

Online Research @ Cardiff

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository: <http://orca.cf.ac.uk/92968/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Davies, Gail F., Buller, Henry, Greenhough, Beth J., Hobson-West, Pru, Kirk, Robert G. W., Applebee, Ken, Bellingan, Laura C., Diefenbacher, Daniela, Berdoy, Manuel, Cassaday, Helen J., Davies, Keith, Druglitrø, Tone, Escobar, Maria Paula, Friese, Carrie, Herrmann, Kathrin, Hinterberger, Amy, Jarrett, Wendy J., Jayne, Kimberley, Johnson, Adam M., Johnson, Elizabeth R., Konold, Timm, Leach, Matthew C., Leonelli, Sabina, Lewis, David I., Lilley, Elliot J., Longridge, Emma R., McLeod, Carmen M., Miele, Mara, Nelson, Nicole C., Ormandy, Elisabeth H., Pallett, Helen, Poort, Lonneke, Pound, Pandora, Ramsden, Edmund, Roe, Emma, Scalway, Helen, Schrader, Astrid, Scotton, Chris J., Scudamore, Cheryl L., Smith, Jane A., Whitfield, Lucy and Wolfensohn, Sarah 2016. Developing a collaborative agenda for humanities and social scientific research on laboratory animal science and welfare. PLoS ONE 11 (7) , e0158791. 10.1371/journal.pone.0158791 file

Publishers page: <http://dx.doi.org/10.1371/journal.pone.0158791>
<<http://dx.doi.org/10.1371/journal.pone.0158791>>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



1 **Full title: Developing a collaborative agenda for**
2 **humanities and social scientific research on**
3 **laboratory animal science and welfare**

4
5 **Short title: Humanities and social scientific research on**
6 **laboratory animal welfare**

7 **Authors**

8
9 Gail F Davies^{1*}, Beth J Greenhough², Pru Hobson-West³, Robert G W Kirk⁴, Ken Applebee⁵, Laura C
10 Bellingan⁶, Manuel Berdoy⁷, Henry Buller⁸, Helen J Cassaday⁹, Keith Davies¹⁰, Daniela Diefenbacher¹¹,
11 Tone Druglitrø¹², Maria Paula Escobar¹³, Carrie Friese¹⁴, Kathrin Herrmann¹⁵, Amy Hinterberger¹⁶,
12 Wendy J Jarrett¹⁷, Kimberley Jayne¹⁸, Adam M Johnson¹⁹, Elizabeth R Johnson²⁰, Timm Konold²¹,
13 Matthew C Leach²², Sabina Leonelli²³, David I Lewis²⁴, Elliot J Lilley²⁵, Emma R Longridge²⁶, Carmen M
14 McLeod²⁷, Mara Miele²⁸, Nicole C Nelson²⁹, Elisabeth H. Ormandy³⁰, Helen Pallett³¹, Lonneke Poort³²,
15 Pandora Pound³³, Edmund Ramsden³⁴, Emma Roe³⁵, Helen Scalway³⁶, Astrid Schrader³⁷, Chris J
16 Scotton³⁸, Cheryl L Scudamore³⁹, Jane A Smith⁴⁰, Lucy Whitfield⁴¹, Sarah Wolfensohn⁴²

17

18 ¹ Department of Geography, College of Life and Environmental Sciences, University of Exeter, Exeter,
19 United Kingdom

20 ² School of Geography and the Environment and Keble College, University of Oxford, Oxford, United
21 Kingdom

22 ³ Centre for Applied Bioethics, School of Veterinary Medicine and Science, University of Nottingham,
23 Leicestershire, United Kingdom

24 ⁴ Centre for the History of Science, Technology and Medicine (CHSTM), Faculty of Life Sciences,
25 University of Manchester, Manchester, United Kingdom

26 ⁵ Biological Services, Health Schools, King's College London, London, United Kingdom

27 ⁶ Society of Biology, Charles Darwin House, London, United Kingdom

28 ⁷ Biomedical Services, University of Oxford, Oxford, United Kingdom

29 ⁸ Department of Geography, College of Life and Environmental Sciences, University of Exeter, Exeter,
30 United Kingdom

31 ⁹ School of Psychology, University of Nottingham, University Park, Nottingham, United Kingdom

32 ¹⁰ Joint Biological Services, College of Biomedical and Life Sciences, Cardiff University, Cardiff, United
33 Kingdom

34 ¹¹ Society of Biology, Charles Darwin House, London, United Kingdom

35 ¹² TIK – Centre for Technology, Innovation and Culture, Faculty of Social Sciences, University of Oslo,
36 Oslo, Norway

37 ¹³ Department of Geography, King's College London, London, United Kingdom

38 ¹⁴ Department of Sociology, London School of Economics, London, United Kingdom

39 ¹⁵ Institute of Pharmacology and Toxicology Department of Veterinary Medicine, Freie Universität
40 Berlin, Berlin, Germany

41 ¹⁶ Department of Sociology, University of Warwick, Coventry, United Kingdom

42 ¹⁷ Understanding Animal Research, London, United Kingdom

43 ¹⁸ Centre for Research in Animal Behaviour, Psychology, University of Exeter, Exeter, United Kingdom

44 ¹⁹ Biological Services Facility (BSF), Faculty of Life Sciences, University of Manchester, Manchester,
45 United Kingdom

46 ²⁰ Department of Environmental Studies, Hobart and William Smith Colleges, Geneva, New York,
47 United States of America

48 ²¹ Animal Sciences Unit, Animal and Plant Health Agency Weybridge, Addlestone, United Kingdom

49 ²² School of Agriculture, Food & Rural Development, Newcastle University, Newcastle upon Tyne,
50 United Kingdom

