

‘Bred, but not used’: understandings of avoidable and unavoidable waste in animal research

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Introduction

In 2018, reporting on UK animal research statistics included for the first time the number of animals ‘bred, but not used’.¹ The category includes animals that are by-products from the breeding of a specific genetically altered (GA) animal, are bred to maintain a live ‘tick-over’ animal colony, or are research-ready but do not get used in experiments. This new statistic adds to the annual publication of the number of licensed ‘procedures’ carried out on animals, across species, as defined by the Animals (Scientific Procedures) Act (ASPA). At a stakeholder meeting held in 2018 at the start of the Animal Research Nexus Programme (AnNex) to help scope out our research, we sensed apprehension from two attendees, both highly engaged experts in laboratory animal research and welfare, about the first public release of these UK figures. The question that troubled them was how these numbers would be understood and received by the public. The statistics are already hard for many people to interpret, while also being the focus of debate by different interest groups. There had been a steady reduction in the number of animal procedures in UK research from the 1990s until the early 2000s.² At this point numbers started to rise due to increased breeding of GA animals, which involves an experimental procedure. Since 2015 procedure numbers have been falling again.³ This chapter explores the apprehension about the release of this new statistic by discussing findings about the industry’s language and meanings attached to animals ‘bred, but not used’ in a regulated scientific procedure.

We were curious to understand why our two meeting attendees conveyed concern that the descriptive category 'bred, but not used' conjured up ideas that these research animals would be considered surplus, disposable, or waste, language that might denote a lack of respect for animals' lives, or inefficiencies within the supply chain. Our research interviews with people involved in the breeding and supply of research animals confirmed that the language of surplus and waste is commonly used for certain groups of animals. This concern connects to ongoing discussion about how far the regulatory protection of animals in science should be extended to breeding and supply animals. The UK government discussed this during the initial development of ASPA⁴ and conversations have continued. The breeding of vertebrate animals used in scientific procedures has to take place in a licensed establishment, which sets standards for care and accommodation, but in the majority of cases the process of breeding itself is not counted as a 'licensed procedure' under ASPA. The current guidance on ASPA does now include guidance on reducing waste, yet uneasiness persists about the number of surplus or 'bred, but not used' animals. For example, surplus animals were framed as a public concern in the late 1990s following parliamentary questions,⁵ and professional bodies within the animal research sector also confronted their own internal concerns during this period.⁶

The Additional Statistics of 2018 showed that 1.81 million animals (of which 1.45 million were mice)⁷ were 'bred, but not used'. The report was welcomed as a step towards greater transparency,⁸ but, contrary to our meeting attendees' fears, received little wider public interest. Instead, the publication of these new statistics has been of greater significance for those inside the industry, prompting further reflection on the complex array of practices that can lead to animals being 'bred, but not used'. These reflections within the industry are the focus in this chapter. To understand thinking and practice around surplus animals, we undertook qualitative research in 2018–2019, immediately following the publication of the new figures. After discussing our theoretical framing and research methods, we introduce our research participants' distinction between animals deemed avoidable and unavoidable waste, which is not captured in the 2018 'bred, but not used' statistics.

We then explore proposals for reducing waste from regulatory guidance, and from our own research, with a particular focus on the outsourcing of breeding facilities. We discuss tensions between researchers' expectation of immediate availability of research animals and the distress experienced by those responsible for killing surplus animals. We then conclude with recommendations for regulatory attention.

Theoretical framing

This section discusses our theoretical framing and contribution to the literature for our social science readers. We use a cultural economic analytic framework, which closely follows the thinking of post-Marxist feminist economic geographers such as Gibson-Graham,⁹ alongside socio-material approaches to things, in this case live animals, becoming waste.¹⁰ This approach moves away from understanding and describing economic relations through a lens focused solely on the operation of capital. Instead, our approach pays greater attention to the role of emotions as part of the distributed practices involved in breeding a point-of-sale animal commodity to consider the materiality of aliveness as waste and thereby to 'decentre the object of commodity fetishism'.¹¹ A capital-centric approach in this case would look at how animals are commodified as research tools, with the repeated breeding of litters of mice producing surplus-value and enabling capital accumulation.¹² The young mice as surplus-value are positively valued when they are exchanged for capital and become used in one or more animal procedures. However, we also are aware that the social forms and institutions around animal research produce a second group of surplus animals that do not achieve a use-value for experimental research; to use the Home Office nomenclature these are the 'bred, but not used' animals. In defence and explanation of why surplus is normalised, Smith argues that the production of surplus combats a social crisis from scarcity and with that assists the 'social emancipation of human society as a whole from nature';¹³ in other words, mouse lives are a unit of production and it benefits human society to have a ready supply of this product. However, an explanation based

only on the operation of capital does *not* explain how the industry has different reasoned sentiments, feelings, and ethical practices attached to this second group of surplus, and sub-groups of surplus animals that lie within it.

