

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository:<https://orca.cardiff.ac.uk/id/eprint/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

Publishers page: <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<sup>1\*</sup>, Beth J Greenhough<sup>2</sup>, Pru Hobson-West<sup>3</sup>, Robert G W Kirk<sup>4</sup>, Ken Applebee<sup>5</sup>, Laura C  
10 Bellingan<sup>6</sup>, Manuel Berdoy<sup>7</sup>, Henry Buller<sup>8</sup>, Helen J Cassaday<sup>9</sup>, Keith Davies<sup>10</sup>, Daniela Diefenbacher<sup>11</sup>,  
11 Tone Druglitrø<sup>12</sup>, Maria Paula Escobar<sup>13</sup>, Carrie Friese<sup>14</sup>, Kathrin Herrmann<sup>15</sup>, Amy Hinterberger<sup>16</sup>,  
12 Wendy J Jarrett<sup>17</sup>, Kimberley Jayne<sup>18</sup>, Adam M Johnson<sup>19</sup>, Elizabeth R Johnson<sup>20</sup>, Timm Konold<sup>21</sup>,  
13 Matthew C Leach<sup>22</sup>, Sabina Leonelli<sup>23</sup>, David I Lewis<sup>24</sup>, Elliot J Lilley<sup>25</sup>, Emma R Longridge<sup>26</sup>, Carmen M  
14 McLeod<sup>27</sup>, Mara Miele<sup>28</sup>, Nicole C Nelson<sup>29</sup>, Elisabeth H. Ormandy<sup>30</sup>, Helen Pallett<sup>31</sup>, Lonneke Poort<sup>32</sup>,  
15 Pandora Pound<sup>33</sup>, Edmund Ramsden<sup>34</sup>, Emma Roe<sup>35</sup>, Helen Scalway<sup>36</sup>, Astrid Schrader<sup>37</sup>, Chris J  
16 Scotton<sup>38</sup>, Cheryl L Scudamore<sup>39</sup>, Jane A Smith<sup>40</sup>, Lucy Whitfield<sup>41</sup>, Sarah Wolfensohn<sup>42</sup>

17

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

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

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

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

26 <sup>5</sup> Biological Services, Health Schools, King's College London, London, United Kingdom

27 <sup>6</sup> Society of Biology, Charles Darwin House, London, United Kingdom

28 <sup>7</sup> Biomedical Services, University of Oxford, Oxford, United Kingdom

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

31 <sup>9</sup> School of Psychology, University of Nottingham, University Park, Nottingham, United Kingdom

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

34 <sup>11</sup> Society of Biology, Charles Darwin House, London, United Kingdom

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

37 <sup>13</sup> Department of Geography, King's College London, London, United Kingdom

38 <sup>14</sup> Department of Sociology, London School of Economics, London, United Kingdom

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

41 <sup>16</sup> Department of Sociology, University of Warwick, Coventry, United Kingdom

42 <sup>17</sup> Understanding Animal Research, London, United Kingdom

43 <sup>18</sup> Centre for Research in Animal Behaviour, Psychology, University of Exeter, Exeter, United Kingdom

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

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

48 <sup>21</sup> Animal Sciences Unit, Animal and Plant Health Agency Weybridge, Addlestone, United Kingdom

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

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

53 <sup>24</sup> School of Biomedical Sciences, Faculty of Biological Sciences, University of Leeds, Leeds, United  
54 Kingdom

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

57 <sup>26</sup> Biotechnology and Biological Sciences Research Council (BBSRC), Swindon, United Kingdom

58 <sup>27</sup> Faculty of Medicine & Health Sciences, University of Nottingham, Leicestershire, United Kingdom

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

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

63 <sup>30</sup> UBC Animal Welfare Program, Vancouver, BC, Canada

64 <sup>31</sup> School of Environmental Sciences, University of East Anglia, Norwich, United Kingdom

65 <sup>32</sup> Faculteit of Law, VU University, Amsterdam, The Netherlands

66 <sup>33</sup> School for Social and Community Medicine, University of Bristol, Bristol, United Kingdom

67 <sup>34</sup> School of History, Queen Mary, University of London, London, United Kingdom

68 <sup>35</sup> Department of Geography and Environment, University of Southampton, Southampton, United  
69 Kingdom

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

72 <sup>37</sup> Department of Sociology, Philosophy and Anthropology, University of Exeter, Exeter, United  
73 Kingdom

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

76 <sup>39</sup> Mary Lyon Centre, MRC Harwell, Harwell, United Kingdom

77 <sup>40</sup> Faculty of Science, The Open University, Milton Keynes, United Kingdom

78 <sup>41</sup> Named Veterinary Surgeons Group, Royal Veterinary College, London, United Kingdom

79 <sup>42</sup> School of Veterinary Medicine, University of Surrey, Guildford, Surrey, United Kingdom

80

81 \*Corresponding author

82 E-mail: [g.f.davies@exeter.ac.uk](mailto: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](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, Bellingan 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.