51 ²³ Exeter Centre for the Study of the Life Sciences (Egenis) & Department of Sociology, Philosophy
52 and Anthropology, University of Exeter, Exeter, United Kingdom

53 ²⁴ School of Biomedical Sciences, Faculty of Biological Sciences, University of Leeds, Leeds, United
54 Kingdom

55 ²⁵ Research Animals Department, Science Group, RSPCA, Wilberforce Way, Southwater, West Sussex,
56 United Kingdom

57 ²⁶ Biotechnology and Biological Sciences Research Council (BBSRC), Swindon, United Kingdom

58 ²⁷ Faculty of Medicine & Health Sciences, University of Nottingham, Leicestershire, United Kingdom

59 ²⁸ School of Planning and Geography, College of Art, Humanities and Social Sciences, Cardiff
60 University, Cardiff, United Kingdom

61 ²⁹ Department of the History of Science, University of Wisconsin—Madison, Madison, Wisconsin,
62 United States of America

63 ³⁰ UBC Animal Welfare Program, Vancouver, BC, Canada

64 ³¹ School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom

65 ³² Faculteit of Law, VU University, Amsterdam, The Netherlands

66 ³³ School for Social and Community Medicine, University of Bristol, Bristol, United Kingdom

67 ³⁴ School of History, Queen Mary, University of London, London, United Kingdom

68 ³⁵ Department of Geography and Environment, University of Southampton, Southampton, United
69 Kingdom

70 ³⁶ Honorary Research Associate, Geography Department, Royal Holloway, University of London,
71 London, United Kingdom

72 ³⁷ Department of Sociology, Philosophy and Anthropology, University of Exeter, Exeter, United
73 Kingdom

74 ³⁸ Institute of Biomedical and Clinical Sciences, University of Exeter Medical School, Exeter, United
75 Kingdom

76 ³⁹ Mary Lyon Centre, MRC Harwell, Harwell, United Kingdom

77 ⁴⁰ Faculty of Science, The Open University, Milton Keynes, United Kingdom

78 ⁴¹ Named Veterinary Surgeons Group, Royal Veterinary College, London, United Kingdom

79 ⁴² School of Veterinary Medicine, University of Surrey, Guildford, Surrey, United Kingdom

80

81 *Corresponding author

82 E-mail: g.f.davies@exeter.ac.uk (GFD)

83

84 **Abstract**

85 Improving laboratory animal science and welfare requires both new scientific research and
86 insights from research in the humanities and social sciences. Whilst scientific research provides
87 evidence to replace, reduce and refine procedures involving laboratory animals (the ‘3Rs’), work in
88 the humanities and social sciences can help understand the social, economic and cultural processes
89 that enhance or impede humane ways of knowing and working with laboratory animals. However,
90 communication across these disciplinary perspectives is currently limited, and they design research
91 programmes, generate results, engage users, and seek to influence policy in different ways. To
92 facilitate dialogue and future research at this interface, we convened an interdisciplinary group of 45
93 life scientists, social scientists, humanities scholars, non-governmental organisations and policy-
94 makers to generate a collaborative research agenda. This drew on methods employed by other
95 agenda-setting exercises in science policy, using a collaborative and deliberative approach for the
96 identification of research priorities. Participants were recruited from across the community, invited
97 to submit research questions and vote on their priorities. They then met at an interactive workshop
98 in the UK, discussed all 136 questions submitted, and collectively defined the 30 most important
99 issues for the group. The output is a collaborative future agenda for research in the humanities and
100 social sciences on laboratory animal science and welfare. The questions indicate a demand for new
101 research in the humanities and social sciences to inform emerging discussions and priorities on the
102 governance and practice of laboratory animal research, including on issues around: international
103 harmonisation, openness and public engagement, ‘cultures of care’, harm-benefit analysis and the
104 future of the 3Rs. The process outlined below underlines the value of interdisciplinary exchange for
105 improving communication across different research cultures and identifies ways of enhancing the
106 effectiveness of future research at the interface between the humanities, social sciences, science
107 and science policy.

108

109 **Introduction**

110 A recent editorial in *Nature* makes the case that social, economic and cultural issues should be
111 taken into account in the initial framing of research agendas as these factors are critical to the
112 subsequent take-up of scientific developments [1]. The potential social, economic and cultural issues
113 informing laboratory animal science and welfare are significant and complex. We review these
114 below before outlining the methods and outcomes of a collaborative process for developing a future
115 agenda for humanities and social scientific research on laboratory animal science and welfare. This
116 process and resulting agenda aim to develop the capacity for future collaborative research involving
117 the humanities and social sciences, to address these important issues and contribute to their
118 inclusion in the framing of future research agendas in this field.

119 The use of animals in biomedical research continues to be an area of public and scientific
120 debate. The broad social acceptability of laboratory animal research, as suggested in opinion polls in
121 the UK [2], depends upon a tacit social contract between citizens, scientists and the state. Whilst
122 individuals may oppose laboratory animal research, its continued social acceptability can be
123 evidenced through these polls. Yet, they also indicate the conditionality of public support, showing
124 how responses vary according to the extent to which there are no alternatives, minimisation of
125 harms to animals, and benefits for human and/or animal health. This variability demonstrates the
126 importance of assurances, assumed or demanded by different groups of the public, that the
127 governance of research and practices of science can match these expectations. Relations between
128 state, science and social trust are thus crucial to the social acceptability of laboratory animal
129 research; yet, they are also contested and changeable [3-4]. Ideas about socially acceptable
130 experimental practices involving laboratory animals have changed over time in response to changes
131 within science and across society [5-8]. They also vary over space; evident in the recent European
132 Citizens' Initiative to 'Stop Vivisection' [9]. As the organisation of laboratory animal research
133 becomes increasing transnational [10-11], with growing imperatives for translational benefits [12-

134 14], and developing demands for transparency [15-18], the social relations underpinning support for
135 laboratory animal research cannot simply be assumed. On the contrary, they should be taken into
136 account in the framing of future research.