To study the differently reasoned sentiments, feelings, and practices around animals 'bred, but not used', we turn to the diverse economies approach pioneered by Gibson-Graham.¹⁴ This approach involves paying greater attention to how emotional work shapes markets and economic practices. Our study identified how ethical and social factors lead to the subdivision of the group of animals 'bred, but not used' into those labelled as 'avoidable waste' and 'unavoidable waste'. For example, we examine where, when, and how live animal resources become 'avoidable waste', which is a category of greater ethical concern than those viewed as 'unavoidable waste'. 'Unavoidable waste' often references those animals necessarily bred as part of the process of making specialised, often GA, animals as scientific tools.

Our diverse economies approach also involves responding to the experiences and expertise of those who look after animals that become 'waste'; who undertake not only practical labour but also affective and emotional labour, for example when they cull these animals. Acknowledgement of their affective labour is not visible through current regulatory guidelines or facility budgeting practice, although it may shape happiness in the workplace and staff turn-over. We find that this affective labour is a finite and limited embodied resource. We suggest that it is not only practical labour that shapes how animals are valued, but also affective labour of scientists or animal technicians. In other words, animal values are shaped not just by how people care *for* them, but also how they care *about* them,¹⁵ and this in turn diversifies animals' value. Following a diverse economies approach, we show that animals have value well beyond their use-value as resources for scientific research. In doing so, we illustrate the importance of extending a culture of care into research animal breeding and market activities (for more on the culture of care see Greenhough and Roe, Chapter 6).

Finally, our research highlights the importance of being alert to the changing practices and meanings associated with reduction as people carry out their work in the laboratory. This ethical principle

is, in practice, relational, that is, a distributed effect of the connections between various agents, places, and events, and not solely a principle or right ascribed to an individual.¹⁶ Conversations about avoidable and unavoidable waste in animal breeding do not take place through application of the 3Rs at any one point, but permeate the practices and infrastructures that work to actually reduce or increase animal numbers, revealing how these come to matter for people and animals across the breeding system.

Research methods

Between 2018 and 2019, we carried out interviews with 27 participants (some of whom were interviewed in pairs) working across nine UK facilities involved in the breeding, supply, and procurement of research animals. Participants included animal care technicians, facility managers, Named Veterinary Surgeons (NVSs), and researchers, and those with experience both within and outside of the commercial contract research industry. Interviews sought to understand participants' working-life experiences related to the breeding and supply of research animals. In addition, there were two short periods (five days in each location) of ethnographic participant observation with staff involved in animal care, administration, and research. All participants were given pseudonyms, using letters I to L in line with AnNex's policy (see Introduction). Research was approved by the University of Southampton's ethics committee. The transcripts were inductively coded using NVivo software by Peres, using a coding schema devised by Peres and Roe. We also draw on some documentary sources to assist in our analysis of regulation around animal breeding and supply. As we move through the sections of our analysis, we use a diverse economies approach to explore the emotional and affective resources of those tasked with handling the caring and killing of wasted animal lives. We start with a review of how feelings are attached to the terms 'avoidable' and 'unavoidable waste' by those who breed, care for, and supply research animals, before exploring how different economic and ethical values align around efficiencies in science with implications for those involved in the production of animals seen as waste.

How are avoidable and unavoidable waste defined?

The numbers included in the 2018 'bred, not used' statistics conceal an important distinction between avoidable and unavoidable surplus made by our research participants. Laura, who is in a leadership position at a research institution, makes the point that, as far as the Home Office returns go, 'there's no definition between bred and [can] not [be] used, and bred and not needed'. Thus, the category 'bred, but not used' is equated uneasily with the inference that all these animals are surplus to requirements, or waste. For Laura, defining what, in her words, she calls 'surplus' animals should mean the subtraction of those animals it was necessary to breed, but are not used:

Surplus isn't what animals we breed and don't [include in the reporting] return, it's what we didn't need to breed. So, there's quite a big difference between what you breed and you can't use, because [they are] a consequence of a genetic cross or a consequence of a husbandry practice, and what you breed and you shouldn't have bred. That's quite different. So, in terms of what we breed and we can't use, that's unavoidable [breeding]. (Laura, research leadership, research institution, interview, 2018)

It was therefore important for our research participants to distinguish between those practices and rationales that led to the breeding of unnecessary animals, compared with breeding that is difficult to avoid. Gretchen, an NVS,¹⁷ argues for these distinctions:

you need to distinguish between bad planning, where people don't think it through, and they don't want to waste time, and therefore they always want to have animals on the ground ready to use, and ... genetic altered strains where you ... will always have a percentage of mice that are unsuitable for the research. And the only thing you can do is literally then see if the animals can be used for something else, but you cannot avoid having this wastage or surplus because to produce the suitable animals you will automatically produce the non-suitable animals. (Gretchen, NVS, university sector, interview, 2019)

It is evident how different kinds of waste are met with different situated moral judgements and actions. Breeding GA strains may

involve the production of many ‘unusable’ animal genotypes, leaving care staff carrying an emotional burden when culling them. Yet this can be seen as *unavoidable* waste: a consequence of the biological process of strain-making that does not pose a challenge to the underlying principles of the 3Rs. There is often no obvious option for reduction here. The alternative term offered by Gretchen of ‘surplus’ carries less moral hazard compared with the more negative term ‘wastage’, yet she uses both; this perhaps conveys her own moral conundrum. The more ethically manageable term of ‘surplus’ follows the efforts to create an animal that is an exchangeable commodity, yet with acceptance that there will not be a use or a buyer for every genetically altered mouse life made in the process. Avoidable waste, on the other hand, was described by Gretchen as a consequence of prioritising the ready availability of animals, or the outcome of ‘bad planning’, leading to avoidable overproduction of animal lives as ‘wastage’.

