NUFFIELD COUNCIL ON BIOETHICS

The culture of scientific research

Summary of discussion events June-September 2014

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Background

1 The primary aim of the Nuffield Council on Bioethics project on the culture of scientific research* was to foster constructive debate among all those involved in scientific research about the culture of research in the UK and its effect on ethical conduct in science and the quality, value and accessibility of research. To help achieve this aim, the Council held a series of discussion events in collaboration with universities around the country to facilitate debate among researchers on this topic between June and September 2014.

2 Proposals for co-hosting an event were sent to 19 UK universities. Fifteen of the universities agreed to work with the Council and events were organised at a range of locations in England, Scotland, Wales and Northern Ireland. Annex 1 contains a full list of the locations, dates and speakers.

3 Most of the events were one and a half hours in length and held at lunchtime with a sandwich lunch provided beforehand. The format was typically a panel of three speakers each giving a ten-minute presentation, followed by a discussion with the audience for around one hour, facilitated by a chair. The Council worked with staff at the universities to decide on the focus of the events. A list of possible topics to discuss was supplied by the Council (see Annex 2). The universities either chose topics they thought would be most relevant and interesting to the local audience, and sought speakers to talk about those issues, or opted to keep the focus broad and allow their speakers to decide which topics to focus on.

4 In most cases, the Council worked with the universities to organise the panel of speakers. Efforts were made to ensure each panel incorporated a balance of levels of seniority, gender and scientific expertise. Speakers were predominantly local academics from the natural sciences. Academics from the

* See www.nuffieldbioethics.org/project/research-culture

social sciences and medical humanities and senior university administrators also spoke at some events. One speaker was the editor of a high profile science journal. A member of the project Steering Group, a member of Council or a senior member of the Council staff was a speaker or chair at every event. Sixty-three speakers and chairs took part in the events altogether. Speakers and chairs were sent a briefing note with guidance on the length, format and content of presentations and an outline of the structure of the event.

5 Most of the events were one-off events organised specifically as part of the Council's project and were open to anyone. However, the event at Sheffield University was arranged as an invitation-only event, linked to the Research and Innovation Services Office's wider activities to promote research integrity and standards. In Oxford, the event was presented as part of the University's public engagement lecture series and a high proportion of non-academics attended. All the events were free to attend.

6 The Council encouraged universities to use email circulars, newsletters and social media to promote the events to university researchers and other staff, as well as to research organisations and companies in the local area. Some of the universities designed posters to advertise the events (an example of which is included at Annex 3). The events were also publicised on the Council's website, Facebook page and Twitter feed. Members of the project Steering Group also helped to promote the events through the networks and social media channels of their organisations.

7 Participants registered for events by completing of a short, voluntary survey hosted on Survey Monkey. The survey asked participants about their area of science, the type of organisation they work for and their job title. This information can be found at Annex 4. The survey also asked participants to describe their single biggest concern about the research environment and submit any advance questions for the panel. A list of participants' answers to these questions can be found at Annexes 5 and 6. The speakers and chairs were sent information collected through the registration survey prior to the events. In total, 684 people registered for the 15 events. The exact number of people who attended the events is hard to quantify, given that people entering and the leaving the room were not strictly monitored. However, headcounts taken during the events suggest the actual number that attended overall is likely to be similar to the number that registered, given that slightly less people attended some events and additional people turned up on the day at others. Numbers attending each event varied, with 81 people registering for the event at University College London, for example, and 20 people registering for the event at the University of Exeter.

8 At each event a note taker recorded the issues raised in the presentations and audience discussion. A summary of the key topics and themes to emerge across all fifteen events follows.

Funding

Science funding and impact

9 A commonly expressed view across the events was that when science is funded by Government money it should be justified to the public. It was widely felt that science should be accountable and that people should be able to understand how money is being spent within science and should agree broadly with decisions about what research is being funded in the UK. This was seen as important for its own sake, but also as a means of protecting budgets for science research in Government spending reviews.

10 There was disagreement as to what public accountability entailed. Some felt that societal or economic impact is a worthy goal of science with a number of participants believing that scientists have obligations to tax payers to show their research has practical applications, and that it is appropriate for funding bodies to take potential public benefits of research into account in decision making. One speaker said that the prominence of impact has led to the development of schemes like the Economic and Social Research Council Collaborative Ventures Scheme in 2004, which involves recruiting funding partners from the private sector. Another speaker said that impact case studies, developed as part of university Research Excellence Framework submissions, are a high quality resource which could be used to support and justify the use of public money in supporting science research.

11 Others disagreed strongly. One speaker thought that incorporating goals of research impact into project design distorted the research process and perverted the scientific method. Concern was expressed that this focus has encouraged a move away from investigative or curiosity-driven research toward research aimed at generating economic benefits, which it was suggested is bad for science. A related view was that predictions about the impact of research are not reliable and should not be a part of grant proposal assessments. Some participants pointed out that impact can take a long time to manifest itself and therefore that it can be difficult to demonstrate, or even know, that one's research would go on to have impact. It was said that the impact of much important research throughout history could not have been predicted.

12 There was also disagreement as to how important the impact of research is to funders. A participant who worked at one of the research councils emphasised that research excellence, and not the 'impact statement' - the section of a funding proposal where an applicant sets out their aims and expectations for the impact of their research - continued to be the most important aspect of a grant application. Audience members, however, reported having had applications rejected on grounds of insufficient potential impact. Some discussion about how best to describe the potential impact of one's research took place at one event, with some researchers reporting that they are not confident they understand what kind of information should be included in impact statements.

Kinds of work funded

13 There were a number of points raised about the kinds of work that Research Councils and other funders support. Some felt that Research Councils' use of

themes and strategic priorities may induce researchers to pursue particular kind of research, making it more 'fundable', which over the long term may exert a distorting influence on what work is conducted. The responsibilities of funders to consider the broader influence of their decisions was highlighted by a panellist who pointed out that it may be problematic if decisions about focusing money in certain research areas were to lead scientists to 'reinvent themselves' as different kinds of researchers and pursue alternative areas of inquiry.

14 Several participants at different events expressed the view that replication work is not attractive to funders and that this is problematic, given the important role that reproducing results plays in science. One reply made to this point was that reproduction work is often undertaken by PhD students in the lab, although it is not always directly funded or subsequently published.

15 Some felt that funders, especially some of the larger bodies, are reluctant to take risks with research, and tended to fund the same projects, or research teams, repeatedly. One speaker said that more 'predictable' or 'safer' work tended to be favoured in the current climate. Another participant argued that some 'big names' in science in the UK continued to receive funding in spite of not always producing 'big' results. The Wellcome Trust New Investigator Awards, which are targeted at researchers in the first five years of their careers, was singled out as a kind of scheme running counter to such trends, which could be extended.

16 Some participants were concerned that current trends in funding are adversely affecting innovation. A number suggested that more 'blue skies' or basic research should be funded than is currently, although there were also dissenting voices who insisted that research should be directed towards tackling recognised fundamental problems in science. Multidisciplinary research was said by one participant to be more favoured by funders than by publishers.

17 Grant flexibility and uncertainty around which aspects of research are covered by research grants were other themes to emerge. Small portions of each grant should be made available to support the career development of post doctoral researchers recruited onto an award, one participant said. Another pointed out that there could be problems securing grant support for travelling to conferences and seminars. One participant made the point that some grants made funds available for data sharing activities and that support for this could be applied for in research proposals.

18 One speaker reported feeling pressure from public opinion. It was said that public perceptions about the value of research are more important now than in former years and that this could create obstacles for scientists in securing funding and getting ethical approval for certain kinds of research.

Influences on funding decisions

19 The use of peer review in different contexts was widely discussed across the events. Some participants felt that peer review panels assessing grant applications (see below for points raised on the use of peer review in publishing) may be subject to certain kinds of influence and are vulnerable to conflicts of interest and bias.

20 A key concern among participants related to conflicts of interest in peer reviewers. Researchers who were reviewing rival scientists' work could find themselves presented with opportunities to delay or undermine competitors' work. Hyper specialisation – the emergence of sub-fields of science within which only a small number of scientists could be considered 'expert' enough to peer review – was felt by a number of participants to be exacerbating this issue, since this made it more difficult to identify researchers who are not in direct competition with the scientists whose work they are reviewing.

21 Some felt that decision-makers in funding bodies have a responsibility to be aware of these issues when inviting scientists to peer review grant proposals, and that they should arbitrate on disputes. The view was also expressed that conflicts of interest are ultimately a matter of personal integrity, and that it is the responsibility of the scientist undertaking the review to make a fair, unbiased assessment of the work they are reviewing. It was pointed out that the peer reviewer's own reputation is at stake in the long-term and that this should provide a separate incentive for researchers to make a fair assessment of competitors' work.

22 A related issue regarding integrity and peer review concerned other kinds of bias. One participant stated that personal connections or perceptions around applicants' status would have played a more decisive role in funding decisions in the past, and that the current situation is an improvement on former models.

23 Conducting peer review for grant proposals was seen to be time consuming and one participant suggested that more junior scientists should be mentored and supported to become more involved in peer reviewing activities. Finding peer reviewers was seen to be challenging, especially around the time of the REF, one participant said.

24 There was discussion about the pros and cons of peer reviewers and researchers being anonymous in the peer review process as a means of addressing issues of bias. Attempting to anonymise applications may not be effective, some felt, as reviewers are sometimes asked to review entire teams, which are harder to anonymise. Some expressed scepticism about the possibility of genuinely anonymising applications in certain fields at all. It was also felt by some that a system in which peer reviewers are identified would be preferable since this would help to expose issues around conflicts of interests and may raise standards more broadly

25 One suggestion for addressing conflicts of interest and bias was to make more use of peer reviewers based at overseas institutions who are less likely to know applicants personally, and less likely to be in direct competition with them for funding. An idea for making standards in peer review more consistent was making public or accessible reviewers' comments on grant decisions so that other reviewers could see them and calibrate their own reviews accordingly.

26 A separate concern raised by more than one participant was the role of politics in decision making around funding and some wondered how Government priorities or interests may influence decisions. One of the speakers explained that application of the Haldane Principle is intended to

ensure that decisions about the funding of specific projects remain independent of Government, although one participant expressed the view that Government efforts towards commercialising science research may nevertheless be playing an undisclosed role in project specific funding.

27 It was pointed out by one participant that the key role a researcher's publication record plays in how decision-makers assess grant proposals means that journals have a high degree of power in the funding system. It was suggested that this is problematic given that decisions about what to publish made by editors are likely to be influenced by financial interests and journal sales. One of the speakers reported estimates that a publication in *Nature* could equate to $1 million in grants.

Different models of funding

28 The distribution of research funding was addressed at a number of events with participants offering suggestions for ways that money could be assigned to scientists differently. One issue related to size of grants awarded by funders and whether models which tended to award a lower number of large grants, or which awarded a higher number of smaller grants, are better overall for science. One view was that it is mostly senior scientists who benefit from the granting of large research awards. Another participant agreed, and thought that research is being concentrated in a smaller number of centres to which researchers gravitate. One participant gave examples of funders they felt are adopting positive approaches, such as the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) and Forest Research, which provide researchers with small amounts of seed funding. Other participants favoured long-term research grants, which they suggested are more likely to enable labs to offer scientists more stable employment contracts and working environments.

29 One participant made the point that the adoption of either funding model – fewer large grants or more small grants – would generate both winners and losers and the focus should instead be on fairness in assigning money to the most deserving projects. Another point made was that wider use of alternative sources of funding, such as foundations, charities and 'crowd-funding' should be considered by scientists.

30 A number of participants reported finding it more difficult than in the past to get funding. Some, however, argued that funding has always been difficult to secure and that whilst there may now be more people involved and more competition for available funding, the amount of money available for research has increased.

Publication

31 The importance of publishing the findings of research was widely recognised by participants at the discussion events, as well as the fact that competition for funding, jobs and promotions were adding to pressures on scientists to publish their work. The idea that there are ongoing and increasing incentives to publish ever more was voiced, with the effect that there may now be too much published research for scientists to reasonably keep abreast of.

