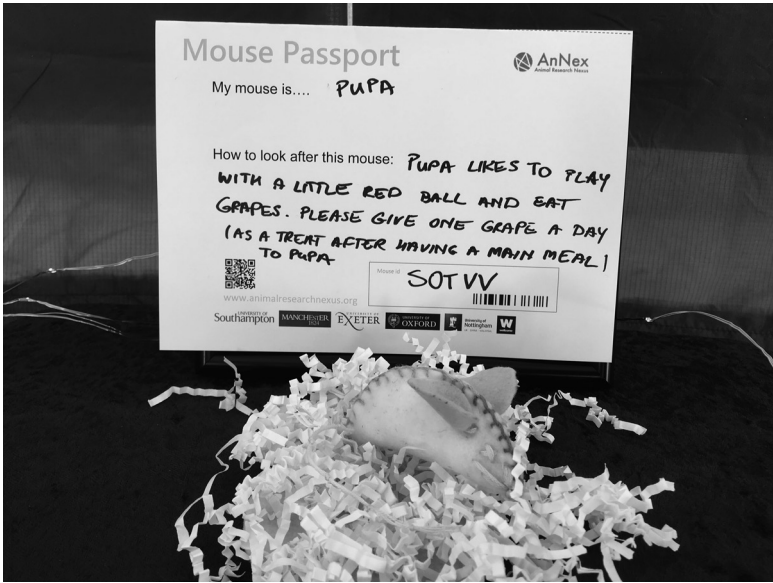


Figure 14.4 An early form of mouse passport and the mouse
(Source and copyright: Bentley Crudgington).

The passport has evolved over time in the project from a simple, two-question prompt to a more detailed form that includes data like the mouse's name, place, and date of birth as well as information about their phenotype (what they look like), character, and instructions for their care, including who they want to care for them (Figure 14.5). We also ask makers about their hopes and expectations about the future of their mouse. What, then, does it look like to care for this mouse, now and in the future? Questions about character and phenotype, who cares for them, and what needs they have continue the work of thinking about individual animals' sentience and welfare. By collecting the passports that participants have created alongside their mice, we are putting together an archive that not only preserves the mice, but also – in a small, creative way – records the makers' engagement with their mice as beings to be cared for as well as scientific resources. Together, the mouse and the passport make up the primary units of the MX and embody something of the experience after the event is complete.

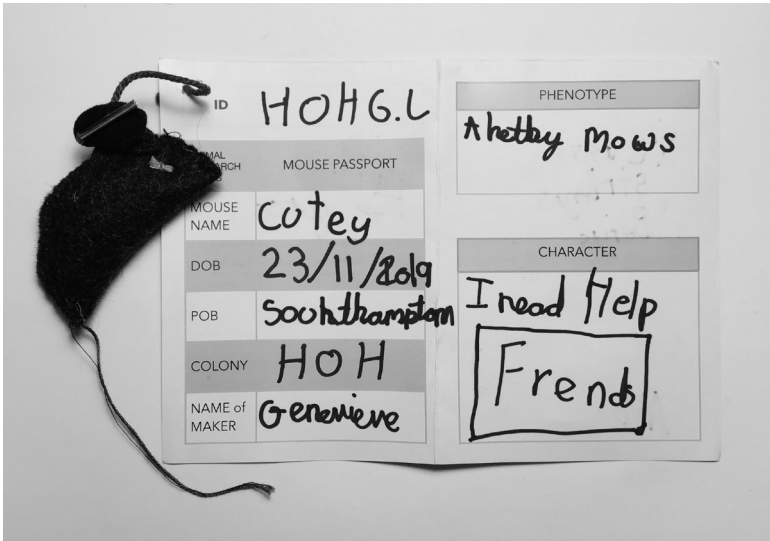


Figure 14.5 The current form of mouse passport (Source and copyright: Bentley Crudgington).

The ear-punch, a hole-punch stationery tool re-purposed, clips the ear for genotyping (to find out what genes are in this particular mouse) (Figure 14.6). Participants get to encounter how the work of caring for a research mouse does not allow for easy refusal of inflicting harm on them. Genotyping the mouse, and ensuring that the mouse and its passport remain together, depend on the maker's willingness to punch a hole in the mouse ear. The meaning of this act, however, is constructed by each maker, and is as unique as their mouse.