137 Social factors are also relevant to the policy interventions and internal practices of laboratory
138 animal science and welfare. Social, economic and localized institutional factors influence the ability
139 of those working within laboratory animal research and care to respond to new forms of regulation,
140 ethical assessment, data practices and animal welfare science [19]. A growing number of policy
141 processes are seeking to balance developments in biomedical research with considerations of animal
142 welfare, for example through the international promotion of ethical review, harm-benefit analysis,
143 application of the principles of the 3Rs (Replacement, Reduction and Refinement) [20] and the
144 ARRIVE guidelines on reporting animal research [21-22]. Yet, these initiatives vary internationally
145 and are often uneven or ambiguous in application [23-26], suggesting that culture has an important
146 role to play. There are also efforts to extend care through international veterinary training [27], and
147 harmonise regulations through policy review [28]; once again, these have to contend with and
148 accommodate local differences in practice and social context. Furthermore, debates on
149 reproducibility and bias, relevant to the benefits of laboratory animal research, indicate how
150 individual, institutional and commercial pressures on scientists may influence the selection of data
151 and presentation of results [29-33]. Given the importance of these and other social factors in
152 shaping laboratory animal science and welfare, we propose a crucial role for humanities and social
153 science research in developing evidence to understand the influence of social, economic, and
154 cultural factors within the practices of laboratory animal science, as well as in the wider public.

155 This paper describes a collaborative process designed to create a shared research agenda for
156 defining and prioritizing interdisciplinary questions around the social, economic and cultural
157 dimensions to laboratory animal science and welfare. The process sought to define questions
158 amenable to study by the concepts and methods of the humanities and social sciences and identify

159 areas where scientists and other stakeholders agreed that innovative interdisciplinary approaches
160 could be most productively applied. The process builds on recent experiments in the development of
161 collaborative research agendas, which were pioneered in conservation biology and ecology [34-35],
162 and have been extended to include research questions at the science-policy interface [36-37] and
163 elsewhere [38]. Many of these have become both widely cited and generative of new research
164 projects in their respective fields. As such, collaborative processes have been shown to contribute to
165 capacity building for interdisciplinary enquiry by improving mutual understanding and trust between
166 different research communities, especially at the interfaces of science and policy. This experiment in
167 extending these processes to the development of a collaborative agenda for humanities and social
168 scientific research on laboratory science and welfare confirms the value of framing research
169 questions collaboratively through open dialogue and communication.

170 **Methods**

171 The optimum process for structuring the production of a collaborative research agenda differs
172 according to the aims of the study, the scope of the field and the scale of the enquiry [38]. The
173 process used in this research had four main aims: to define a collaborative agenda for humanities
174 and social scientific research on laboratory animal science and welfare, to enhance communication
175 and understanding between disciplines, to develop relationships important for knowledge transfer
176 and impact, and to increase research capacity within the social science and humanities. It followed
177 prior methods in adopting a four-stage process consisting of the recruitment of participants, the
178 generation of questions, the agreement of priorities (through discussion and voting), and the
179 collective drafting of outcomes. At each stage, the process made explicit commitments to openness
180 and inclusivity, in order to develop an honest and constructive dialogue between different
181 perspectives in a field often characterised by polarized opinions. Previous initiatives on much
182 broader topics have produced lists of up to 100 questions [34-38]. Our goal of producing 30
183 questions therefore reflects the more specific nature of the animal research topic, as well as our

184 practical desire to maximise discussion within the time available.. The methodology is outlined
185 below; a more detailed explanation of every step used in this process is provided in supplementary
186 materials (S1 Methodological Details).

187 The process was organised and facilitated by a small team of humanities and social science
188 scholars. This group has experience of researching the social, historical and cultural dimensions to
189 laboratory animal science and welfare [3, 17, 19, 39-45], and had previously collaborated in
190 establishing the Laboratory Animals in the Social Sciences and Humanities (LASSH) network in 2014
191 [46]. These prior activities were an important precursor to building the relations, trust and networks
192 for collaborative work. The organisers were also guided by past research on deliberative processes in
193 controversial areas of science [47-48] and made explicit commitments to participants that the
194 process would be inclusive, collaborative, deliberative and transparent. Inclusivity meant being
195 aware of and open to the diversity of potentially relevant stakeholder perspectives, in recruitment
196 and communication with participants. To facilitate a collaborative approach, the process sought to
197 open-up established framings of the issues by a mix of methods: treating all submitted research
198 questions anonymously, then allowing participants to refine questions through face-to-face
199 deliberation and the exchange of reasons with others at the workshop. Transparency was
200 maintained by informing participants of all stages of the process and in all iterations of the
201 development and prioritization of research questions, via email and at the workshop.

202 The participants in this agenda-setting exercise were recruited through purposeful or theoretical
203 sampling, rather than representative sampling. The aim is thus to maximise diversity in terms of the
204 range of perspectives on laboratory animal science and welfare. The overall process involved 45
205 participants, with 35 attending the workshop, and incorporated a range of expertise from the
206 humanities, social sciences, biological research, animal welfare science, science policy-makers,
207 animal advocacy groups and other stakeholders (see author list). Around one third of those present
208 were current personal licence holders, permitting them to carry out licensed procedures on animals

209 under the UK's Animals (Scientific Procedures) Act 1986, although a larger number had past
210 experience of using animals in biomedical research. Each participant was encouraged to consult their
211 colleagues and peers in generating the initial list of questions. Five participants reported running
212 pre-workshops or discussion fora in their institutions. Around 100 individuals were involved in
213 producing an initial list of questions, emailed to the organisers, indicating their proposed ideas for
214 new interdisciplinary research on laboratory animal science and welfare.