This binary framing carries all the moral and economic meanings associated with and conveyed by the term ‘waste’ discussed in the waste literature.¹⁸ For example, while live animal waste can be regarded as socially unacceptable, in reality its social distinction is contingent on changing spatio-temporal relations of the animal research nexus. Animal life as waste, as an outcome of avoidable human practices, weighs heaviest on those who see how such waste could be reduced, or who deal with the consequential culls. The lack of wider public outcry at the ‘bred, but not used’ statistic supports this reading. Thinking with Gay Hawkins,¹⁹ some live animals becoming known as waste is in fact the stuff of politics, conveying socio-technical changes of our time around the politics of animal research and shifting societal relations to the sentient animal. The live animal as waste is not an inert object but is driving conversations and concerns that have the potential to reshape the operations of animal research – something we are contributing to in this chapter by highlighting the distinction between avoidable and unavoidable waste. In much the same way, it matters what is in surplus to understand the ethical response to its existence. Animals as surplus and animals as waste both sit uncomfortably with those acknowledging animal lives.

We learnt from our participants what practices lead to animal ‘waste’. Researchers may be primarily concerned with the

availability of animals to ensure that no *time* is wasted, especially given the competitive nature of contemporary biomedical research and the perceived pressure to produce results and publish them as quickly as possible.²⁰ Hence, it is important to consider that, although powerful, 'waste' may be a relative term – or, at least, one applied not only to animals, but also to other resources (such as time and money) that are required to produce scientific outputs. A research culture that prioritises speed may place higher value on researchers not wasting time waiting for animals to be bred for their work, as opposed to the consequential waste of animal lives if they are treated as a resource that is always ready to hand.

Where is responsibility for reducing waste located?

Current regulatory guidance in the UK conveys efficiency as a central goal for breeding. For example, it is in the title of the 2016 guidance document published by the Home Office to share best practice on breeding GA animals.²¹ Efficiency as a term speaks to prudent, careful allocation of resources to minimise wastage – not just of animals, but also of financial and labour resources. In other words, using efficiency arguments can seemingly align ethical and economic factors. For example, we heard of efforts to demonstrate that outsourcing animals from a separate breeding facility saves the user on animal husbandry costs (sometimes known as 'hotel charges'), along with a reduction in in-house surplus animals. Equally, there is a clear acknowledgement in the regulatory guidance (both at EU and UK level) that the dynamics of supply and demand for research mice can be unpredictable, and that matching the two is complex. Consequently, the regulatory guidance leaves open considerable flexibility, allowing that breeding practices are contingent on the local context and the needs of the project.²² Responsibility for breeding, according to the guidance, falls to establishment and personal licence holders, who lead research experiments using animals. They are not only accountable for the animals that they procure, through breeding or buying, but also must ensure that the production of surplus animals is minimised.²³ It is notable that no specific statement is made in the guidance to

show care for those tasked with culling surplus animals, although they could broadly be referred to in the ‘local context’ category.

In its guidance on APSA’s operation, the Home Office provides different strategies for avoiding wastage of animals. Specifically, they recommend:

- 1 planning experiments with enough time to breed to requirements, and applying the principle of Reduction by designing experiments with an accurate number of animals;
- 2 justifying any special characteristics in the experimental population (e.g., sex and age) that may make animals unusable;
- 3 sharing animals and tissues with local users ‘wherever feasible’;
- 4 ‘Question[ing] the need for small, often in-house breeding colonies of common strains’ where they are available from larger colonies;
- 5 using cryopreservation;
- 6 keeping a record of surplus animals and reviewing reasons for overbreeding; and
- 7 a role for the AWERB in awareness-raising, policy-making, coordination, and rationalisation of breeding *vis a vis* users’ needs.²⁴

We note in these strategies how there is nothing specific about the implications of promoting a ‘culture of care’ in facilities as a strategy to guide policy on this issue.

The rest of this chapter addresses practices discussed in our empirical data that implement recommendations (1) and (4). We chose these because they are commonly discussed in our data, and because they most clearly speak to how breeding practices extend beyond a facility’s walls to encompass other agents through which research animals are procured. These strategies involve outsourcing breeding to places where demand and supply can be better matched and where breeding expertise has been developed, such as commercial suppliers or university breeding ‘cores’. Outsourcing is a widely used strategy to reduce surplus waste, though not universally applied. Moreover, advance planning and breeding on-demand are framed as ways to make breeding efficient through enabling easier management of supply and demand. Therefore, we find that outsourcing is a particularly interesting aspect to examine, as it

illustrates how the ethics of making life are deeply embedded in social relations between different parts of the supply chain, such as between breeders and the researchers who are their customers (hence, we refer to 'researcher-customers'). Outsourcing can therefore point to how a culture of care might be extendable beyond the institution.