32 Participants on the whole felt that peer review is an integral part of science, though a number of concerns about how peer review currently works were expressed. Many of the issues participants raised in relation to the use of peer review in publishing were similar to those raised in the context of funding decisions, such as conflicts of interest (see paragraphs x-y). These relate to competence of peer reviewers as well as a number of ethical concerns about peer reviewers' behaviour.

33 Various ethical issues concerning bias and conflicts of interest were raised, with participants expressing worries about impartiality. Anonymity in the peer review of papers came up in a number of the discussion events and there was some level disagreement over whether entirely anonymous – or 'double blind' review, where neither the author nor reviewer are identified – would have a positive or negative effect, or no effect at all.

34 Some felt that anonymising authors in the peer review process would help to address issues around bias, which may work either positively or negatively in respect to a given author. It was felt by some that factors like status, level of seniority or gender may influence how reviewers perceive work. However, one speaker referred to a trial of double-blind review undertaken by physics journals which had resulted in no significant difference in outcomes.

35 Arguments against anonymity were also posed. Some felt that peer reviewers should be identified and that more openness may help minimise unconstructive or rude comments. On the other hand, it was said, open peer review may also deter reviewers from saying anything negative. A second participant echoed this point, contending that junior or less well established researchers may feel less inclined to be critical of their seniors if their reviews are attributed to them. It was also suggested that "two reviewers may be better than one" and that researchers undertaking reviews may be inclined to behave more ethically when they are in the company of other reviewers, who know their identities. Within this debate, it was suggested that journals may want to stop short of insisting that reviewers are named, but instead give them the option of identifying themselves.

36 It was felt by some that there is a lack of time for busy academic scientists to competently review papers, with one participant reporting that they feel guilty about having insufficient time to provide genuinely constructive feedback. A number of participants also said that there are increasing problems finding scientists able and willing to peer review articles.

37 A point made by more than one speaker was that there are few penalties for those who do not perform competently in peer reviewing activities. This tied in with comments made elsewhere that editors should take greater responsibility for managing disagreement between reviewers and addressing conflicts of interest. Some felt that journals should play more of a role in editing comments made by peer reviewers, though it was contended by one participant that good editors already did this. It was also pointed out by one speaker that measuring the accuracy or fairness of peer review can be very difficult.

38 More initiatives to encourage training for those conducting peer review were suggested by some participants, echoing comments made in relation to the use of peer review in grant application assessment. One idea along these lines was that peer reviewing skills could be assessed as part of PhD evaluations. The possibility of paying peer reviewers was also proposed as a means of raising standards. One participant suggested that this may positively change their own attitude towards such work, though another participant indicated that they are very uncomfortable with the idea of paying peer reviewers.

High impact factor journals

39 Issues related to high profile 'high impact factor' journals were discussed, with some participants expressing the view that the prominence of a small number of 'big' journals is having a negative impact on science publishing. One participant said that there are now just two or three journals which are seen as the 'holy grails of publications' and which have a high degree of influence over what areas of science are fashionable. One speaker said that journal names are now used as a proxy for quality, and should not be. It was pointed out, though, that the choice of which journal to submit work to is still the researcher's own, with the implication that researchers can exert some influence over how the publishing landscape develops. Some felt that the open access movement is supporting a shift away from the influence of big journals.

40 One speaker said they believed that editors should be taking more responsibility for identifying cases of fraud and other kinds of misconduct, singling out a recent case where a high profile piece of work involving plagiarism had not been spotted. Retractions, and the way they are managed was also raised. Some participants felt that journals could handle these situations more proactively and it was noted that *Nature's* current policy is to make retracted articles available to view.

41 One participant pointed out that editors themselves have high workloads in some cases and that this creates challenges for maintaining high standards and ensuring proper management of publication issues. There was some discussion around the idea of a full-time professional editor position, but there was disagreement as to whether this would be good or bad thing. Some felt that editors need to be experts in their field, which would require holding an academic position in a relevant field. On the other hand, it was said that such editors would inevitably have quite narrow academic expertise and that it may be good for science editors to be non-specialists. Training in editing was also suggested.

Open access, post-publication peer review and alternative publishing models

42 A number of participants felt that the UK is in a period of transition where there is widespread support for the move to open access publishing but that this has not yet been fully realised. One participant said that open access is something to be aimed for over the coming five years. Open access publishing was seen by some as a solution to the dominance and power of the larger journals. It was also said that open access publishing may strengthen reproducibility and help to minimise fraud.

43 One challenge relating to open access concerns the costs with which it is associated. One speaker reported that they had experienced problems securing financial support from their university to pay for the open access publication of their work. It was said at other events that universities are sometimes able to provide such support, but only where research is funded by certain bodies. One speaker pointed out that some kinds of research bodies, such as certain research charities, similarly have open access policies, but do not pay open access fees. It was said by another speaker that the nature of incentive structures involved in open access publishing made the situation complicated. Another speaker highlighted issues specifically concerning the conflict between the move towards open access and the call to secure patents.

44 Post-publication peer review and other forms of feedback on published science were discussed at several events. One speaker said that more post-publication discussion, particularly of controversial results, would be welcome. Citizen science and the role the public can play in scrutinising and providing feedback on published science was also highlighted by one participant. It was said that that this kind of activity would need to be moderated or 'policed' regulated to ensure constructive conversations were taking place. Another speaker highlighted the positive role played by alternative publishing models, such as arXiv, an online research repository where papers in the fields of physics and mathematics are self-archived by authors.

45 One participant thought that changes in attitudes towards data sharing would change the publishing landscape radically over the coming years, pointing out that the Large Hadron Collider project makes all its data available on its website for anyone to review and use. It was pointed out that the journal *Nature* now includes a checklist for authors, referees and editors to ensure high standards and improve the reproducibility of published results which requires that raw data be submitted alongside articles. Participants broadly supported data sharing and a number voiced the view that a move in this direction would be good for science.

Authorship

46 Authorship and the fairness of assigning credit were also addressed. One speaker pointed out that the different conventions in different fields of science made it difficult to regard author lists as authoritative in terms of which individuals should receive credit for a given piece of research. It was also suggested by one speaker that there are challenges in ensuring that appropriate credit for published work is given to researchers at different stages of their careers.

47 The position of a scientist's name on an authorship list was similarly seen as important, with one speaker suggesting that 'first author' credits are vital, especially for researchers early on in their careers. The ethical implications of this were alluded to by one participant, who said that there seemed to be a culture of scientists attempting to ensure that their name appear on as many author lists as possible.

48 It was pointed out by a speaker that they knew of an author who had over 15,000 publications attributed to them. One participant suggested that the

Law Society or other relevant body should issue guidance on how to make decisions about authorship credits.

Publication bias

49 It was noted by some participants that the kind of work that is seen as publishable or interesting by editors played a role in what science is undertaken, and that researchers may be influenced by what they think editors find interesting.

50 Some participants thought that there are publication biases in favour of positive results. This issue was discussed in depth at one event in relation to the issue of clinical trials, where it was argued by one speaker that high quality research is not always published and that the depth of data missing from the science literature is problematic. Another speaker suggested that overlooking negative results compromised the body of scientific knowledge, pointing out that failure can be informative and arguing that this should be more widely acknowledged.

51 The idea of pre-registering trials was discussed in this context with some claiming that this would help to improve transparency. Others expressed the view that the situation is complex, and that alongside positive and negative research results there are also 'un-interpretable' results, which may create a problem for pre-registration models.

52 Some participants thought that there is also a bias in favour of publishing novel results. One speaker said that results needed to be seen as "exciting and novel" in order to have a chance of being published. It was pointed out by one speaker that this has consequences for reproducing results, since scientists may be less inclined to undertake reproduction work if they find it difficult to publish their research.

Research assessment

53 Research assessment of some kind was considered to be necessary by many participants. A number, however, made observations about the stresses that such activities place on researchers. It was also suggested that complex evaluation systems can lead people to take risks, or might encourage people to engage in ethically suspect practices. For example, evaluating scientists according to the amount of funding they generate for their institutions may result in amounts of money requested in grant proposals being overstated which, it was suggested, is wasteful.

Research Excellence Framework

54 The Research Excellence Framework, or REF, is the system used to assess research conducted in higher education institutions in the UK. The outcomes of the REF inform decisions made by the higher education funding bodies on how to allocate core funding to higher education institutions. The REF was a common topic of discussion at the events with participants expressing both positive and negative views.

55 One speaker presented a comprehensive list of advantages and disadvantages associated with the REF. The positive features of the REF

identified were: it helps to evaluate how public money is spent; it has led to the development of a record of how research has worked and evolved over time in the UK; it prompts universities to think strategically about research and the areas in which they should specialise; and it has led to the development of impact case studies, required as part of REF submissions, which are likely to be a useful resource. The speaker added that prior to the introduction of systematic research assessment, the UK was not a research-leading nation, but now it ranked alongside the US as one of the top two nations for research quality worldwide. The negative features of the REF raised by the speaker included: the REF could distract scientists from research itself; it encourages 'game playing' to improve institutions' scores; people in the early stages of their careers are assessed in the same way as senior scientists, which may be unfair; and researchers could be marginalised by their institutions if their research is not ranked highly in the REF. The challenges relating to reliably measuring the societal and economic impact of research were also mentioned.

56 Many of these ideas were reflected in other discussions across the events. Some felt strongly that the REF is having a negative effect on science research. One person said that the REF should be 'abolished'. Specific concerns related to the bureaucracy associated with the REF, which one participant said meant that academics' time is being diverted from research and teaching. Another participant agreed, saying that the effect on teaching has been "catastrophic".

57 Another widely discussed issue in this context was 'game playing' by researchers and institutions to try to get better results in the REF. It was suggested that some institutions had delayed academics' retirement, or hired researchers for very short periods of time in order to benefit from their work in REF assessment. Some believed that the REF has created an academic 'transfer market' and that institutions sometimes 'buy in' research quality, rather than nurturing young researchers. One participant said that a candidate's potential contribution to the REF is now an important consideration in academic recruitment and another, separately, said that there are sometimes issues with recruiting people from industry into academic roles, as they are less "REF-able". One participant said that the rules around which researchers could be included in their institutions' REF submissions should be reconsidered.

58 It was also pointed out that the REF could induce researchers to behave strategically for example by delaying or rushing their own publications to optimise REF scores. One participant said that the REF intensified competition between researchers, which may be incentivising unethical behaviour.

59 One speaker said that the range of work for which researchers could receive credit in the REF is not wide enough, pointing out that conference proceedings are not taken seriously. She also said that the REF is not well able to acknowledge the value of interdisciplinary research, pointing out that whilst it might be reasonable to expect researchers to demonstrate impact and have dissemination plans in place, interdisciplinary work does not fit neatly into the framework.

60 Some thought that the REF is wasteful, in that it consumed a large amount of state resources which could otherwise be directed towards research itself. In addition, some felt that it is run inefficiently. A different view expressed within this theme was that whilst the REF attempts to make state spending on research more efficient, it does this by encouraging narrower, more focussed science which may not be in the interests of science more broadly.

61 On the other hand, some participants felt that the REF supports the financial accountability of research and helps to maintain the public's trust in science. One participant said that the REF encourages researchers to focus their attention on the purpose of their research and forces them to explain it clearly to others.

62 Other points made in defence of the REF were that articles themselves, rather than the quality or impact factor of the journal in which they are published, are used as the bases of assessment. Another comment made was that the next REF, due to be held in 2020, will need to acknowledge the changing publication landscape, in which traditional, peer reviewed journals are becoming less important.

63 One participant pointed out that in Holland, research assessment is staggered in such a way that different departments and fields are assessed at different times. This, it was said, helps to discourage cross-field comparisons, which may be misleading. Another participant said that researchers should be making use of their research support offices, which can offer advice on how to ensure research will be recognised in research assessment activities.

Impact

64 The 'impact' component of the REF, which requires that researchers show how their research has had wider societal or economic effects, was discussed widely across the events and there were both positive and negative views about its effects on science.