215 The collated list of 136 questions was circulated to all participants, via email, for an initial round
216 of voting on priorities. Participants then met at an interactive day workshop in London. This enabled
217 participants to discuss and decide on the final agenda together, through a mix of small group
218 discussions and plenary sessions. Small group discussions enabled the clarification of issues and the
219 redefinition of questions, so they could be met by research in collaboration with the humanities and
220 social sciences. The closing plenary involved discussion to prioritise these questions into a future
221 agenda for new research on laboratory animal science and welfare. The final editing and grouping of
222 questions took place over email. This resulted in a collaborative research agenda comprising 30
223 priority questions, grouped into four thematic categories to aid communication and application. No
224 attempt was made to rank the final list of priority questions.

225 This exercise was considered and approved by the Geography Discipline Ethics panel for the
226 grant holder, Gail Davies, at the University of Exeter. Other than protection of personal data, the
227 research was not felt to raise significant ethical issues. All those participating in the submission and
228 final definition of questions provided written consent to participate in the study. The workshop
229 organisers, Davies, Greenhough, Hobson-West and Kirk, led on the production of the paper. All
230 participants, by virtue of their contribution to generating, defining and prioritizing questions in the
231 workshop, and via email, were invited to become authors of the paper.

232 **Results**

233 The collaborative research agenda for humanities and social scientific research on laboratory
234 animal science and welfare is presented below. The research questions produced reflect the
235 considerable and collective efforts of all participants. Each question provides the starting point for
236 developing future innovative research in the social sciences and humanities responsive to, and in
237 dialogue with, the needs of the animal research and welfare community.

238 **Changing Contexts in Science and Policy**

- 239 1. How are moves towards open science, data accessibility and greater transparency
240 influencing research design and practices in laboratory animal research?
- 241 2. In what contexts do the practices and governance of animal research become responsive to
242 change (e.g. in the context of new technologies and emerging risks), and how can these
243 inform the development of better regulation?
- 244 3. What are the drivers for, and implications of, international circulations of expertise in
245 relation to changing national practices and policies of laboratory animal science?
- 246 4. How does, and could, attending to animal welfare generate different forms of value (e.g.
247 research innovations, economic opportunities, social acceptability) for different groups?
- 248 5. How is the credibility of animal models and non-animal alternatives constructed, decided
249 upon and challenged in different contexts?
- 250 6. What factors (e.g. scientific, animal welfare, economic, political) influence the sourcing,
251 breeding and transportation of animals in laboratory animal research and use?
- 252 7. In what ways have legislative categories that offer enhanced protection to some species
253 over others, shaped and been shaped by attitudes to and uses of animals in research?
- 254 8. How do species categories and characteristics get used and amended as indicators of
255 *sentience* within animal research and care practices?

256 **Cultures of Animal Care**

- 257 9. How can a *culture of care* be defined, what does it look like in institutions where it is
258 functioning well, and what factors enable or constrain its development?
- 259 10. How, and with what implications, does the practice and understanding of a *culture of care*
260 differ according to personal, professional, institutional and other contexts?
- 261 11. How can animal care staff and other individuals be supported or empowered to improve
262 good welfare practices and policy, and what are the institutional and other barriers to
263 realising this?
- 264 12. What is the significance of *emotional labour*, and the potential for processes of
265 de/sensitization, for developing a *culture of care* and sustaining animal care as a profession?
- 266 13. How can innovations in practices of care be fostered within and across local, national and
267 international contexts?
- 268 14. How do recruitment strategies and motivations for entering the animal care profession
269 impact upon a *culture of care*?
- 270 15. How do the emotional, embodied and affective relations between animals and people shape
271 animal research and care practices?

272 **Public Attitudes and Engagement**

- 273 16. Where are the opportunities for greater and meaningful public and stakeholder engagement
274 in the policy and practices of animal research?
- 275 17. What, and in what contexts, do different publics want to know about animal research?
- 276 18. How do peoples' life experiences and other factors (e.g. profession, religion, health, pet-
277 keeping) influence attitudes and behaviours around animal research?
- 278 19. What factors influence the construction of trust around animal research in diverse publics?
- 279 20. What is the influence of primary, secondary and tertiary education on people's attitudes to
280 the use of animals in education and research?

281 21. How do understandings of animal experience and personal motivation influence public
282 attitudes towards the use of animals in research and how does this compare to other sectors
283 (e.g. agriculture)?

284 **Ethical Review and Replacement, Reduction and Refinement** 285 **(3Rs) in Animal Research**

286 22. How do harm-benefit assessments of proposed animal research involve the contributions
287 from different roles, knowledges and ethical positions, and how are these resolved in
288 practice?

289 23. How is the promissory discourse around the *translation* of animal research to humans
290 influencing practitioner, policy-maker and public understandings of harm-benefit analysis?

291 24. What are the consequences for laboratory animals, researchers and animal care staff of the
292 new EU requirement to record the actual (as opposed to predicted) severity of procedures?

293 25. How do harm-benefits assessments vary according to the use of animals for different
294 permissible purposes (e.g. basic research, treatment of disease, animal welfare, species
295 preservation)?

296 26. What factors shape the format, content and communication of decision-making in the
297 ethical review of animal research in different contexts?

298 27. In what ways have the 3Rs been taken up and interpreted in different national contexts?

299 28. What factors influence the way researchers in different types of organisations implement
300 and use the 3Rs?

301 29. How do different stakeholders define, use, and prioritise the 3Rs, in both rhetoric and
302 reality?