What are the implications of outsourcing breeding for ethics, economics, and expertise?

The work of commercial suppliers or large breeding facilities is increasingly at the forefront of innovations in colony management. We consider how their use is a form of outsourcing a service, and is an example of how positive affective and exchange-value may align behind an economic practice. These facilities have been managing supply and demand at greater scales and for far longer than the academic sector. Therefore, they can act as centres of expertise for breeding. For instance, the Jackson Laboratory in the US operates both as a (commercial, yet non-for-profit) supplier of mice and a provider of resources and training in colony management.²⁵ Indeed, as economic geographer Bronwyn Parry notes, this institution's commercial strategy uses its 'reputation for the fidelity and stability of their mouse strains' as a selling point, with intellectual property protected through trademarks rather than patenting. In other words, the Jackson Laboratory emphasises its craft in colony management, and the ability to produce a genetically 'true to form' mouse of a given Jackson strain.²⁶ However, underlying the strategy of outsourcing breeding is the hopeful expectation that the larger commercial or institutional breeder is responsible for, and able to, better manage supply in relation to demand in order to minimise surplus. By centralising demand in this way, it is hoped, suppliers can allocate small numbers of mice to many different buyers, and so reduce waste. The emotion of hope is important to recognise here; it is not known how well commercial supplies meet these expectations.

We found that many UK institutions were avoiding in-house small breeding colonies and instead sourcing animals from either a

commercial supplier or, where available, an institutional breeding ‘core’. Yet there is still notable variation in how such outsourcing is implemented between institutions and for different colonies. For instance, Leonard reports that his institution (see quote below, which we have not independently verified) increased their sourcing of animals from commercial operations some decades ago. We understand this shift as inspired by ongoing arguments that to ensure the genetic integrity of the animal model being used, it is better to purchase a specific sub-strain from suppliers. This enables users to have a degree of quality assurance that the colony of origin has been carefully managed to minimise ‘genetic drift’, a phenomenon whereby isolated colonies of mice can become increasingly genetically different over generations.²⁷ Despite these services being on offer, an interview with a Named Animal Care and Welfare Officer from the same institution as Leonard revealed how the scientific work at the institution meant that they still held and bred from GA breeding colonies for work requiring timed pregnancies. Therefore, we interpret Leonard’s words as referring to the move towards buying increasingly standard, off-the-shelf models for the reasons outlined below:

decades ago, [the University] said we can’t make this work. Therefore, commercial operations make it work and I can’t answer for them with regards to the amount of wastage, but any wastage for them is unecological so they will be very clever in the way they design their production schedules, and of course their prices and their catalogue. So we’ve said it’s far easier to just buy these animals in, rather than take up valuable space in one’s institution and then unfortunately have to kill more animals than you actually sell, if that’s the right word, to your local scientific community. And so we said let’s stop, so we did. (Leonard, facilities leadership, university sector, interview, 2018)

Notable here is how commercial companies’ production schedules, prices, and catalogue are admired as ‘very clever’ ways to address waste. Yet the scale of wasted animal lives is unknown, thus it is only a hopeful supposition that it will be less. Interestingly, there is ambiguity in Leonard’s comment about whether regret about killing surplus animals is attached to economic loss, ethical concern for the animals, concern for the human emotional toll, or

a combination of all three. What is clearer is that Leonard seems attached to the idealised relation between producer, seller, and consumer, leading to seamless accessibility to live animal commodities that meet a researcher's specifications at the time they want, perceived as potentially workable for commercial operators, but not universities. After all, and as we previously heard from Gretchen, researcher-customers 'don't want to waste time and therefore ... always want to have animals on the ground ready to use'.

And yet, the reality perhaps can be different. As we observed in our ethnography, there can be a process of negotiation between a potential purchaser and a commercial supplier whereby surplus animals may be offered at a discounted price. Alternatively, in cases where the potential purchasers' specifications couldn't *quite* be met, a to-and-fro might occur between the two parties (via specialist administration staff) where the supplier makes an alternative 'offer' with a view to meet the demand, even if not completely fulfilling the whole specification. This begs the question: Will the experiment be designed differently if the seller is persuasive enough about the price discount? Outsourcing to commercial suppliers was therefore not simply used as a strategy for shifting waste upstream in the supply chain. We thus found an idealised view of the centralised breeder's ability to simultaneously bypass the ethical costs of breeding and provide ease of access.

Who carries the emotional costs in outsourcing?