65 Relatedly, some were concerned that pure or basic research may be undermined by requirements to show research impact. One speaker argued that the timescale allowed for impact to take effect is critical in whether it is a fair aspect of research assessment exercises. He said that the 20 year period, currently allowed by the REF, is reasonable but suggested that 'blue skies' research could be affected if that timescale is shortened. He argued that the discovery of DNA would not have counted as 'impactful' research within a short time period. A connected point raised was that research impact can be particularly difficult to demonstrate in certain areas of science. One speaker felt that it is more challenging in interdisciplinary fields, for example. More general challenges associated with measuring impact were also noted.

66 One speaker said that impact does not necessarily go hand in hand with quality, pointing out that researchers who work on water reclamation, for instance, may be very proud of the social benefits of their work but are not necessarily better scientists than those whose research has less impact.

67 On the other hand, some believed strongly that the impact agenda is having a positive influence on science and that impact has contributed to a culture within which scientists are more accountable to the public. It was said that the

public are now more aware of science and how money on science research is spent than in former years. One participant said that scientists should not simply be paid to do whatever they want, echoing views expressed elsewhere that research should be justifiable to tax payers. Another participant said that impact encouraged scientists to engage more closely with the users of research, who might be patients or professionals of different kinds.

68 It was also argued that the definition of impact used in the REF is quite flexible and can accommodate a range of different kinds of impact. It was said that it is possible for many areas of science to have impact, and that the range of what might count as impact is quite wide.

69 Of the more general points made about impact, one participant felt that there is an inherent tension between research quality and impact, but that it should not necessarily be assumed that research quality is more important. Another participant said that researchers are able to exercise some control over the impact of their work, and potentially increase it, by involving research participants and research users early on in their work.

70 It was also said that communicating and explaining the impact of research is a skill that researchers should aim to develop. One speaker described arguing successfully for research that had concluded with a negative result being included in his institution's impact case studies. This, he had maintained, had had a high degree of impact, in that it prevented a large amount of money being spent on further work pursuing the same line of research.

Metrics

71 The use of metrics in research assessment was widely discussed by participants and a number of negative comments were made about their influence on science.

72 Impact factors, which reflect the number of times papers recently published in a journal have been cited in other peer reviewed published papers, were criticised by participants at a number of events. They are perceived by some to be used improperly as a proxy for research quality and that this is damaging to research. One participant said that the emphasis on impact factors undermined the intrinsic value of science, which they saw as the drive to fundamentally understand nature.

73 The REF was praised by one participant for reviewing the quality of individual studies rather than basing assessments on metrics associated with journals in which work has been published. One participant said that it is a tragedy that their generation has led people to believe that impact factors are more important than societal impact.

74 Some were concerned about the idea of measuring the quality of research at all. One participant said that it does not make sense to assign metrics to everything, as distinct areas of science could be quite different from one another and it is not always possible to compare them. One participant said that some aspects of science cannot be quantified at all and another said that there should be no measurement whatsoever involved in the assessment of science. At one event Einstein was quoted as having said that "not everything that counts is countable and not everything that is countable counts".

75 It was pointed out that the impact factor of a given journal is not necessarily indicative of its quality. Interdisciplinary journals, it was said, tend to have lower impact factors, which do not necessarily reflect the standard of the science they publish. Another criticism levelled at impact factors was that their use could be manipulated, which compromised their capacity to reliably indicate quality.

76 Some said that metrics are in principle a legitimate part of research assessment, but that they need to become more accurate. One participant said that there are metrics other than impact factors which are more reliable and should be used more widely. Some participants argued that a variety of different metrics should be developed and used, so that impact factors alone are not exclusively relied upon to assess science. Some, for instance, felt that qualitative metrics should be used in addition to quantitative ones – though it was said by one participant that such metrics may be hard to develop. Alternative metrics, such as download numbers and blog and social media mentions, collectively referred to as 'altmetrics', were discussed and some thought there is growing momentum behind the drive to find new ways of measuring the value of research.

77 At one event, reasons for the widespread use of metrics were discussed. One speaker suggested that their prominence today is a consequence of large scale growth within the science sector and the need to find ways of more quickly appraising or assigning merit to work. One participant noted that there tends to be disagreement amongst research managers, administrators, academics and funders about the utility of metrics in appraising science. Participants wondered whether impact factors will ultimately cease to be useful, given the move towards open access publishing and the shift towards new kinds of peer review, although some thought that impact factors will not disappear altogether.

Careers

78 General concerns were expressed by participants about the incentives for working in academia and the kinds of people that are able to pursue academic careers. Some said that academic careers are not well incentivised, with one participant saying that people start out in science enthusiastically but that they can be discouraged very quickly. Another worried about "losing bright minds" because people feel they need to give up too much of their lives to be successful in science. One speaker reported having witnessed a degradation in conditions for lecturers which she thought will make academia very unattractive as a career in the future.

Early career researchers

79 Many of the issues raised in the area of science careers related particularly to early career researchers (ECRs). The prevalence of short-term contracts for ECRs was widely discussed. Participants felt that there is an expectation that people will change jobs regularly (around every 3-5 years) which, in academia, often amounts to moving location within the UK, or even moving abroad. This was said by one person to be an "unspoken rule" which has the capacity to undermine the stability of researchers' lives outside science, especially for those with a family. One participant reported having heard

senior staff talking about junior researchers in their labs as though they are “disposable assets”.

80 It was noted by a number of participants and speakers that there is a significant discrepancy between the number of PhDs and the number of permanent positions in academic science. Participants discussed what the right ratio for this might be. One speaker cited Royal Society statistics showing that just 4 per cent of PhD graduates manage to secure permanent academic positions in science but that 90 per cent aspire to a career in academic science. Another speaker referred to a statistic that the average age at which a scientist takes up his or her first permanent job is now 41 compared to 36 a few years ago. Participants expressed the view that the length of the ECR period is long, with one speaker explaining that at the start of their own career they had worked on short-term contracts for 15 years.

81 Expectations around the development of science careers were also widely discussed. It was said by one participant that there is a perception that staying in short-term positions is looked down upon, and that there is an expectation that researchers should ultimately move onto faculty or Principal Investigator (PI) positions.

82 Some made suggestions for how to tackle these issues. One idea was to develop initiatives to support people in moving into jobs outside of academic science. It was said that it is important to communicate to science PhD students that most will leave academia and that they should be encouraged to consider a wide range of alternative careers. It was said that there is a role for universities to play in this. One participant pointed out that getting the balance between keeping people in science and supporting them into appropriate alternative careers could be difficult.

83 Another proposal was that there should be positions in science that are seen as genuine career options which are nevertheless not routes into PI roles, such as permanent junior research posts. One speaker pointed out that some research bodies, such as Cancer Research UK and other institutes, already offer such positions and thought they should be more plentiful.

84 Pressure to publish was felt particularly strongly by ECRs, many participants thought. Scientists on short-term contracts reported feeling the need to publish before the end of a fellowship, for instance, or feeling more pressure to obtain first author credits. This, participants said, could result in long working hours. One participant who argued in favour of the use of longer-term research grants made the point that this could help to remove pressures on junior scientists to publish material very quickly. It was also pointed out that the Biotechnology and Biological Sciences Research Council currently funds 6-year post-doctoral research positions which provided this kind of support.

85 A key theme of the discussions centred on whether or not there was sufficient support for ECRs. One of the speakers reported having received good support from her own PhD supervisor. However, it was noted by another speaker that ECRs, as junior scientists, often do not have a wider team to support their own work. Some felt there is not sufficient support available to junior researchers to help them collaborate with others or publish their work, and the absence of a clearly defined career structure is a key problem. One suggestion was that ECRs should receive guidance on developing a

'publication strategy'. Another participant stressed the importance of encouraging ECRs to think strategically early on in their careers and focus on what would be involved in achieving their short and long-term goals.

86 It was raised by a number of participants that training is an area in need of attention. Science is perceived to involve a high degree of "learning on the job". One of the speakers reported not receiving any training in peer review, external examining or project management, which would have been useful in her work. Some raised concerns that the traditional model of learning in science, which involves the transfer of skills from senior researchers to junior ones is not working effectively, as senior staff are now very time-pressed. Another point made was that there tends to be a greater focus on the training of PhD students rather than post-doctoral researchers, who also have training needs. One participant pointed out that the ESRC now requires that the post-doctoral researchers they fund have their career paths periodically reviewed, although a number of participants said that more training for ECRs would be welcome.

87 Field-specific issues were also raised. It was pointed out that the culture of working on a number of short-term contracts in the early stages of a career may be more problematic in fields like medicine, where people tend to enter the field later and may be less prepared to move around for jobs. It was pointed out elsewhere that assumptions should not be made about the age of ECRs, since many enter science having initially pursued alternative careers. For any researcher who already has a family or other personal commitments, it was said, the instability and movement associated with working on short-term contracts may provide a disincentive to remain in science.

88 It was suggested that a collegial approach would benefit ECRS. Some participants suggested that ECRs should take advice from peers and make efforts to mix with scientists from other areas to increase opportunities for interdisciplinary working. Initiatives to support collaboration between ECRs should be developed, some said.

Teaching, administrative responsibilities and time pressures

89 Long working hours and less time for scientists to do research was a key theme to emerge across the events. One participant suggested that 60 hour working weeks are now normal, whereas in the past workloads for scientists have been more manageable. One participant said that senior staff sometimes found it difficult to spend any time in the lab at all, although it was argued that this could deliver benefits, such as junior researchers gaining better practical skills. One speaker reflected that much of his time is spent on grant applications, many of which, given the low success rates for many funding schemes, are destined to be unsuccessful. Another speaker referred to research conducted in the US in 2006 suggesting that 42 per cent of research time is now spent on grant applications and management. Grant applications may be particularly time consuming for senior staff, it was said, as they may be unaccustomed to new application processes.

90 Bureaucracy and administration tasks were also seen by some participants as more onerous than in previous years. One example given was the administration associated with submitting an article for publication, which

involves completing forms and other tasks. Administration involved in lecturing was also mentioned.

91 Relatedly, a number of participants argued that teaching is not sufficiently well recognised or rewarded in science. One said that the current assessment and appraisal structures create a tension between being a good researcher and a good teacher. One participant said a colleague avoided teaching due to time constraints. On the other hand, some participants said that conducting high quality research is essential to being a good teacher of science and that space for both activities needs to be created. It was pointed out that there are now teaching excellence awards in some areas, which some see as having a positive influence.

92 Promotion was said by one speaker to be more transparent than in former years. He claimed that it had once been a case of "dead man's shoes", where academics could wait many years for a senior position to become available. One speaker suspected hiring committees made use of impact factors in recruitment decisions. One participant highlighted the fact that researchers would normally seek references from senior colleagues who are less likely to work directly alongside them and who may therefore have a less vivid sense of a researcher's strengths or the range of work they do in the course of their jobs.

Research ethics and integrity

93 Issues around research integrity and ethics came up frequently at the events. It was said that honesty is fundamental to science and that trust lies at the heart of the "scientific ecosystem". It was also pointed out by a number of participants that scientists are typically held in high esteem by the public who report regarding them as trustworthy when surveyed. Some thought that issues around poor reproducibility and high profile cases of misconduct are undermining the public's trust in science. A number of participants expressed the view that high levels of competition for very scarce resources put scientists under immense pressure with one participant saying they felt this means that scientists are "bound to behave less well".

94 Participants described instances of poor practice ranging from researchers 'self-plagiarising' or 'salami slicing' their work – the attempt to generate multiple publications from a single set of results – to well known cases of scientists fabricating data. Issues around publication ethics and very long publication lists were raised, with the suggestion that undue credit is being taken by some researchers for published work. Another speaker explained that poor practice may simply involve scientists failing to sufficiently scrutinise expected results.

Distinction between poor practice and poor ethics

95 Some participants were keen to highlight the distinction between misconduct and other kinds of poor practice which might be attributed to factors other than unethical behaviour. One participant expressed this point by saying that there is a "spectrum of poor practice", with fraud and fabrication at one end and poor experimental design at the other, each of which she said should be tackled differently. It was said that lack of training or 'ignorance' of correct techniques or procedures could explain some cases of apparent misconduct.