303 30. To what extent are the 3Rs still fit for purpose and in what ways might they need to be
304 superseded or supplemented?

305 **Discussion**

306 The final research agenda is a collective summation of current questions regarding the social,
307 economic and cultural aspects of laboratory animal research and policy. We propose that this new
308 agenda demonstrates the common ground on which future collaborative research can be developed.
309 It can be used to ensure time and resources are directed to those issues commanding interest across
310 the humanities and social sciences and where new research can make significant difference to
311 laboratory policy and practice. We recognise there are barriers, especially in funding for
312 interdisciplinary research in an increasingly competitive research environment. However, we suggest
313 the collaborative derivation of this research agenda highlights the scientific, social and political value
314 of this area of research, with topics closely aligned to funder priorities. For example, the UK's BBSRC
315 has recently established a collaborative network to foster the best in animal welfare research which
316 involves social science and humanities scholars. Other examples of work which tie in to the agenda
317 we describe here including work on data-driven biology and the 3Rs (BBSRC), the bioeconomy
318 (Horizon 2010), big data and health innovation (ESRC). Together, these initiatives confirm the value
319 of multi-disciplinary conversations which are increasingly central to research [49].

320 As we now discuss, the four themes listed above provide a broad framework for formulating
321 research priorities and new programmes of research. First, there is an important set of questions
322 which reflect the changing international landscapes of animal research. Research priorities here
323 include understanding how international changes in biological research, open data and open access,
324 legislation on the sourcing and use of animals, and understandings of sentience may alter the
325 regulation and practice of animal research. Second, there are questions around the different aspects
326 of a 'culture of care'. The establishment and maintenance of a culture of care within institutions is
327 now the explicit focus of regulation, training and compliance in the UK and EU. The research
328 questions here suggest recognition of the growing importance of this concept, and reflect
329 participant uncertainties around how it might be identified, understood and enacted across research

330 and regulation. Thirdly, there is a recurrent interest in the ways different publics come to
331 understand, trust and hold different attitudes towards animal research. These questions require
332 consideration of changing cultural and social contexts, as well as the changing science and regulation
333 of laboratory animal science and welfare. Finally, there is renewed attention and evaluation of the
334 ethical framework underpinning animal research governance, including the principles of 3Rs
335 (replacement, reduction and refinement) described by Russell and Burch's [20]. Conceived in the
336 1950s, and coming to prominence from the 1990s, the 3Rs are now widely recognised as providing a
337 framework for minimizing suffering within laboratory animal practice. Yet, there are challenges in
338 their implementation, and questions about their continued applicability. There is also recognition
339 that there are aspects of ethical review that exceed the 3Rs, such as good reporting, reproducibility
340 and robust experimental design [50], and also questions about the assumptions involved in harm-
341 benefit assessment, which are all open to further interdisciplinary enquiry.

342 The derivation of this research agenda through communication across the humanities, social and
343 laboratory animal sciences demonstrates the potential for developing collaborative responses to
344 these questions. It also acts as further validation of this collaborative method which has previously
345 been used in other fields [34-38]. Crucially in our case, there was a clear commitment from the
346 spectrum of participants to ways of working which were open-minded, transparent and accountable.
347 Meeting face-to-face, and over time, helps build communities of trust across different disciplines
348 and perspectives. This is crucially important given animal research often involves entrenched
349 positions. It also helped create a safe space where, for example, junior technicians spoke openly in
350 the presence of management and policy makers. The combination of individuals and interests in this
351 exercise allowed questions to emerge in novel ways, supported by evidence from practitioners and
352 enriched by interdisciplinary exchange. This ensured no one discipline dominated the final framing
353 of questions, and that questions have both relevance for the scientific community and significance
354 for researchers within the humanities and social sciences.

355 Yet, the disciplines involved in this process do have specialised languages reflecting the concepts
356 and practices important to them [51-52]. There are differences across and within the sciences, social
357 sciences and humanities. The involvement of laboratory animal scientists and other practitioners
358 was essential for framing questions with the potential to gain traction with stakeholders. The
359 involvement of these participants meant others could clarify their understandings of key terms, roles
360 and concepts in laboratory animal science at an early stage. Yet, some ambiguities could not be
361 removed from the final questions. For example, a good ‘culture of care’ is now a key objective in the
362 regulation of laboratory animal research in and beyond the UK [53]. Yet, the term has wider
363 meanings in clinical contexts [54], in relation to care ethics [55], or in relation to other concepts such
364 as emotional labour [56]. We have left certain terms in italics to indicate their potential variability.
365 However, we have not sought to remove these ambiguities as they could be productive – in
366 signalling adaptability and opening up useful conversations – or a challenge – in indicating an
367 inconsistency which is an obstacle to communication. Both are significant points for further
368 research. In addition, and across all questions, technical discussion explored whether questions were
369 addressed to research on whole organisms, or research using animal tissues. We would encourage
370 future users of this agenda to identify and draw out these differences when relevant.

371 The involvement of representatives from anthropology, geography, history and sociology
372 foregrounds an interest in social and spatial variations in laboratory animal practices. This was also
373 evident in practitioner enquiries into international and other differences, their causes and
374 implications for laboratory animal science and welfare. Some geographical issues are explicit in the
375 final set of research priorities, but going forward we would emphasize the need for empirical studies
376 across laboratories and across countries to fully understand the increasingly globalized contexts of
377 many of the questions. Contribution from historians and humanities scholars also highlighted how
378 relations between laboratory animal science, animal welfare and the governance of research have
379 changed over time. These conversations were similarly enriched by personal accounts from those
380 with long careers in animal research and welfare. Current research policies and practices have

381 histories that are important for understanding the circumstances in which they emerged, their
382 present operation and future development. Some research questions inquire into particular aspects
383 of history, but again there is an opportunity to add a temporal dimension to other aspects of this
384 agenda. Throughout, this attention to comparison foregrounds the interactions between regulatory
385 frameworks, policy processes and the implementation of practice, which are often absent from
386 individual ethnographic accounts of animal care.