During our fieldwork at Leonard's research institution, we witnessed orders being placed for animals to arrive the next day. This is not an unusual situation; administrative staff responsible for overseeing orders reminded users that the maximum cut-off point was midday the day before delivery. In the 1998 Laboratory Animal Science Association (LASA) Taskforce on Surplus report, 16 different reasons for surplus animals were identified.²⁸ 'Breeding pressures', such as an inability to match supply and demand and 'trying to meet a variable customer demand and short notice orders', was the first item on this list. Indeed, from the perspective of the supplier, customers' demand for the availability of mice with fairly tight

specifications was indeed a major contributing factor for surplus, and in turn for creating distress among staff. Remembering the situation in commercial breeders in the late 1970s, Jacqueline reflected:

actually some of these were quite distressing because they were euthanised at weaning, so you literally took them away from their mum and actually said, 'I've just weaned 700 females, I know I only ever sell 300, I'm going to kill those 400.' So it was quite a big waste. But the industry outside the commercial breeder wanted that flexibility, they wanted to be able to phone you up and say I want 300 female mice, 18–25g ... So you had to be flexible, there was no computer system, ... especially as a young technician back in 1977, it definitely felt that way to me. (Jacqueline, ex-animal technician at a commercial breeder, interview, 2018)

This story is in the past, but our fieldwork shows that customer expectations about next-day availability of mice at short notice from commercial breeders is still a regular occurrence.

It is clear from how Jacqueline tells this story that there are negative affective costs involved in handling surplus: a team of animal technicians tasked with culling will still carry the costs of surplus even if it is outsourced to a supplier. Using outsourced mouse breeders who are down a phone line and off-site runs the risk of simply shifting the affective (if not economic) costs of breeding and killing surplus mice, as paradoxically they become less visible. It also may then avoid tackling aspects of surplus production through a pan-institutional lens of a culture of care for humans and animals. We suggest that knowing how much surplus there is across a supply chain can be the basis for productive concern for doing the right thing, as exemplified by this reflection from Lydia, a senior technician at a university:

I understand that there's a lot of surplus that's produced with these external suppliers, but the researchers are able to get the [mice] cohorts that they need. And perhaps this is because it's out of sight out of mind, perhaps, that you don't really give too much thought about it. But also that, you know, in the same breath we're not producing them here, and having to kill them or put the onus on the technicians to kill that excess stock. So it is something that we do think about, but it is happening somewhere else. (Lydia, senior technician, university sector, interview, 2019)

This quote illustrates Lydia's grappling with the spatial ethic of efforts to reduce surplus, as she ponders how achieving specific goals around surplus reduction locally can have repercussions elsewhere. Yet we also sense an ambivalence between this tentative reaching out, and the recognition that it is a matter of where it happens, not if it happens. Nonetheless, reflections such as these represent useful and important starting points for caring about breeding and surplus throughout the supply chain, and an impetus to extend the reach of the 'culture of care' through the supply chain, going beyond the institution. Bringing attention to Lydia's role and her concern, and amplifying the experiences of Jacqueline and others in her line of work, might counter attempts to organisationally 'externalise' the affective costs of surplus by locating it elsewhere.

Throughout our analysis, we have amplified the human affective labour and associated anxieties of those close to culling practice. Ultimately, we found that outsourcing breeding per se should not provide assurance that surplus will stop, unless done in tandem with cultural shifts surrounding activities elsewhere in the mouse supply economy. Using outsourced mouse breeders does shift the problem away and makes less visible the affective costs of breeding and killing surplus mice. Indeed, it is unclear the scale of surplus animals produced by commercial suppliers. For instance, the Additional Statistics point to a third of animals 'bred, not used' being wild types, which one might speculate are procured from a commercial breeder,²⁹ but with no further detail. During our interviews, several participants expressed a desire for greater transparency around the quantity of surplus animals culled by commercial breeders. Equally, we are aware that some surplus rodents enter the pet and zoo animal trade as food, but again the scale is unknown.

How can care extend throughout the supply chain?

We propose that recognising the relational nature of surplus and, especially, becoming attuned to the implications for animals and people elsewhere in the supply chain can change the moral economy around making life. To do so would mean to engage forms of 'caring at a distance': a form of ethical consumption³⁰ that goes beyond

regulatory requirements or narrow readings of ethical principles. Returning to Jacqueline, she shared with us that it was in the private sector that she learned to manage colonies and match supply and demand. Eventually, she moved to the academic sector, and there made use of her expertise to encourage improvements in breeding efficiency at her university. Her experience means she is very attuned to the implications of surplus, as demonstrated by this story that took place around Christmas when people take time off work:

somebody made a flippant comment that ‘it’s alright for the commercial breeders, they just breed over Christmas and keep killing them all off’. I looked at this person and said, ‘So if the commercial breeders stopped breeding over Christmas will you promise to not want animals until February, and beyond?’ ... ‘No, no I want them when I want them.’ I said, ‘Okay, you can’t have both worlds. You cannot take the commercials to task about breeding over Christmas and having to kill them all, because that’s what happens invariably, and then tell me you want animals on 2 January’ ... And I was quite offended by that comment because I thought actually you don’t understand what your demand sometimes does. (Jaqueline, now facilities leadership in the university sector, interview, 2018)

This phrase ‘you don’t understand what your demand sometimes does’ poignantly illustrates the frustrations about a lack of care for breeding and the consequences for staff tasked with culling. Although there are various useful strategies that can be deployed to minimise the making of surplus life, a more dramatic change could perhaps emerge from nurturing a deeper awareness of the affective costs on human and animal lives associated with some researcher-customer expectations. That means, of course, revisiting the customer–breeder relationship, perhaps with a view to making more visible the full panoply of costs or experiences associated with dealing with surplus, across the supply chain.