One speaker said that a lack of ‘craft skills’ may explain why some results have not been reproduced when attempts have been made to do so. One speaker made the point that expectation bias – the phenomenon of being more inclined to observe what one expects – affects everyone, including scientists, and this may influence how scientists interpret results.

Universities

96 One theme related to comments about research integrity concerned the role of higher education institutions in tackling integrity issues and research misconduct. A number of participants asked questions about the role that universities should be playing in tackling misconduct and suggested ways in which they might be more proactive. It was said that universities have a responsibility to create the conditions for ethical research conduct and demonstrate clearly the consequences of poor research practice. One participant said that universities should adopt stronger policies around failures in research integrity by issuing guidance on processes for handling misconduct charges, as well as on the repercussions for researchers who are found to have behaved unethically. Another participant echoed the point that universities should state more clearly their position on misconduct, saying that they should be more open about such matters and how individual cases are resolved – something that confidentiality considerations currently impede at some institutions.

Journals

97 Alongside the issues concerning conflicts of interest in peer review and ethics of assigning authorship credits discussed above, some more general questions around research integrity and publications were raised by participants. Some argued that journals have a responsibility to tackle misconduct more directly. One participant said that there should be clearer or stronger policies on how to deal with retractions which, they said, would be likely to help tackle issues around poor practice. One participant expressed the view that there is a stronger focus on ethics in publishing than in scientific research itself. Initiatives such as the website Retraction Watch, which publishes details of retracted science papers, were welcomed by one participant, who said such enterprises help to expose cases of poor practice.

Ethics and teaching

98 Research ethics training and teaching were also addressed at the events. One participant queried whether research ethics should be taught more comprehensively at undergraduate level. Another participant said that training in good research practice is in fact better at undergraduate level and that post-graduate level teaching in this area is less well developed.

99 Participants posed questions about science PhDs and whether they are constituted so as to produce ethical scientists. One participant voiced the view that ethics should be a core part of science PhD programmes, with lectures on topics relating to research integrity and misconduct. It was suggested that instances of poor practice or ‘bad science’ should be described by way of example in teaching. One participant recommended that consideration be given to novel ways of engaging students with ethics, pointing out that

courses could be quite dry. She suggested that thought be given to developing imaginative or creative ideas for teaching research ethics.

100 One participant pointed out that in the past, ethics training had involved implicit instruction from senior, experienced researchers, to junior researchers who learned by example. However, increased time pressures meant that senior researchers have less time with junior researchers, meaning that this system worked less effectively (see above, paragraph x). One participant reported being recruited onto projects where her fellow researchers had evidently not had the same level of training or experience as she had, and seemed to be unaware of the difference between good and bad practice in some areas.

Regulation, ethics approval and research governance processes

101 Participants were generally supportive of research integrity initiatives, such as Universities UK's *Concordat for Research Integrity*, and a number of participants suggested that further guidance or advice, in areas of research such as publishing, would be welcome. One participant felt that scientists themselves should be more involved in research governance and should take opportunities to exert influence over how ethics processes are developed.

102 There was some discussion of the obstacles that seeking ethics approval for research can present scientists. More than one participant expressed the view that ethics approval systems are sometimes insensitive to the level of risk involved in the research. It was said by one that ethics approval requirements should be proportionate to the research activities in question, but that currently high-risk procedures are subject to the same level of scrutiny as much more benign procedures. Another participant at a different event echoed this point, and described their own difficulties obtaining approval for what they felt was a low-risk piece of research on the accessibility of medical consent forms.

103 Another point relating to research ethics committees concerned expertise and competence, and one participant suggested that committees may not always have the appropriate knowledge and experience to make informed decisions about every piece of research they are asked to approve. Another participant said they thought researchers are not always able to communicate effectively with ethics committees and should be better supported by them to be more creative with their research, or take different approaches.

104 One participant said they felt that current systems allowed researchers to think of ethics as a 'tick box' exercise, which could be concluded at the beginning of a project. She felt that this is problematic, as research ethics should be considered and kept under review throughout the duration of a project.

105 One speaker pointed out that overly cumbersome or restrictive regulations and protocols around research could impede science. She cited the example of the UK Stem Cell Bank, which she felt has created difficulties for researchers in developing stem cell therapies because the associated rules around their use are onerous. One speaker expressed a pessimistic view about the regard with which ethical governance procedures are seen by researchers in medical research. He reported having the impression that effort

is sometimes being directed towards ensuring research is seen to comply with rules and procedures, but that other aspects of science, such as recruiting research participants to take part in studies quickly and self-promoting, are in fact regarded to be more important than complying with ethics and governance requirements in science.

106 The risks of over regulation were stressed by others at the events. One speaker described the adverse effects that excessive regulation could have, and mentioned the first European Clinical Trials Directive as an instance of regulation which may have impeded research. One speaker pointed out that heavy-handed regulation threatened to interfere with academic creative autonomy, which has the capacity to undermine science.

107 Ideas for new governance approaches to address misconduct issues were also raised. One speaker mentioned trials of 'integrity audits' in certain areas. There was debate over whether such initiatives would raise standards or merely impose new administrative burdens. Another suggestion was that science as a whole may benefit if scientists are expected to sign up to a professional code of conduct, as doctors or lawyers do in their own fields.

Collaboration

108 Various issues concerning the way scientists work together were raised, including multidisciplinarity, team science and data sharing.

Multidisciplinarity

109 One speaker said that it is an exciting time in science with work becoming more interdisciplinary than in previous years. He said that scientists are finding themselves needing to work with researchers who have trained in completely different ways and that the wide gaps between disciplines that had existed in the past are now becoming much narrower. It was also said that interdisciplinary work is important since it could help to address issues within science around 'silo working' and support the development of links to related fields such as ethics and policy. Some felt that multidisciplinary work is now becoming more attractive to funders than it has been in the past.

110 It was said at one event that there is both 'easy' and 'difficult' multidisciplinary research. The easy kind brings together similar disciplines that use shared methods, such as Computing and Mathematics, History and English, and Physics and Engineering, and journals recognise the value of these groupings. Difficult multidisciplinary research, it was said, involves more unusual groupings, such as social science and environmental modelling, which might usefully combine on flooding, or political studies and science working together on issues around genetically modified crops, and this kind of collaboration is rarer.

111 Challenges presented to those working across disciplines were discussed. One speaker explained that she has been asked a number of times to become involved quite late in the day in projects which did not have multidisciplinary aims built in from the start. She said that some projects which purported to be multidisciplinary are not genuinely so and in some cases have had an ethics component 'tagged on' at the end.

112 A further issue in this area related to assessment. It was said by more than one speaker that demonstrating the value and impact of one's work in an interdisciplinary field could be difficult. Some expressed a belief that the journals that publish interdisciplinary work have lower impact factors and that it is harder to publish in both interdisciplinary and single discipline publications. It was said by more than one participant that the REF penalises multidisciplinary research through, for example, the set-up of the assessment panels which judge only the element of a REF submission that falls within their remit.

113 Some felt that different conventions of authorship in different fields of science, for example relating to which researchers receive authorship credits and where they are ranked on author lists, may deter scientists from working in interdisciplinary areas.

114 One participant wondered how more multidisciplinary working could be encouraged in their own university. It was thought that encouraging ECRs to move around within their institution and incentivising them to attend seminars in other departments, for example, could help them to make connections with scientists in other fields.

Team science

115 It was suggested at the events that there should be more team science and that teams are necessary for ground-breaking research. One speaker made the point that teams are beneficial to science since not every scientist could be good at everything, and groups are able to embody a fuller range of skills. One speaker spoke in support of team science saying that teams, as a whole, have been shown to outperform their smartest members.

116 It was suggested that funders are becoming more responsive to team science, with Research Councils embracing team-based projects and another major funder about to announce a new collaborative scheme.

117 Some general discussion around collegiality and collaboration took place at the events. One speaker expressed concerns that pre-occupation with measuring individual scientists' outputs is undermining collegiality and goodwill amongst researchers. It was also pointed out that measuring and rewarding collegiality is difficult in an environment of competition and targets, which activities such as the REF may promote, and which may incentivise unethical behaviour.

118 As above (see paragraph x) it was pointed out that collegial approaches and team working could be particularly useful to ECRs who could benefit from taking advice from their peers and using opportunities to engage in interdisciplinary work.

Data sharing

119 A number of participants felt that data sharing issues are important but there were different attitudes expressed towards the effects that moves towards open data are having on science.

120 One speaker said that the notion of open data is fraught with difficulties, partly as a result of labelling. Challenges around requiring full openness in research were highlighted by another speaker. She pointed out that investors may be deterred from supporting research if they are unable to retain intellectual property rights over the scientific knowledge generated by their investment.

121 A different speaker described the challenges she had experienced in relation to accessing raw data. She suggested that researchers have an ethical obligation to share expertise and 'improve the world', and proposed that raw data be made available online. This, she said, might benefit the researchers who had gathered the data too as they would be able to include such activities in their wider dissemination of research and potentially generate better citation statistics.

122 The same speaker explained that she had asked colleagues for their views on data sharing; half had thought that such data should be available online and half had thought it should not. Most PhD students she had asked had thought data should be available. She speculated that more senior people may feel a greater sense of competition amongst one another, which may affect their attitudes towards data sharing, or that they may be concerned about damaging their reputation by opening themselves to scrutiny and sharing data at an early stage.

123 Some felt that publicly funded scientists, specifically, should make their data freely available, arguing that this would help improve the reproducibility of research. It was pointed out that the US National Institute of Health has had an open data policy for some time already. As above (see paragraph x) it was pointed out that some grants included funds for data sharing activities.

124 As above (see paragraph x) one participant felt that changes in attitudes towards data sharing would have an impact on how the publishing landscape developed, using the example of data generated by the Large Hadron Collider project being made freely available.

Women in science

125 One speaker said that in the course of his career he has seen diversity in the workforce improve enormously, explaining that earlier in his career, the biology faculty in which he had worked had employed no women at all. The Athena SWAN Charter, a national award scheme which recognises achievements in advancing women in science, was mentioned at a number of events and was seen as a positive influence.

126 As above, (see paragraph x) one speaker said that the introduction of formalised research assessment systems may have helped to tackle biases of different kinds, including gender biases, which may have formerly influenced decisions about funding allocation. In the past, he said, these judgements were much more likely to have been made on the basis of personal opinion and connections, which are more vulnerable to bias.

127 Views were also expressed about ongoing issues facing female scientists. It was said at one event that journalists are twice as likely to cite male instead of female scientists and that when journalists do cite women scientists, they are more likely to comment on their appearance. Women themselves are less

likely to cite or promote other women, it was said. It was argued that measures need to be put in place to address these biases as they will not disappear without efforts to combat them.

128 One participant pointed out that the gender mix in university research offices is not balanced, and speculated that many roles in these offices are occupied by women who have left research. Some participants reported personal stories of bias. One female scientist reported having been told that she should not be working in science research since, as a mother, her children should be her first priority.

129 Some participants were interested in the influence that growing numbers of women in science are having on the culture of science itself. One participant asked the speakers at an event whether they felt that having more women in science made science more collaborative, or had changed the kinds of research in which scientists are interested in pursuing. It was suggested that having more women in science may help to demonstrate that working '24 hours a day' was not necessary to be a good scientist.

130 Some participants wondered whether there are female and male characteristics that may have different effects on scientists' careers. It was suggested by one participant that women scientists may find it harder to say 'no' when asked to help with others' work or engage in activities such as mentoring or administrative tasks. They speculated that those who do say 'no' in such circumstances may find it easier to succeed long-term in science, and find themselves rewarded for what they are able to achieve for themselves as individuals. One speaker said that the women in her department are less mercenary and tended to support each other more than male colleagues, but added that she did not think these are female characteristics and did not believe it is only women who have these features.