387 The emergence of new research ideas through this process strengthens studies suggesting
388 humanities and social science scholars can make important contributions by facilitating reflection on
389 scientific practices within, as well as outside of, the scientific community [57-59]. This approach to
390 science does not seek to undermine the value of scientific knowledge, but to recognise its plurality in
391 practice and identify the contextual factors which influence how different ways of knowing and
392 working with animals emerge as dominant in different times and places [60]. It also emphasizes the
393 need to foster dialogue about the diversity of practices across sites, to help identify and share best
394 practice, and to understand what enables or constrains multi-disciplinary communication and
395 collaboration, without collapsing one discipline into another.

396 The ongoing nature of social, economic and cultural change means it is unlikely there will be a
397 simple or final answer to the research questions generated in this collaborative agenda-setting
398 process. For experimental scientists, working to generate data and reduce uncertainty, the open and
399 reflexive nature of questioning and explanation in the humanities and social sciences can be
400 challenging. Nevertheless, this was not the dominant experience in this exercise. The collaborative
401 process and publication demonstrates the shared commitment to communication and research
402 across disciplinary divides. By staging a structured conversation to generate research questions
403 together, this process has deepened interdisciplinary understandings and demonstrated future
404 capacity for careful collaborative enquiry.

405 **Conclusions**

406 To recap the *Nature* editorial with which we opened, we would agree we ‘need to support a
407 capacity to understand society that is as deep as [...] our capacity to understand the science’ in the
408 area of laboratory animal science and welfare [1]. To achieve this, we need to generate and prioritise
409 research questions that effectively get to the heart of the social and ethical issues, and adequately
410 address the dilemmas and challenges faced by laboratory animal stakeholders. The authors consider
411 that the questions resulting from this interdisciplinary process do have significant merit in
412 functioning as a credible research and funding agenda going forward. This agenda should therefore
413 encourage future empirical research projects which demonstrate the social, economic and cultural
414 interactions that influence responses to new scientific research and regulation, within and outside of
415 the scientific community. Indeed, the questions identified in this collaboration are already being
416 used by some of the authors to develop novel research proposals and deepen relationships for
417 shared enquiry. We therefore predict that future social science research will be able to provide
418 greater understanding of how biomedical research, using animals, succeeds or fails to become
419 credible with the public. Policy relevant work could complement welfare science agendas focusing
420 on the experience of the animal by identifying the international and local infrastructures that
421 influence the adoption of particular practices. Humanities research can contribute to recognising the
422 communicative, embodied and empathetic practices that underpin a ‘culture of care’ and connect
423 the day-to-day work of laboratory animal research and welfare with the welfare of staff and
424 researchers. More broadly, interdisciplinary agenda-setting processes of the kind described in the
425 present paper can help secure advances in our understanding of contested areas of scientific and
426 technological practice.

427 **Acknowledgements**

428 This project was organised as an activity of the Laboratory Animals in the Social Sciences and
429 Humanities (LASSH) network (<http://labanimalstudies.net/>). Thanks to Friends House, London, for

430 hosting this event. We would like to thank William J. Sutherland for formative conversations in the
431 development of this process and recognise the generous contribution of time from all participants.

432 **References**

- 433 1. Editorial: Time for the social sciences. *Nature*, 2015; 517: 5. doi:10.1038/517005a
- 434 2. Ipsos Mori. Attitudes to animal research in 2014. Available: [https://www.ipsos-](https://www.ipsos-mori.com/researchpublications/publications/1695/Attitudes-to-animal-research-in-2014.aspx)
435 [mori.com/researchpublications/publications/1695/Attitudes-to-animal-research-in-](https://www.ipsos-mori.com/researchpublications/publications/1695/Attitudes-to-animal-research-in-2014.aspx)
436 [2014.aspx](https://www.ipsos-mori.com/researchpublications/publications/1695/Attitudes-to-animal-research-in-2014.aspx)
- 437 3. Hobson-West P. The role of 'public opinion' in the UK animal research debate. *J Med Ethics*.
438 2010; 36: 46-49.
- 439 4. Ormandy EH, Schuppli CA. Public attitudes toward animal research: a review. *Animals*. 2014;
440 4(3): 391-408.
- 441 5. Ferdowsian HR, Beck N. Ethical and Scientific Considerations Regarding Animal Testing and
442 Research. *PLoS ONE*. 2011; 6(9): e24059. doi:10.1371/journal.pone.0024059
- 443 6. Franco NH. Animal experiments in biomedical research: a historical perspective. *Animals*
444 2013; 3(1): 238-273.
- 445 7. Guerrini, Anita. *Experimenting with humans and animals: from Galen to animal rights*.
446 Baltimore, Maryland: John Hopkins University Press; 2003.
- 447 8. Rudacille, Deborah. *The scalpel and the butterfly: the war between animal research and*
448 *animal protection*. London, England: Macmillan Publishers; 2000.
- 449 9. European Commission. Communication from the commission on the European Citizens'
450 Initiative 'Stop Vivisection'. 2015. available:
451 http://ec.europa.eu/environment/chemicals/lab_animals/pdf/vivisection/en.pdf
- 452 10. MacArthur Clark JA. A Global Vision for Laboratory Animal Medicine. *AATEX*. 2007; 14: 735-
453 737.