Happily, we have found some evidence of a diversifying of practices (following Gibson-Graham) within the customer–breeder relationship. The practices we learnt about – even if piecemeal or restricted to particular institutions – do, by dint of their specialist status or other factors, suggest other ways of negotiating supplier–customer relations. For instance, one approach is to adjust the expectations of researcher-customers. Take Leon’s statement

below. He works at a large institutional breeding facility that carries out contract research work. Albeit not exactly a commercial supplier, they must contend with similar concerns in terms of business sustainability, and again in the quote below we read quite strong feelings of a desire to take a moral stand with a customer about mouse availability, rather than his institutional supply system being framed as a supermarket:

So now you know from my perspective it'll be really sort of 'okay, what do you need? This will be the timescale that we can deliver them on because we're breeding to your demands' rather than having them, you know, I'd hate to think of them ever being considered as almost like, you know, we're a supermarket, where you come in and it's a case of 'oh I'll have one of those, one of those and one of those'. Because I'd rather say, 'Well actually no, those aren't available yet' because we breed to requirements rather than having a big colony waiting a while. Because that's when you get stock that are, which I hate the term, surplus to requirements. (Leon, facilities leadership, large breeding facility, interview, 2018)

The strength of feeling in what Leon says suggests to us that he may have first-hand experiences, not captured in our interview, that explain his forcefulness about rejecting the breeding facility as a supermarket representation. Perhaps the capacity to stand firm on slower supply chains is aided by developments in cryopreservation, as well as other innovations in colony management systems that hold, for some interviewees, the promise of greater efficiency and transparency in the management of breeding. And yet, more than this we have found feelings and changes in practices that, although still with problems, are starting to address animal surplus by more careful procurement practices. These practices in turn also work to lessen risks – to people and to animals – of suffering unnecessarily.

Conclusion

We conclude with three points. Firstly, we have discussed what practices and feelings surround the making of 'avoidable waste'

animals. We have demonstrated that these differ between roles, given the ‘emotional division of labour’ in animal research that increasingly separates those who bear the emotional cost of caring for research animals from those who carry out experiments and assume the economic costs of research.³¹ The separation between, on the one hand, practices of husbandry and care, and on the other those of experimentation and knowledge-making, can engender a lack of awareness on the part of the animal users of the affective, emotional resources ‘spent’ when animals become waste. We heard from the voices in the laboratory who are most familiar with the practical details that create waste, who convey concerns over the acceptability of waste-making practices, girded by the public release of the ‘bred, but not used’ statistics in 2018. We found confidence in the voices of people working within the industry to speak up about their concerns and experiences, and thereby to shape the social contract, more actively, around animal research. This is perhaps related to the shift to a ‘culture of care’,³² which is reducing the tolerance of animal care staff for practices that appear care-less to how humans suffer from the unnecessary making and killing of research animals. It is indicative of how the ‘culture of care’ is enabling people working in the industry to speak openly of their ethical concerns, and drive change in the industry’s resource economy.

Secondly, and connectedly, the chapter also demonstrates the recognition of expertise perhaps previously overlooked – not only that of the animal technician as carer, which has been discussed before,³³ but also breeding expertise located either in-house or out-sourced. We illustrate these two points with reference to the surplus reduction strategy of outsourcing, which involves social and affective aspects that connect the whole supply chain, from breeding animal technologists to end-users. Stories from our research participants about this strategy suggest that it is important to take a holistic view of the supply chain and think relationally about the distribution of priorities and practices, whether around efficiencies, science-making, or caring. We have shown the importance of thinking holistically about relations within the animal research economy, through adopting a cultural economies approach. In addition, we have pointed to the important role of highlighting affective practices into our writing about animal research.³⁴ To this point, the culture

of care concept could be usefully extended beyond an institution to be a consideration across the distributed economy of research animal supply.