131 One speaker said that more women in science would encourage others to join or stay in the profession and that senior female scientists with children set a strong example for younger researchers. Another participant agreed, saying that a snowball effect could arise in which younger or more junior women are inspired by those women they see already succeeding in science.

Annex 1 Event locations, dates and speakers

University of Sheffield, 18 June
Hugh Whittall, Director, Nuffield Council on Bioethics (Chair)
David Grundy, Professor of Biomedical Science and Head of Department, Department of Biomedical Science, University of Sheffield
Chris Littlewood, Research Fellow, School of Health and Related Research, University of Sheffield
Linda Evans, Professor of Leadership and Professional Learning, School of Education, University of Leeds

University College London, 20 June
Jonathan Montgomery, Professor of Health Care Law, UCL; Chair of the Nuffield Council on Bioethics; and Chair of the Health Research Authority (Chair)
Geraint Rees, Professor of Cognitive Neurology, Institute of Neurology, UCL
Philip Campbell, Editor, Nature
Giovanna Tinetti, Professor of Astrophysics, UCL

University of Birmingham, 7 July
Peter Main, Institute of Physics (Chair)
David Adams, Professor of Hepatology, Dean of Medicine and Director NIHR BRU in Liver Disease and Centre for Liver Research, University of Birmingham
Pam Kearns, Professor of Clinical Paediatric Oncology, School of Cancer Sciences, University of Birmingham
Heather Draper, Professor of Biomedical Ethics, Primary Care Clinical Sciences, University of Birmingham

University of Southampton, 7 July
Anneke Lucassen, Professor of Clinical Genetics, Honorary Consultant in Clinical Genetics, Wessex Clinical Genetics Service, Co-ordinator Ethics and Law teaching Southampton Faculty of Medicine and member of the Nuffield Council on Bioethics (Chair)
Judith Petts, Professor Pro Vice-Chancellor, University of Southampton
Peter JS Smith, Professor Director of the Institute for Life Sciences, University of Southampton
Dr Mariana Vargas-Caballero, Research Career Track Lecturer, University of Southampton

University of East Anglia, 8 July
Tom Shakespeare, Senior Lecturer in Medical Sociology, Norwich Medical School, University of East Anglia and Member of the Nuffield Council on Bioethics (Chair)
Yann Lebeau, Senior Lecturer in Educational Research and Associate Dean of Postgraduate Research, University of East Anglia
Andrew Watkinson, Professor in Environmental Sciences, University of East Anglia
Xana Rebocho, Researcher, John Innes Centre, Norwich

University of Surrey, 23 July
Michael Kearney, Vice President, Research and Innovation, University of Surrey (Chair)
Ann Gallagher, Professor of Ethics and Care and Director of the International Care Ethics (ICE) Observatory, University of Surrey
Ruth Harris, Professor of Nursing Practice and Innovation, Kingston University

and St. George's, University of London
Marie Breen-Smyth, Chair in International Politics, University of Surrey
Peter Hegarty, Head of the School of Psychology, University of Surrey
Emma Lewis, Lecturer, Centre for Vision, Speech and Signal Processing, University of Surrey

Oxford University, 2 September
Andy Greenfield, Medical Research Council and Human Fertilsation and Embryology Authority(Chair)
Alistair Fitt, Professor of Mathematics and Pro Vice-Chancellor, Oxford Brookes University
Emily Flashman, Royal Society Dorothy Hodgkin Fellow, Oxford University
Ian Walmsley, Pro-Vice-Chancellor (Research, University Collections), Hooke Professor of Experimental Physics, Oxford University

University of Nottingham, 9 September
Kate Millar Director, Centre for Applied Bioethics, Faculty of Science, University of Nottingham (Chair)
Philip Moriarty, Professor of Physics, School of Physics and Astronomy, University of Nottingham
Cornelia Lawson, Research Fellow, Faculty of Social Sciences, University of Nottingham
Hugh Whittall, Director of the Nuffield Council on Bioethics

Aberystwyth University, 10 September
Kate Bullen, Professor of Psychology and University Director of Ethics and Equality, Aberystwyth University(Chair)
Colin McInnes, UNESCO Professor of HIV/AIDS, Education and Health Security in Africa, Aberystwyth University
Hannah Payne, REF and Research Monitoring Manager, Department of Research Business and Innovation, Aberystwyth University
Will Haresign, Deputy Director, Director of Farms and Professor of Agriculture, Institute of Biological, Environmental and Rural Sciences, Aberystwyth University

University of Exeter, 12 September
Nick Talbot FRS, Professor of Molecular Genetics and Deputy Vice-Chancellor, Research and Knowledge Transfer, University of Exeter (Chair)
Tim Naylor, Professor of Astrophysics, College of Engineering, Mathematics and Physical Sciences, University of Exeter
Elizabeth Bohm, Senior Adviser, The Royal Society Professor
Nicky Britten, Professor of Applied Health Care Research, University of Exeter Medical School

Cambridge University, 15 September
Ottoline Leyser, Professor of Plant Development and Director of the Sainsbury Laboratory, University of Cambridge; Deputy Chair of the Nuffield Council on Bioethics (Chair)
Ian Leslie, Professor of Computer Science and former Pro-Vice-Chancellor (Research), University of Cambridge
Alan Hughes, Margaret Thatcher Professor of Enterprise Studies (Emeritus), Cambridge Judge Business School
Alice Denton, Research Associate, Department of Medicine and CRUK Cambridge Institute

University of Edinburgh, 17 September
Graeme Laurie, Chair of Medical Jurisprudence, Director of the JK Mason Institute for Medicine, Life Sciences and Law, Senior Wellcome Trust Senior Investigator in Medical Humanities, University of Edinburgh (Chair)
Nuno Ferreira, Lecturer in Clinical Psychology, School of Health in Social Science, University of Edinburgh
Bob Fisher, Professor of Computer Vision, School of Informatics, University of Edinburgh
Joyce Tait, Director of the Innogen Institute, University of Edinburgh
Adam Lloyd, Master's Candidate, University of Edinburgh

Queen's University Belfast, 22 September
Ann Gallagher, Professor of Ethics and Care at the International Care Ethics Observatory, University of Surrey, and member of the Nuffield Council on Bioethics (Chair)
Dave Archard, Professor of Philosophy, School of Politics, International Studies and Philosophy, Queen's University Belfast (Chair)
Cathy Craig, Head of School of Psychology, Queen's University Belfast Nathan Emmerich, Visiting Research Fellow, School of Politics, International Studies and Philosophy, Queen's University Belfast
Frank Kee, Professor of Public Health Medicine, School of Medicine, Dentistry and Biomedical Sciences, Director of the UKCRC Centre of Excellence for Public Health Research (NI), Queen's University Belfast

Newcastle University, 23 September
Erica Haimes, Executive Director, Policy, Ethics and Life Sciences, Research Centre, Newcastle University (Chair)
Deborah Henderson, Professor of Cardiac Development and Deputy Dean of Research, Newcastle University
Tom Joyce, Professor of Orthopaedic Engineering, Faculty of Science, Agriculture and Engineering, Newcastle University
Ted Schrecker, Professor of Global Health Policy School of Medicine, Pharmacy and Health, Durham University

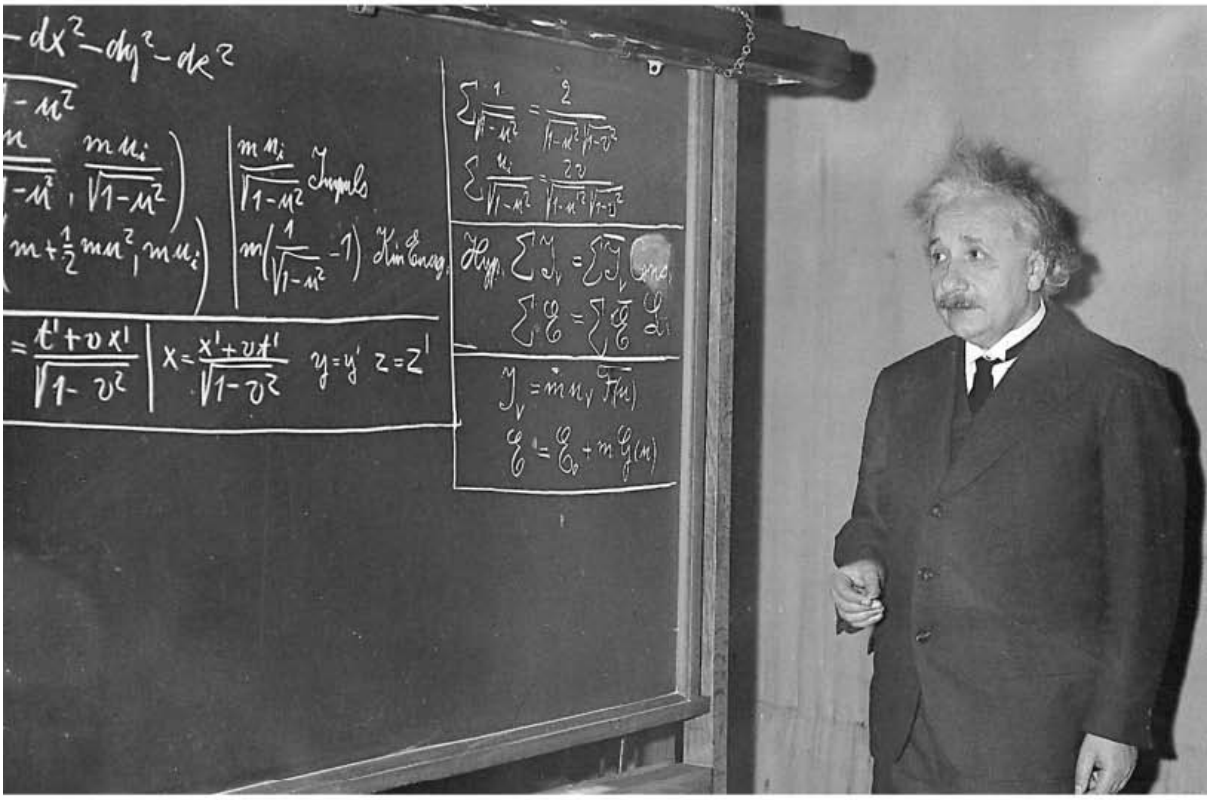
University of Manchester 24 September
Margaret Brazier, Professor of Law, University of Manchester (Chair)
Neil Hanley, Professor of Medicine and Wellcome Trust Senior Fellow in Clinical Science, University of Manchester
Cay Kielty, Royal Society Wolfson Professor, Faculty of Life Science, University of Manchester
Steve Pettifer, Reader, School of Computer Science, University of Manchester

Annex 2 List of possible speaker topics

The Research Excellence Framework
How funding for specific projects and programmes is awarded
How interdisciplinary & collaborative research is supported
Open access publishing
The peer review system
Media coverage of science
How scientists are assessed for promotion during their careers
Provision of professional education, training and supervision
Commercialisation of research
Ethical review processes
Research governance and contractual processes
Initiatives that promote integrity in science, such as codes of conduct
Data sharing policies

Annex 3 Example of promotional materials

Calling all scientists – what's it like being you?