- 454 11. Davies G, Frow E, Leonelli S. Bigger, faster, better? Rhetorics and practices of large-scale
455 research in contemporary bioscience. *Biosocieties*. 2013; 8: 386-396.
- 456 12. Wells D. Improving translational studies: lessons from rare neuromuscular diseases. *Dis*
457 *Model Mech*. 2015; 8(10): 1175-7.
- 458 13. Mak, I. W., Evaniew, N., & Ghert, M. (2014). Lost in translation: animal models and clinical
459 trials in cancer treatment. *Am J Transl Res*, 6(2): 114–118.
- 460 14. Friese C. Realizing Potential in Translational Medicine. *Curr Anthropol*. 2013; 54: S129-S138.
- 461 15. Understanding Animal Research: Concordat on Openness on Animal Research. 2014.
462 Available: [http://www.understandinganimalresearch.org.uk/policy/concordat-openness-](http://www.understandinganimalresearch.org.uk/policy/concordat-openness-animal-research/)
463 [animal-research/](http://www.understandinganimalresearch.org.uk/policy/concordat-openness-animal-research/)
- 464 16. Yeates JW, Reed B. Animal research through a lens: transparency on animal research. *J Med*
465 *Ethics*. 2015; 41(7): 504-505.
- 466 17. McLeod C, Hobson-West P. Opening up animal research and science-society relations? A
467 thematic analysis of transparency discourses in the UK. *Public Underst Sci*. 2015; doi:
468 10.1177/0963662515586320.
- 469 18. Holmberg T, Ideland M. Secrets and lies: ‘selective openness’ in the apparatus of animal
470 experimentation. *Public Underst Sci*. 2012; 21: 354-368.
- 471 19. Hobson-West P. Ethical boundary-work in the animal research laboratory *Sociology*. 2012;
472 46: 649-663.
- 473 20. Russell WMS, Burch RL. *The principles of humane experimental technique*. London:
474 Methuen; 1959.
- 475 21. Kilkenny C, Browne WJ, Cuthill IC, Emerson M, Altman DG. The ARRIVE guidelines: Animal
476 Research: Reporting of *In Vivo* Experiments. NC3Rs. 2013. Available:
477 [https://www.nc3rs.org.uk/sites/default/files/documents/Guidelines/NC3Rs%20ARRIVE%20](https://www.nc3rs.org.uk/sites/default/files/documents/Guidelines/NC3Rs%20ARRIVE%20Guidelines%202013.pdf)
478 [Guidelines%202013.pdf](https://www.nc3rs.org.uk/sites/default/files/documents/Guidelines/NC3Rs%20ARRIVE%20Guidelines%202013.pdf)

- 479 22. Kilkenny C, Browne WJ, Cuthill IC, Emerson M, Altman DG. Improving Bioscience Research
480 Reporting: The ARRIVE Guidelines for Reporting Animal Research. *PLoS Biol.* 2010; 8:
481 e1000412. doi:10.1371/journal.pbio.1000412.
- 482 23. Baker D, Lidster K, Sottomayor A, Amor S. Two years later: journals are not yet enforcing the
483 ARRIVE guidelines on reporting standards for pre-clinical animal studies. *PLoS Biol.* 2014;
484 12(1): e1001756
- 485 24. Schuppli CA. Decisions about the use of animals in research: Ethical reflection by Animal
486 Ethics Committee members. *Anthrozoos.* 2011; 24: 409-425.
- 487 25. Olsson IAS, Franco NH, Weary DM, Sandøe P. The 3Rs principle—mind the ethical gap! *ALTEX.*
488 2012; 1: 333–336
- 489 26. Hobson-West P. What kind of animal is ‘The Three Rs’? *Altern Lab Anim.* 2009; 37: 95-99.
- 490 27. Turner PV, Pekow C, Clark JM, Vergara P, Bayne K, White WJ, Kurosawa TM, Seok SH, Baneux
491 P. Roles of the International Council for Laboratory Animal Science (ICLAS) and International
492 Association of Colleges of Laboratory Animal Medicine (IACLAM) in the Global Organization
493 and Support of 3Rs Advances in Laboratory Animal Science. *J Am Assoc Lab Anim Sci.* 2015
494 Mar;54(2):174-80.
- 495 28. Rose M, Everitt J, Hedrich H, Schofield J, Dennis M, Scott E, Griffin G; ICLAS Working Group
496 on Harmonization: international guidance concerning the production care and use of
497 genetically-altered animals. *Lab Anim.* 2013 Jul;47(3):142-52
- 498 29. Kilkenny C, Parsons N, Kadyszewski E, Festing MFW, Cuthill IC, Fry D, et al. Survey of the
499 Quality of Experimental Design, Statistical Analysis and Reporting of Research Using Animals.
500 *PLoS ONE.* 2009; 4: e7824. doi:10.1371/journal.pone.0007824;
- 501 30. Avey MT, Fenwick N, Griffin G. The Use of Systematic Reviews and Reporting Guidelines to
502 Advance the Implementation of the 3Rs. *J Am Assoc Lab Anim Sci,* 2015; 54: 153-162.