As the activity draws to a close – the mouse is completed and the passport has been written – participants are invited to put their mouse inside the Infinity Box and see their mouse multiplied into many animals. The Infinity Box uses mirrors and a light to show multiple ongoing reflections of their mouse (Figure 14.7). They watch as their single unique mouse becomes many indistinguishable mice; it provides a way to exemplify the sorts of practical ethical questions that may not necessarily be covered by regulation, but which arise when making life. As they watch their single unique mouse become a lineage, we unfold the idea of care from



Figure 14.6 Hole-punch as ear-punch (Source and copyright: Bentley Crudginton).



Figure 14.7 Image of a mouse in the Infinity Box (Source and copyright: Bentley Crudginton).

the individual to a colony. Mice in science are often lost in the multitude.⁴⁴ With the Infinity Box, we can start to ask about caring for an individual versus caring at scale. What kinds of responsibilities and care does a maker have for the future life of a creation? The Infinity Box multiplies our relationships over space and time.

Whereas the original MX offered people the opportunity to take their mouse home, swap it, or leave it in our care, later variants of the MX asked participants to leave them behind.

The completed mouse and passport are then left to live in our 'caging system', where rows of different felt mice start to stack up in a hanging shoe-storage rack (Figure 14.8). These are then photographed and added to a virtual online archive. This isn't easy: the invitation to leave the mouse behind brings a sense of loss and anxiety, of not knowing and trusting someone else with the responsibility to care. The anxiety is ours, as much as the makers': what does it mean for us to be custodians of these mice, and responsible for what happens in their future? These kinds of questions remain live as we seek to create a future for the MX as a toolkit for others to use.

Collectively, these items help to demonstrate how the assemblage that is animal research requires caring maintenance, and mandates specific forms of care for the animals intimately entangled with UK science. Moreover, they do so in a way that both recognises the animals' individual sentience, but also the collective expression of being one of a multitude,⁴⁵ one example amongst an expanding variety of mouse strains (Figure 14.9).

Conclusion

Public engagement suffers many of the same critiques as other form of participatory art: that it is trivial or trivialises⁴⁶ in that the science is dumbed down. However, as Helen Molesworth⁴⁷ argues, as one moves away from attempting to fill any knowledge deficit, public engagement can create situations where questions that ask, 'what if the world was different?' can be articulated and responded to. The MX crafting table can be read as a performance 'art form' for legitimising public discourse, locating itself as 'a conduit through



Figure 14.8 The shoe-holder as mouse caging system
(Source and copyright: Bentley Crudgington).



Figure 14.9 Variety of mice strains made (Source and copyright: Paul Hurley).

which to enter ideas into public discussions'.⁴⁸ This is a deliberate move away from many forms of animal research public engagement, where roles are predefined, and facts are neatly packaged up to be taken away. Instead, the MX is a feast for situated, spontaneous knowledge-making and transfer. In doing this, it continues the work of combining science and technology studies with performance and theatre studies.⁴⁹

The MX adds something unique to forms of public engagement on animal research. It offers participants a space where they can engage with animal research on their own terms. Here, hesitancy about taking part because of associations of anxiety or controversy in relation to animal research can be allayed, and participants are invited to engage with curiosity and care. In this way, we have devised a method that seeks to engage participants' curiosity and create space for a range of perspectives including affective, emotional, and embodied engagements with animal research. The MX positions the participant not as audience or information deliberator and ethical decider, but as maker and carer through being provided with crafting materials and engaged in curiosity-led conversations

that inspire care. We found that creating a space for curiosity, whilst crafting a felt mouse with stitches and thread in a curated performance space, could achieve a different way to support reflective conversations about the objects and animal supply chain infrastructure of animal research.

In part because it involved communicating research findings on the supply, biobanking, and rehoming of laboratory animals, the MX has worked to be open about what happens in spaces and practices around animal research that are not structured around ethical decision-making, but rather ethics in practice of making and caring for animal life. It never asks whether a particular experiment, or any experiments, should be carried out, but places participants as carers, which can be read as ethics in practice. While the introduction to the event does not presume an interest in any of these elements, the MX brings a focus on the practices that perform laboratory animal journeys, how animals come to be in laboratories, and how they are cared for while they are there. Doing public engagement that focuses on these practices is therefore a way to engage beyond either the science or the (deliberative) ethics of the use of animals in research. Rather, it shows how participants become immersed in a process of animal care through the practices of making, listening, and conversing around a table, which changes the way publics talk about ethics associated with using animals in research.

Finally, the activity's name gestures at the idea that making mice is a collective endeavour. It was also chosen to highlight other highly social aspects of this practice. Firstly, mice can be exchanged between collaborators. Secondly, the 'exchange' refers to the dialogues that we wish to encourage between participants. The MX is an experiment that we construct together. We have created this process together, and we offer it up for curiosity and future evolution.

Notes

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