Lunchtime discussion

Wednesday 17 September, **Informatics Forum**
12.30-14:00 (sandwich lunch from 11:45)

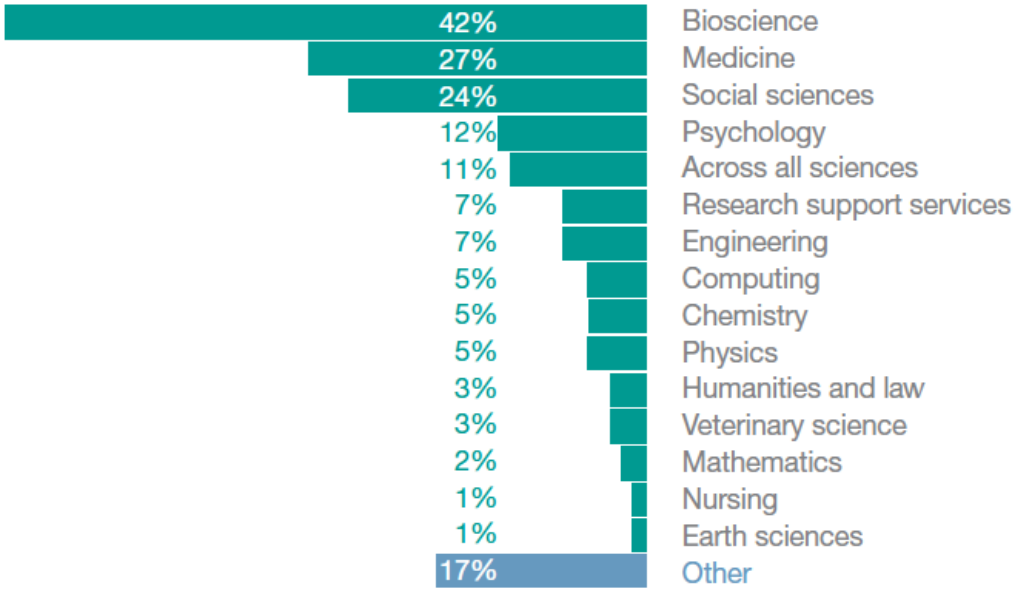
The event is free and open to all
but please register in advance at:
https://www.surveymonkey.com/s/Sci-cul-Ed

THE UNIVERSITY OF EDINBURGH

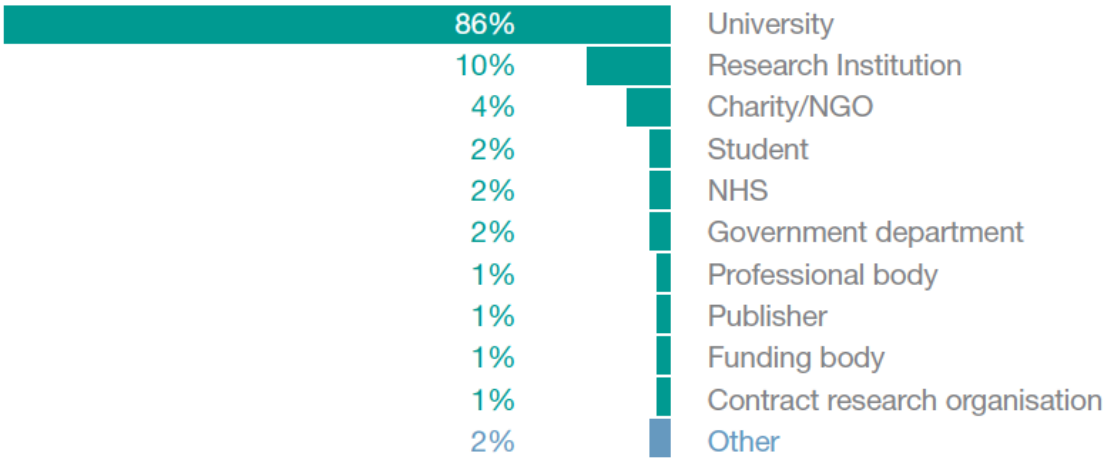
NUFFIELD COUNCIL ON BIOETHICS

Annex 4 Statistics on the area of science, employing organisation and job title of participants who registered across all events

What area(s) of science do you work in, if relevant? You can tick more than one answer[†]

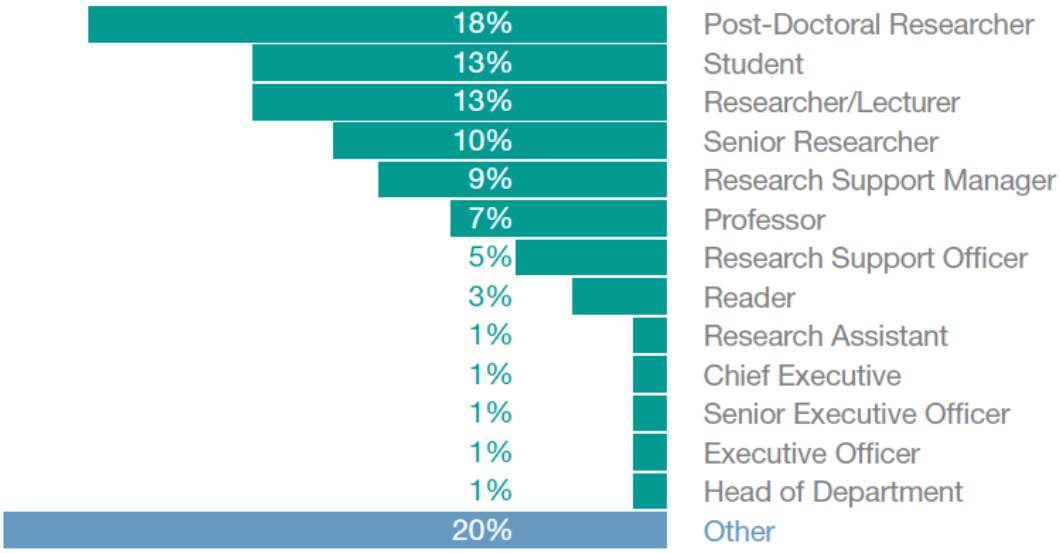


What type of organisation do you work for, if relevant? You can tick more than one answer[†]



[†] The percentages show the proportion of the total number of participants who provided an answer to the question on registering for an event. In the graphs on area of science and type of organisation, the percentages do not total 100 due to participants being able to tick more than one answer. For all graphs, the percentages may not total 100 due to rounding of numbers.

Which of the following most closely matches your job title?[‡]



Examples of job titles provided by those who ticked 'Other' include: Administrator, Careers Advisor, Citizen Scientist, Editor, Engagement Manager, Grants Manager, Programme Manager, Policy Officer, Science Communications Officer, Teacher and Visiting Researcher.

[‡] The percentages show the proportion of the total number of participants who provided an answer to the question on registering for an event. In the graphs on area of science and type of organisation, the percentages do not total 100 due to participants being able to tick more than one answer. For all graphs, the percentages may not total 100 due to rounding of numbers.

Annex 5 - Questions posed by event registrants

University College London

1. Do you have a set of best practices cases that proved to promote new cultural framework to improve collaboration instead of competition between researchers? and also more ethical approach of journals toward academic publication "rules of engagement" that reduce inequality in the publication field ?
2. I'm interested in raising awareness among university students about bio-ethics and dual-use research.
3. When will the quality and quantity of independent research opportunities become a reality for those of us who merely wish to find the truth of how things work and how systems interact? I am not looking for profit or praise but I do think we are facing a really seriously dangerous period in human history where science needs to get a grip of the ethical and moral issues and stop bowing to vested interests with more money and no moral or ethical compass to speak of.
4. What would the panel consider is the best way to highlight the excitement of GIS - both as a high level mapping technique and as an everyday simple tool that could introduce the practical long term contribution that it would have in a Knowledge economy?
5. The banks have shown us where a bad culture can lead - what will prevent us from having a 'banking crisis' in science?
6. What more do you think can/should be done to help researchers meet research integrity standards as set out in the Concordat on Research integrity and by research funders/organisations?
7. Why does UCL pay Macmillan for altmetrics? Why does UCL suggest that you supply bibliometrics when you apply for promotion?
8. Are there better models for how the Academy can work with industry and the third sector?
9. Do the panel believe that the time is now right to demand that all patients receive due notification, education and support, for any active implantable devices which has been applied / utilised across the uk, whether they have been applied as part of an emergency procedure at a university teaching hospital with no duty to inform either patient or gp of their use, or howsoever applied, whether for research or prosthesis. In line with the ruling - following the PIP scandal - that all cosmetic silicone implants procedures now be placed on patients medical records, given that the BMJ acknowledge that their are non-consensually applied active implantable devices which have been applied to people in the UK - but no statistics are available.
10. Should ALL trial data have to be published somewhere? Would this benefit our knowledge base whilst making the provenance of that knowledge more transparent?

University of Birmingham

1. How can we encourage a scientific environment which is more curiosity driven (including admitting to previous mistakes) and less competitive. Do you think that this is a goal we should be striving to meet or is a little competition healthy?
2. What is your strategy to align scientific disciplines and different sectors (academia, public, industry) to improve collaboration efficiency?
3. Is a trial that is using an existing drug/process that already exists and is already given to patients in primary care at all times of day across GP surgeries, e.g., a flu jab, a CLINICAL trial if we then officially stipulate a time of day to vaccinate, and randomise this across the trial? Or is it simply a randomised trial?

University of Southampton

11. I have grave concerns that the institutional constraints on the funding of research are informed by two principles: (1) That research should show some economic impact, and (2) It should in some way enhance an institution's REF return. The problem is that such a regime seems to be little more than what you'd expect when you engage in contract research sponsored by a company. This, I think, may stifle creative thinking, especially in basic science. My question: Although I have these concerns, I'm wondering if they are overblown or otherwise too pessimistic.

University of East Anglia

12. Early career researchers are often dependent on a pipeline of fixed term contracts and having the mobility to take them up; How do we discourage students and PhD's and postdocs from becoming seen as disposable assets?
13. What advise would you give to someone at +3 years post PhD and on a series of fixed term contracts trying to make themselves 'REF-able' for 2020?
14. What is the best way to alleviate public suspicion and distrust of science, particularly in the fields of food and energy sustainability?
15. How do we ensure that research is benefitting the economy and wider society? What should teh role of researchers, universities, funders, publishers, industry, charity, NGOs, governments etc. be in doing this and what needs to change in our current culture to enable it to happen?
16. Will this research have any impact on the REF process?

University of Surrey

1. Simply teaching ethics on courses does not produce high moral values. How does the panel think the Universities can contribute to bringing high moral standards and ethical values to society under the tight managerialism that is driving the intellectual life internally and externally. Ethical values require tolerance, inclusiveness, transparency, even empathy, and managerial control is killing these values.
2. The flaws in the peer review process of both grants and manuscripts are numerous and evident to all of us. How do you envision the future for peer review, and what can funding agencies and journals do now to reduce bias?
3. What is the career progression track for a typical post doctoral researcher in terms of time frames and milestones? What are the key aspects: Publications vs Research Project Involvement? (There is usually a trade-off between the two, although ideally this shouldn't be the case).
4. Is there any way there could ever be enough funding available to support all researchers at all UK HEIs? If not, is the only solution a 'cull' of research-active academics, or are there more equitable (and less resource-intensive) possibilities for allocating research funding than the present system?

Oxford University

1. Who is watching the ethics of the ethicists?
2. Does the panel think that the current pyramid system in academic research (whereby only a v small number of researchers will find stable employment) is an efficient and useful way of using highly trained staff to carry out research, which often has time scales of many years?
3. What issues do researchers need to consider in relation to Open Access requirements?
4. How do issues such as funding, commercial competition and other pressures affect the quality of the novel forensic science techniques entering the Courtroom?

5. To what extent does government commissioned research influence policy.
6. What fast track methods are there for innovation to get interest and support, which will allow the idea to be exploited. With physical medicine in mind!
7. Is it possible to blind reviewers to authors and institutions for both grant applications and papers? If so, what are the panels thoughts on the potential impact (for women for example)
8. not yet

University of Nottingham

1. Does the panel consider that anti-science reporting in the UK press puts us at a disadvantage compared to other countries (especially in the area of GM research)
2. Is the pressure to publish (a.k.a publish or perish) culture having a negative impact on research? If so, how can we counter this?
3. How can the situation of job insecurity, due to short term funding, for university research staff be overcome?
4. How is your life as a researcher different to what you had expected when you started out in research?
5. Do you think it is possible to devise a more equitable, less politically driven science funding mechanism that supports researchers to undertake long term continuous research into basic questions?

Aberystwyth University

1. How to make the research funding more easily accessible?
2. What three pieces of advice do you have for early career academics with regards to becoming a successful, productive researcher in today's academic environment while maintaining a healthy, balanced life?
3. How do they envisage the best future for REF so that it guarantees and fosters global excellence in the social sciences?