- 503 31. Ioannidis JP, Greenland S, Hlatky MA, Khoury MJ, Macleod MR, Moher D, Schulz KF,
504 Tibshirani R. Increasing value and reducing waste in research design, conduct, and analysis.
505 *Lancet*. 2014; 383(9912): 166-75.
- 506 32. Macleod MR, McLean AL, Kyriakopoulou A, Serghiou S, de Wilde A, Sherratt N, Hirst T,
507 Hemblade R, Bahor Z, Nunes-Fonseca C, Potluru A. Risk of bias in reports of in vivo research:
508 a focus for improvement. *PLoS Biol*. 2015; 13(10): e1002273.
- 509 33. Freedman LP, Cockburn IM, Simcoe TS. The Economics of Reproducibility in Preclinical
510 Research. *PLoS Biol*. 2015; 13(6): e1002165. doi:10.1371/journal.pbio.1002165
- 511 34. Sutherland WJ, Adams WM, Aronson RB, Aveling R, Blackburn TM, Broad S, et al. One
512 hundred questions of importance to the conservation of global biological diversity. *Conserv*
513 *Biol*. 2009; 23: 557-567.
- 514 35. Sutherland WJ, Armstrong-Brown S, Armsworth P, Tom B, Brickland J, Campbell CD, et al.
515 The identification of 100 ecological questions of high policy relevance in the UK. *J Appl Ecol*.
516 2006; 43: 617-627.
- 517 36. Parker M, Acland A, Armstrong HJ, Bellingham JR, Bland J, Bodmer HC, et al. Identifying the
518 science and technology dimensions of emerging public policy issues through horizon
519 scanning. *PLoS ONE*. 2014; 9: e96480.
- 520 37. Sutherland WJ, Bellingham L, Bellingham JR, Blackstock JJ, Bloomfield RM, Bravo M, et al. A
521 collaboratively-derived science-policy research agenda. *PLoS ONE*. 2012; 7(3), e31824.
- 522 38. Sutherland WJ, Fleishman E, Mascia MB, Pretty J, Rudd MA. Methods for collaboratively
523 identifying research priorities and emerging issues in science and policy. *Methods Ecol Evol*.
524 2011; 2: 238-247.
- 525 39. Davies G. What is a humanized mouse? Remaking the species and spaces of translational
526 medicine. *Body Soc*. 2012; 18: 126-55.
- 527 40. Davies G. Caring for the multiple and the multitude: Assembling animal welfare and enabling
528 ethical critique. *Environ Plan D*. 2012; 30: 623-638.

- 529 41. Greenhough B, Roe EJ. Ethics, space, and somatic sensibilities: comparing relationships
530 between scientific researchers and their human and animal experimental subjects. Environ
531 Plan D. 2011; 29: 47-66.
- 532 42. Buller H, Roe E. Modifying and commodifying farm animal welfare: The economisation of
533 layer chickens. J Rural Stud. 2014; 33: 141-9.
- 534 43. Kirk RGW. Between the clinic and the laboratory: ethology and pharmacology in the work of
535 Michael Robin Alexander Chance, c.1946-1964. Med Hist. 2009; 53: 513-536.
- 536 44. Kirk RGW. A Brave New Animal for a Brave New World: The British Laboratory Animals
537 Bureau and the Constitution of International Standards of Laboratory Animal Production and
538 Use, circa 1947-1968. Isis. 2010; 101: 62-94.
- 539 45. Kirk RGW. The Invention of the 'stressed animal' and the development of a science of animal
540 welfare, 1947-86. In David C, Ramsden E, editors. Stress, shock, and adaptation in the
541 Twentieth Century. Rochester, NY: University of Rochester Press; 2014. pp.241-263.
- 542 46. Laboratory Animals in the Social Sciences and Humanities. 2014. Available:
543 <http://labanimalstudies.net/>
- 544 47. Burgess J, Stirling A, Clark J, Davies G, Eames M, Staley K et al. Deliberative mapping: a novel
545 analytic-deliberative methodology to support contested science-policy decisions. Public
546 Underst Sci. 2007; 16: 299-322.
- 547 48. Davies G. Mapping deliberation: calculation, articulation and intervention in the politics of
548 organ transplantation. Econ So. 2006; 35:232-58.
- 549 49. Social Sciences & Humanities. Horizon 2020. Available:
550 <https://ec.europa.eu/programmes/horizon2020/en/area/social-sciences-humanities>
- 551 50. ML Graham & MJ Prescott. The multifactorial role of the 3Rs in shifting the harm-benefit
552 analysis in animal models of disease. Eur J Pharmacol 2015; 759: 19–29
- 553 51. Barry A, Born G, Weszkalnys G. Logics of interdisciplinarity Econ Soc. 2008; 37: 20-49.
- 554 52. Buller H. The lively process of interdisciplinarity. Area. 2009; 41: 395-403.

- 555 53. Klein HJ, Bayne KA, Establishing a culture of care, conscience, and responsibility: Addressing
556 the improvement of scientific discovery and animal welfare through science-based
557 performance standards. *ILAR J.* 2007; 48: 3-11.
- 558 54. Greenhough B. Citizenship, care and companionship: Approaching geographies of health and
559 bioscience. *Prog Hum Geogr.* 2011; 35: 153-171;
- 560 55. Donovan J, Adams CJ, editors. *The feminist care tradition in animal ethics: a reader.* NY:
561 Columbia University Press; 2007.
- 562 56. Davies K, Lewis D. Can caring for laboratory animals be classified as Emotional Labour? *Anim
563 Technol Welfare.* 2010; 9: 1-6.
- 564 57. Gibbons M, Limoges C, Nowotny H, Schwartzman S, Scott P, Trow M. *The new production of
565 knowledge: The dynamics of science and research in contemporary societies.* London: Sage;
566 1994.
- 567 58. Doubleday R. Organizing accountability: co-production of technoscientific and social worlds
568 in a nanoscience laboratory. *Area.* 2007; 39: 166-175.
- 569 59. Pallett H, Chilvers J. Organizations in the making Learning and intervening at the science-
570 policy interface. *Prog Human Geogr.* 2015; 39: 146-66.
- 571 60. Jasanoff S. *Designs on nature: science and democracy in Europe and the United States.*
572 Princeton, NJ: Princeton University Press; 2011.

573 **Supporting Information**

574 **S1 File. This is the S1 Methodological Details.** This is the S1 File legend.