Thirdly, we have shown how concerns about surplus animals extend the application of the 3Rs beyond those animals directly experimented upon. Russell and Burch's original definition of the principle of reduction does not specifically call for the overall reduction in the number of animals used in research.³⁵ Instead, it specifies a decrease in inhumanity or distress, according to Tannenbaum and Bennett. Notably, Russell and Burch were pre-occupied with ensuring that sufficient quantity of animals were used to ensure that the experimental results are sound.³⁶ However, and as Tannenbaum and Bennett also observed, newer definitions *do* take reduction to mean minimisation.³⁷ The UK's National Centre for 3Rs (NC3Rs) define reduction as 'methods which allow the information gathered per animal in an experiment to be maximised in order to reduce the use of additional animals',³⁸ which can include experimental, statistical, and breeding practices. Yet, and again according to Tannenbaum and Bennett, it is interesting that *efficiency* was already a concern for Russell and Burch, in the sense of 'generating maximum scientific or medical results from expenditures of monetary and animal resources, facilities, and personnel'.³⁹

Notably, in the latest NC3Rs definition of reduction, there is a return to Russell and Burch's emphasis on maximising scientific efficiency whilst using minimal additional animals that would include the 'bred, but not used' category. However, as we learn from our study, in practice there is a complex ethical spatiality surrounding how and where efficient breeding is located and visible. Breeding efficiency competes with other resources in efficient science-making practices, such as time. Proximity between customer and breeder appears to matter in both cultivating sensitivities about waste and doing something about it. As researchers studying this topic, we see practices leading to the unnecessary breeding of surplus animals as threats to the social contract of the humane use of animals.⁴⁰ A life spent in the laboratory is not considered a 'good life' for an animal, so it is important that human benefits are realised from laboratory animal use and breeding.⁴¹ We would therefore recommend greater

regulatory interest in the details of how surplus can be avoided, and closer scrutiny and transparency about the scale and location of avoidable waste animals.

Notes

- 1 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/901224/annual-statistics-scientific-procedures-living-animals-2019.pdf [accessed 1 February 2023].
- 2 ‘How Many Animals Are Used in Research? | NC3Rs’, www.nc3rs.org.uk/how-many-animals-are-used-research [accessed 5 December 2022].
- 3 Gail Davies et al., ‘Animal Research Nexus: A New Approach to the Connections between Science, Health and Animal Welfare’, *Medical Humanities*, 2020, DOI: 10.1136/medhum-2019-011778, 1–13, (p. 504). Overall the numbers of animals used are less than the number of procedures, as animals can be used in more than one procedure during their life, which is one further factor leading to the arguments around trends in animal use.
- 4 Robert G. W. Kirk and Dmitriy Myelnikov, ‘Governance, Expertise, and the “Culture of Care”: The Changing Constitutions of Laboratory Animal Research in Britain, 1876–2000’, *Studies in History and Philosophy of Science*, 93 (2022), 107–122, DOI: 10.1016/j.shpsa.2022.03.004.
- 5 While in many EU countries, attention to surplus animals has been raised through the revised statistical reporting required by the EU Directive 2010/63/EU, it was an area of UK public interest much earlier. In 1995, questions in Parliament regarding the number of surplus animals produced at Porton Down led the Laboratory Animal Science Association (LASA) to establish a Task Force on Surplus Animals and to produce a report on the issue.
- 6 LASA, *The Production and Disposition of Laboratory Rodents Surplus to the Requirements for Scientific Procedures: A Report of a LASA Task Force Meeting Held on 12th June 1998*, 1998, www.lasa.co.uk/PDF/Surplus.pdf [accessed 3 December 2020].
- 7 Home Office, ‘Additional Statistics on Breeding and Genotyping of Animals for Scientific Procedures for 2017’, 2018, [www.assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/678765/Additional_data_collection_2017_guidance_v2.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/678765/Additional_data_collection_2017_guidance_v2.pdf) [accessed 10 July 2018].

- 8 Sara Wells, 'Increasing Transparency in Animal Research Numbers', *MRC Insights* (Medical Research Council, 2018), www.mrc.ukri.org/news/blog/increasing-transparency-in-animal-research-numbers/ [accessed 2 December 2020].
- 9 J. K. Gibson-Graham, 'Rethinking the Economy with Thick Description and Weak Theory', *Current Anthropology*, 55.S9 (2014), S147–153, DOI: 10.1086/676646.
- 10 Nicky Gregson and Mike Crang, 'Materiality and Waste: Inorganic Vitality in a Networked World', *Environment and Planning A: Economy and Space*, 42.5 (2010), 1026–1032, DOI: 10.1068/a43176.
- 11 Gregson and Crang, 'Materiality and Waste', p. 1028.
- 12 Katherine Perlo, 'Marxism and the Underdog', *Society & Animals*, 10.3 (2002), 303–318, DOI: 10.1163/156853002320770092.
- 13 Neil Smith, *Uneven Development: Nature, Capital, and the Production of Space* (Verso Books, 2010), p. 59.
- 14 Gibson-Graham, 'Rethinking the Economy with Thick Description and Weak Theory'.
- 15 Emma Roe and Beth Greenhough, 'A Good Life? A Good Death? Reconciling Care and Harm in Animal Research', *Social & Cultural Geography*, 24.1 (2021), 49–66, DOI: 10.1080/14649365.2021.1901977.
- 16 Beth Greenhough and Emma Roe, 'From Ethical Principles to Responsible Practice', *Environment and Planning D: Society and Space*, 28.1 (2010), 43–45 (p. 43), DOI: 10.1068/d2706wse.
- 17 The NVS is responsible for, monitors, and provides advice on the health, welfare and treatment of animals.
- 18 Sarah A. Moore, 'Garbage Matters: Concepts in New Geographies of Waste', *Progress in Human Geography*, 36.6 (2012), 780–799, DOI: 10.1177/0309132512437077; Gregson and Crang, 'Materiality and Waste'.
- 19 Gay Hawkins, *The Ethics of Waste: How We Relate to Rubbish* (Rowman & Littlefield, 2006); Gay Hawkins, 'The Politics of Bottled Water', *Journal of Cultural Economy*, 2.1–2 (2009), 183–195, DOI: 10.1080/17530350903064196.
- 20 Daniele Fanelli et al., 'Misconduct Policies, Academic Culture and Career Stage, Not Gender or Pressures to Publish, Affect Scientific Integrity', *PLOS ONE*, 10.6 (2015), e0127556, DOI: 10.1371/journal.pone.0127556.
- 21 Home Office, 'Efficient Breeding of Genetically Altered Animals: Assessment Framework' (London: Home Office, 2016).
- 22 Home Office, *Guidance on the Operation of the Animals (Scientific Procedures) Act 1986* (London: Home Office, 2014), sec. 2.4; European