University of Exeter

1. I cannot attend this event since it was only advertised the night before, this is how the 'voice' theme in the Britten report is addressed? How can we have a real voice from the bottom up (e.g. formulating University values)?
2. Are there plans to extend research grants to 5 years
3. How would you make it easier for people who take career breaks e.g. to have a family or to care for someone to get back into research/science
4. How can we a) allow the space, time and resources for blue skies research in today's funding environment and how can we free researchers from the treadmill of grant writing teaching and admin to allow them to think up the new?
5. Where is there the opportunity in the system for the brilliant idea, if you don't already have a track record?
6. What is being done to limit the flow of young scientists out of the country? The UK may be competitive now, but this competitive edge is slipping fast. A quick look at the immense strides China is making in all areas of research should maybe cause a rethink in how the UK is organised and controlled by a few key people in key Universities

Cambridge University

1. In a collaborative research setting, what are the concerns and what are the ideals in regards to sharing information, intellectual property, and innovation?
2. What is the most worrisome trend and the most heartening trend in research in your opinion?

3. Can we build a good project management system to track a progress of each research project in the University? I am very disappointed that a lot of money is waisted for projects that have no clear objectives and the purpose is just to generate a lot of data without logical and critical thinking about it.
4. How could we not be involved in the politics of what is a trendy subject to study? How could we convince people to invest more into finding a cause of a disease rather then finding a drug for treating symptoms?
5. Instead of the current REF system, could there be better measures for a scientists quality that take into account part-time working, investment in teaching, investment in public outreach.
6. What can be done to allow scientists over 65 years of age to be Principal Investigators.
7. What measures do you take to prevent scientific fraud from ruining other researchers careers, who are falling victim to the crime?

University of Edinburgh

1. How do you think that the private sector can benefit science

Queen's University Belfast

1. What would a 'CONSORT' type code for RCTs in social sciences look like and how could we get consensus on what needs to be in it?
2. How do we encourage young researchers to consider their careers options across all research/scientific sectors in the economy?
3. How to become a successful scientist?
4. Could you give some advice on applying for research funding.
5. How can we prevent the burgeoning legislation associated bureaucracy, which has occurred in the last twenty years or so, from slowing up scientific progress and deterring researchers from considering embarking on projects? Included in this list is legislation associated with genetically modified organisms, pathogens, human tissue and ethics (in relation to both humans and animals), investigational medicinal products. The legislation for each of these individually eat into research time, combined they are sufficient to jeopardise the success of a project.
6. What makes a successful collaboration between researchers? (Both within an organisation and with researchers at other organisations)
7. Is there still a future for fundamental research in the UK? Or is the university research system reduced to an R&D service sector?

Newcastle University

1. Plagerism
2. Short-term attitudes at the policy-making level
3. Lack of support for early career researchers and innovative but high risk proposals - too much focus on incremental 'clearly deliverable' projects that are backed up by already eminent Profs.
4. funding
5. Ongoing changes to the national research assessment exercise and the potential impacts upon workloads/support required.
6. funing for early career lecturers
7. Are we able to address and make a real contribution to solving the big challenges of our time
8. is the purpose of getting to be published for publication?
9. Competition with lack of funding
10. Funding
11. How to successfully develop a new branch of a subject by involving other subjects?

12. recognition of not being part of the faculty but play important role in promoting 'research' university
13. The pressure to publish in high impact journals negatively impacts scientific integrity.
14. Career insecurity and fixed-term contracts; requirement for regular international mobility.
15. It is extremely difficult for a researcher to work on research projects and to apply for funding to keep the research going further at the same time.
16. Challenges to securing funding
17. Funding
18. Openness and communication
19. The growing focus on metrics and money rather than knowledge and creativity.
20. That short term instrumentalism will suffocate deep fundamental research programmes
21. Competition between individuals (sanctioned and encouraged by exercises such as REF) eroding the value of team working and preventing the generation of true knowledge due to the pressure to publish too many papers of dubious value
22. That it is driven by rather narrow conceptions: what is likely to attract funding rather than by more rigorous intellectual thought.
23. reductionist and short-sighted governance

University of Manchester

1. How does the research environment differ between UK and other countries? Why is there such little accountability in research?

Annex 6 - Concerns about the research environment raised by event registrants

University College London

1. Peer review and funding
2. Scientist are under pressure to get grants and publish results.
3. High pressure environments leading to poor research quality
4. not replicatable results
5. Attitudes towards publication
6. Quality of international cooperation
7. The changing publishing landscape and its impact on research and assessment (and the other way round)
8. Lack of security forcing those who can't afford to fall back on "daddy's cash" to leave and find a more stable job
9. Publishing of information which could be harmful if used for the nefarious purpose.
10. Time delays caused by excessive, non-risk based form-filling activities
11. The pressure on young researchers to publish in high impact journals in order to progress their careers. We need to develop a different ethos which avoids this, as it is having a number of negative effects on research
12. The ratio of the creation of positions and funding relative to the rate at which doctoral students are trained.
1. research funding opportunities 2. significant numbers of PhD students leaving scientific research after obtaining PhD
13. Bio-ethics and dual-use research
14. Translation of research into innovation.
15. funding
16. Lack of unbiased and independent research opportunities. Too many Universities take funding from corporations which leads to corporate steered agendas in research. This is primarily for the profit of the corporations and has led to a distinct lack of robustness in research conducted. Too quick to try and profit from the investment and too quick to defend that which they (the corporations) think is inviolate research. The total ethical balance has been skewed away from research for moral and ethical values and reasons to a purely commercial outcome.
17. My biggest concern about the MEXICO scientific research environment is that: there are not a national plan for science and technology, based on priorities (local food production, equity in food distribution, health services, education , etc.), nor clear research evaluation rules, based on response to national priorities. The scientific research depend on the number of publications (internationally defined), human resources formation (who will not have work), and so on... and some times more than fulfill a duty, we have to fulfill with an score... so in these circumstances it is not easy to have or promote ethical rules, when the national and international context are the same.
18. diversity
19. 'unseen' cognitive biases influencing descisions during the scientific process
20. Competitiveness as an underlying cause for misconduct
21. A tangible honest empiricism as a culture within science. And ways to promote as well as render access to the field amongst the public, in schools AS A VOCATION; and in the research community.

22. Philosophy and ethics.
23. That we are wasting resources and talent by not addressing the 'friction' in the system represented by poor culture, practices and results.
24. Mis-measurement of scientific quality
25. Evaluation
26. That funding and career progression appears to be more dependent on the number of publications rather than the potential impact or importance of the research. Do we have a 'quantity over quality' issue?
27. Funding
28. The disincentivising unstable career structure
29. Funding for younger scientists
30. A lack of non-research council research and development
31. I have concerns about the ability of biomedical research to thrive within the NHS.
32. n/a
33. That it is assumed that scientists and students all know, understand and consider the issues that together constitute research integrity during the course of their work. There is increasing evidence that this may not be the case with the frequency of 'accidental' or 'well-meaning', rather than deliberate issues rising.
34. It will be left behind.
35. Shortage of funding
36. Perverse incentives, that encourage unprincipled behaviour eg http://www.dcscience.net/?p=156 The abuse of metrics -eg http://www.dcscience.net/?p=6369
37. It is increasingly hard to get funding, even for A*-rated projects. This drives away many talented scientists who are looking for more job security. Rather than encouraging collaboration, funding shortages can drive competition and encourage unscrupulous or unethical behaviour
38. Increasing admin and bureaucracy-related workload ...this takes time away from other activities (e.g doing the research itself!/ teaching & supervising students) and put on lots of pressure / increases the risks of falling foul of some administrative task. There is a real need to be supported in these requirements by strong / well functioning admin teams.
39. Limited funding
40. Clinical trials sponsored by large pharmas
41. Ensuring that limited funding is used to support the best and most important - rather than just the loudest or sexiest - areas of research.
42. The distorting effect of how most research is funded through grants with low acceptance rates. Funders distort what research is done with ill-conceived calls, while researchers waste time writing research grant after research grant.
43. Impact
44. The waste and excess produced by researchers.
45. COMPETITION. POOR CONTINUUM RESEARCH_HEALTH CARE PRACTICES. POOR CONSIDERATION OF HOLISTIC CARE.
46. Merit purely judged on publication record
47. Encouraging AHP's to join the research community.
48. I am extremely concerned about the historic licensing of active implantable devices and the access protocols which have allowed diverse industries such as telecom, uk terrestrial tv broadcasters, internet service providers to access live medical records of these devices carried at industrial, scientific and medical bandwidth, without notification or consent being obtained from patients or healthcare providers. I am also concerned over data protection in

the context of the licensing of such devices - especially those which have been non-consensually applied - acknowledged to exist by the BMJ - but NO ONE has any management strategies whatsoever for dealing with this historic mess. my primary concern for british scientific research is to see RESPECT for PATIENTS and their HUMAN RIGHTS - and to see uk scientific research as a beacon of good ethical practice in this area. how can the BMJ demand all cosmetic silicon implants now be acknowledged to patients on their medical records - whilst research devices prostheses can be in operation without the same standards applying?

49. international competitiveness
50. Research is becoming more and more directed by institutions and those awarding grants.
51. open access
52. Drug trials, the ethics of.

University of Birmingham

1. transient nature of staff in science
2. funding
3. Publication environment
4. Staying on top of the changes in terms of current practices
5. Funding
6. That risky technologies may enter common usage without sufficient consideration of the balance of risks and potential benefits.
7. Centralisation and the amount of wasted resource.
8. Lack of funding
   Constraint of research in Universities to large funded projects, less value to low income projects. Selection of research areas by 'powerful' others rather than the service users (in my case patients and families) Failure to translate and disseminate pure science
9. Ethics of Public Health research
10. Losing highly educated and experienced researchers to other professions due to lack of job opportunites/permanent positions.
11. Emphasis on publications - number and prestige of publications is becoming the sole focus of scientists. This has the potential to lead to rushed research, leads to loss of good scientists who don't focus on publishing and at it's worst, good encourage falsification or manipulation of data. It's notable that Peter Higgs of Higg's boson fame published very few papers over his scientific career.
12. Decrease of research funding and research support
13. Ethics committees, grant bodies, and governance organisations don't know the difference between different types of trial, therefore cannot advise adequately e.g. clinical vs. non-clinical, pilot vs. feasibility, requiring NHS ethics, or university only
14. The amount of legislation and lack of resources available for setting up and running clinical trials

University of Southampton

1. Inclusiveness
2. Ethical, moral and safety culture with scientific research is poor. It is regarded as a process which is just a form filling exercise rather than a thoughtful process of what should be considered on ethical and moral grounds. There is

a factor 'well it was good enough 20 years ago' - it is a reflection that scientists need to be aware/educated of legal obligations in the current time and not be historical.
3. Funding - what is available and how it is distributed.
4. Public funding being driven by short term agendas with an overemphasis on 'impact'
5. There seems to be a lack of interest in basic research, and perhaps too large an emphasis on the effects that research might have on the economy. 2. The Research Excellence Framework (RAE, REF) appears to stifle interdisciplinary research. 3. There is a tendency to measure the quality of research by a REF yardstick which is really no more than an evaluative framework that doesn't really touch on the quality of ideas, nor on the effects those ideas have on different cognate fields. Taken together, I fear that having the freedom to engage in basic research and having the freedom to explore will be seriously undermined
6. Instability of funding research projects (and therefore jobs)