- Commission, *Commission Staff Working Document Accompanying the Document 'Report from the Commission to the European Parliament and the Council on the Implementation of Directive 2010/63/EU on the Protection of Animals Used for Scientific Purposes in the Member States of the European Union'* (Brussels, 5 February), 2020, p. 41, www.ec.europa.eu/environment/chemicals/lab_animals/pdf/SWD_Implementation_report_EN.pdf [accessed 11 October 2020].
- 23 Home Office, *Guidance on the Operation of the Animals (Scientific Procedures) Act 1986*, sec. 2.4.
- 24 Home Office, *Guidance on the Operation of the Animals (Scientific Procedures) Act 1986*, sec. 2.4.
- 25 *The Jackson Laboratory Handbook on Genetically Standardized Mice*, ed. by Kevin Flurkey et al., 6th edn, 1st printing (Bar Harbor, Me: The Jackson Laboratory, 2009).
- 26 Bronwyn Parry, 'Patents and the Challenge of "Open Source" in an Emergent Biological Commons or ... the Strange Case of Betty Crocker and the Mouse', *BioSocieties*, 2019, DOI: 10.1057/s41292-019-00158-4.
- 27 See Gail Davies, 'Mobilizing Experimental Life: Spaces of Becoming with Mutant Mice', *Theory, Culture & Society* 30.7–8 (2013), 129–153, DOI: 10.1177/026327641349628.
- 28 LASA, *The Production and Disposition of Laboratory Rodents Surplus to the Requirements for Scientific Procedures*, p. 2.
- 29 Wild-type mice may more typically be sourced from commercial suppliers as they are a less specialised (often meaning a type of GA) mouse line. Specialised, bespoke research lines can be developed by a research team who then may choose to keep that line as a live colony of that mouse line within a research institution.
- 30 Clive Barnett et al., 'Consuming Ethics: Articulating the Subjects and Spaces of Ethical Consumption', *Antipode*, 37.1 (2005), 23–45, DOI: 10.1111/j.0066-4812.2005.00472.x.
- 31 Beth Greenhough and Emma Roe, 'Attuning to Laboratory Animals and Telling Stories: Learning Animal Geography Research Skills from Animal Technologists', *Environment and Planning D: Society and Space*, 37.2 (2019), 367–384, DOI: 10.1177/0263775818807720.
- 32 Home Office, *Guidance on the Operation of the Animals (Scientific Procedures) Act 1986*; M. Brown, 'Creating a Culture of Care', *NC3Rs News & Blog Online*, 2014, www.nc3rs.org.uk/news/creating-culture-care [accessed 30 July 2019].
- 33 Roe and Greenhough, 'A Good Life? A Good Death?'; Greenhough and Roe, 'Attuning to Laboratory Animals and Telling Stories'.

- 34 Davies et al., 'Animal Research Nexus', p. 8.
- 35 William M. S. Russell and Rex L. Burch, *The Principles of Humane Experimental Technique* (London: Methuen, 1959).
- 36 Jerrold Tannenbaum and B. Taylor Bennett, 'Russell and Burch's 3Rs Then and Now: The Need for Clarity in Definition and Purpose', *Journal of the American Association for Laboratory Animal Science: JAALAS*, 54.2 (2015), 120–132 (p. 128).
- 37 Tannenbaum and Bennett, 'Russell and Burch's 3Rs Then and Now', p. 128.
- 38 'The 3Rs | NC3Rs' www.nc3rs.org.uk/the-3rs [accessed 20 May 2022].
- 39 Tannenbaum and Bennett, 'Russell and Burch's 3Rs Then and Now', p. 123.
- 40 Davies et al., 'Animal Research Nexus'.
- 41 I. Joanna Makowska and Daniel M. Weary, 'A Good Life for Laboratory Rodents?' *ILAR Journal*, DOI: 10.1093/ilar/ilaa001.