University of East Anglia

1. Fairness and equality for those undertaking research, at all levels.
2. That the extremely competitive nature of the research environment causes people who could be excellent researches, teachers, managers and collaborators to leave research because they lack confidence in their ability to compete in the often male dominated and ego-driven environment of research.
3. Female representatives in the scientific community
4. Gender and disability discrimination
5. The lack of incentives for collaboration and sharing of (both positive and negative) results and data with the wider scientific community.
6. Cancer Therapy
7. The variability in professionalism in leadership, people management and corporate management roles amongst researchers with line management, team lead and corporate responsibilities
8. the lack of skills for the NHS to use health services research
9. lack of funding
10. The mechanism for funding research is too slow and administratively burdensome.
11. The rules of the game changing
12. the need to sustain inclusive & collaborative research communities
13. increasing complexity in processes
14. Lack of sustained funding for long-term research.
15. Lack of funding and the difficulties of pursuing research careers which may put people off. Lecturing jobs are also becoming increasingly pressurised and difficult.
16. Undertaking ethical human research in a sensible time frame i.e. ensuring that ethics and R&D approval processes are undertaken effectively but efficiently.
17. That the small number of positions available means that increasing productivity is the only way to compete. This leads to the cost of science being massively undervalued. i.e grants are massively under-costed they only success because researchers many hours more than they are paid.
18. The move away from fundamental science to commercial science, which seems merely to be driving a shift in how grant applications have to be written

rather than focussing on those areas of blue sky and applied science that are not addressed commercially.
19. A lack of long term funding and emphasis on research outcomes and translation is going to reduce the amount of fundamental research research undertaken. This could have a big impact in the future and reduce the UKs scientific reputation.
20. Lack of public understanding of science propagated by inaccurate, biased and misleading media sources.
21. That the environment might not be driving research in the right direction, where research is done in 'safe' areas or topics because funding is easier to obtain, rather than doing riskier work where getting funding might be more difficult.
22. The fragmentation of funding leads to short term contracts proliferating at points in careers when people tend also to be considering establishing family lives/starting families - women do not seem to weather this career phase as well as men - leads to considerable loss of talent through 'leaky' pipeline, so would be interested to hear views on this
23. That the culture drives people to ensure high impact papers and research income without that research making a difference to society. Researchers don't have time / inclination to undertake the impact elements of work but reserach organisations are unwilling to allow this to be done externally. This results in overworked researchers who cannot give the time they need to their students and the investment government and charities input into research not resulting in economic or societal change.
24. Public perception
25. The influence of the REF on research careers in Psychology and research focus. The REF criteria are biased towards research in neuroscience because of the influence of Journal impact scores which, for psychology research, are highest in neuroscience journals.
26. The amount of time researchers have to spend on funding applications and project management instead of science.
27. short term contracts, limited options to stay in same field and have time to write articles

University of Surrey

1. Incentives (REF and individual HEI) that do not promote collegiality or team working.
2. The single use of journal articles for measuring excellence does not represent the scope of academic activity and the long term value added to institutions and society. Innovation and creativity in academic life is multifaceted and the institutionalisation of narrow definitions is caging the long-term future of academic disciplines and interdisciplinary research. Evaluation of academic outputs as cultural outputs should be based on some values and not merely numerical equivalence for university funding. Universities need to be reminded that they are cultural institutions and not 'commercial establishments' producing graduates and measurable outputs. Prosperity and the knowledge economy and society can not be developed without inspiration and creativity at a personal and group level..
3. Relevance to industry
4. The pressure to produce REFable work and imact at the expense of both solid science and blue skies research.
5. Too much focus on documentation, rather than allocating time on designing and developing novel research work

6. Risk averse funding reduces potential for innovation.
7. Loss of funding for blue skies research.
8. Fixed term contracts
9. Not thought about it but speaking personally and from discussions on PSCI-COM it seems that there is a dearth of very good (interesting, high level, well paid, suitable to use my training which has cost the UK to provide) part time jobs - I have been lucky to continue mine as a job share. I may bring my little one (1) to the lunch and discussion, as two days notice when I usually only work Mon&Tue would seem to be almost automatically disenfranchising part time scientists such as me!
10. Effects of stress on physical and mental health of university staff, due to workplace pressures
11. Funding and lack of support for post-docs.
12. Not enough funding to support all researchers at all UK HEIs. Solution would be either more funding or fewer researchers; the status quo leads to: - huge waste of resources in writing endless grant applications - individuals being employed to carry out research but unable to do so because they are spending all their time chasing money, then finding they cannot progress in their career because they have not published enough because they spend their time chasing money - research funds being concentrated in a few elite labs at a few elite universities (success following previous grant-getting success) - most importantly, research ends up being proposed and carried out in order to get funding, rather than funding being requested to support research.
13. Lack of clear funding routes to support "personal" research.
14. Lack of innovation and funding for broader research with boards of reviewers still "old school" plus shift to super research centres leaving development research not funded
15. The under-valuing of research and researchers
16. How to build an impact portfolio from the research we undertake
17. loosing creativity (and spontaneity)
18. Competition rather than collaboration and redundancy of kit in institutions due to territorial nature of the research groups. Other countries have other models that work much more collaboratively
19. Much research is undertaken by postdocs on contracts. This has several adverse implications. Researcher looking for another job toward end of research so may be incomplete or not fully reported or not understood by investigators. During the research, the postdoc is fully employed by the project so theoretically cannot write grant proposals. Massive waste of research time - Assume each grant proposal takes 4 weeks of work and there is a 20% success rate, then 20 weeks of work is required for each 2-3 years of employment
20. Government budgetary cut-backs and further squeezes on research grant funding.
21. Pressure on researchers to perform leads to shortcuts in integrity/governance practices

Oxford University

1. done ie the newest exciting areas missing the boat, losing the excitement of research freedom.
2. How can the public be assured that the evidence from research is trustworthy?

3. Pressure to produce a large number of publications in high impact journals (rather than focusing on high quality of publications/research focus is on quantity)
4. An appetite for research with funding restraints and pressure of work
5. Research integrity
   not enough funding and too much time spent writing grants and not doing research
6. Ethics
7. lack of stable employment (esp for post-docs) in cities with v high cost of living (e.g. Ox and Cambridge) that make living in the cities on a post doc salary / short term contract v difficult
8. The pressures on researchers to apply fo funding with the diminishing ability of basic science departments to financial support them during this process.
9. Lack of funding
10. The difference between what we can do and what we should do.
11. availability of funding
12. Reduction in funding for research
13. Commerciality
14. How can we financially keep up with implementing medical research in the NHS?
15. The gap between scientific and lay understanding - that the lay population is not adequately informed / do not know what they should question and are too trusting of scientific findings without questionning them or knowing how or what to question.
16. funding
17. ethical problem
18. Lack of opportunities for early career researchers.
19. The pressures caused by the limited and very directive funding regimes.
20. That research will be seen entirely in terms of it's immediate commercial value only.
21. Bioethics
22. publication ethics
23. The lack of open dialogue or sharing of data/research between institutions, creating unnecessary repetition of work across the UK at a very high cost.
24. How accurately research can be carried out.
25. Short term contracts cause hardship for early career researchers and lead to loss of talent from the sector.
26. Due to the lack of career options for postdoctoral researchers (i.e. no jobs unless you obtain independent funding) high quality researchers are leaving the research environment for alternative careers. This loss of staff and constant turnover means that we we are slowing the progress of the actual research due to the loss of knowledge that senior staff have as well as newer/younger staff requiring training and time to get up to speed with the research background. For the majority of early career researchers to be employed in careers outside of science or not within the labour force is a shocking waste of talent as well as resource.
27. Research Funding distribution
28. The regulatory environment and red tape are stifling research. Bureaucratic process need to be followed before any research can be undertaken causing delays to the work being undertaken.
29. There is very little funding for critical research in the truest sense. This, in my opinion, is a detriment to the progress of human civilisation. Although science and research funding is touted as 'value' free, most of scientific research (as driven by funding criteria) by not taking an explicit political position on the

nature of issues and challenges facing the world today (e.g. inequality, climate change) by default assists corporations in their quest for profit and does not honestly serve society or the advancement of human civilisation. In my view, the role of science is to serve society and human progress and this implicitly means offering a critical voice on the various visions competing to shape human society. It is only by being truly critical can science be value free; to be critical is to engage in politics, and to explore the space and relationship between politics and science. The prevalent thinking is that to be value free is not to engage in politics, that is a flawed perspective, one that prevents scientists from truly serving society, which of course is a political construction. The research funding environment does not support this vital function of science.

30. being too narrow in approaches to funding.
31. Its lack of influence on public policy.
32. funding - the limited amount, and its concentration in elitist and research-intensive institutions
33. Innovation is restricted to areas there are easy pathways for funding. Innovation if not in a funding pathway is unable to gain interests. I would like a vetting body which can, assess, approve then direct novel ideas to interested parties to direct of facilitate research.
34. Not enough money!
35. Insufficient focus on pure research
36. Lack of true interest and consideration for the findings of the Humanities/Social Sciences regarding the nature and history of scientific research
37. How to recruit and retain excellent researchers, and the long term financial sustainability of HEIs under current funding approaches
38. funding insufficient time
39. Pressure on academics and researchers to publish etc. possibly resulting in the temptation to cut corners when conducting research (i.e. not explicitly research misconduct, but poor practice in research). Also the lack of mentorship for new early career researchers.
40. Increasing demands made on researchers working in universities by their employer and funders (research outcomes, open access)
41. funding streams are getting fragmented, with more and more matched funding required (which institutions have increasing difficulty finding)
42. Lack of funding
43. Funding

University of Nottingham

1. Push for applicable outcomes that smart academics satisfy by producing convincing but insignificant research papers.
2. Funding and support for young researchers starting out in their field.
3. Instability, lack of funding
4. Pressure to compete and succeed at publication is overtaking the need for long-term science and a healthy career progression, particularly as funding gets tighter.
5. Not enough time for academics to do all the things they need to do. (Research (including knowledge exchange and impact activities), win bids, teaching, mentoring, being on committees, conferences etc etc) The requirement to publish high quality outputs and generate research income leaves little time for other important activities (including thinking), or they are done with little reward or recognition (or sleep).

6. Excessive competition and short term goal seeking.
7. Job security in universities and related organisations for long-term non-academic researchers, relating to short term funding cycles (even when one is technically 'permanent' due to EU rules having been applied). I have been in this position for over 20 years and it has not significantly improved.
8. Time consuming health and safety check
9. Availability of research funding
10. Women's career progression
11. Research Governance i.e. culture of box ticking replacing ethical consideration
12. The potential drain on researchers time through over-reporting requirements of funders, HEFCE and universities. Also the focus on open access via the gold route has the potential to increase overall costs of publication. concentration of research funding on a small number of "excellent" institutes (fostering of cronyism is particularly prevalent here)
13. Commodification, commercialisation and marketisation of research/academia leading to the devaluation of intangible results of research and reduced funding for arts, humanities, and qualitative social science research.
14. Spending overly focused upon the natural sciences; social science/humanities funding going to scientific projects
15. Loss of independence in defining research questions; pressure to conform and validate policy agenda; 'factory' model of research; performance pressure encourages mediocre research and outputs.
16. Focused funding (on big sexy research areas)
17. Impact driven. Pure research with currently unknown benefits or outcomes is largely not funded.
18. Competition between research organisations in the UK stifling the country's overall international competitiveness
19. Pinch point for early-career researchers and insane focus on constant moving.
20. Lack of incentives to potential next generation of researchers.
21. Wrong priorities
22. Funding
23. The way we look at Science now a days.
24. Politics of research funding (not only in the sciences)
25. Why are you being so reductive? There is not one single concern, there are many, all stemming from the same source: cuts to research budgets which create far too much competition for funding, particularly at the early career stage, creating constant anxiety and spending too much time trying to get funding for the next contract when we should be free to concentrate on the one we have.
26. Enabling University of Nottingham academic to make particularly important contributions to knowledge and to the quality and scope of public discussion.
27. Grant capture
28. Impact agenda and industrialisation of universities
29. Funding for research into diagnosis and control of resident and exotic infectious diseases of farm livestock and wild animals.
30. A lack of funding opportunities in my area of research.

Aberystwyth University

1. funding

2. The REF process, specifically the ethical and political questions it raises, its power to shape spaces of research, and its affect on the future of research culture in the UK.
3. Complexity of opportunities
4. Lack of funding and pressure for high impact publications
5. Increased emphasis on "Skills teaching" by teaching fellows breaks link with research, leading universities to become Further Education colleges with separate research institutes employing those whose salary is paid entirely by FEC.
6. communication to the public and trust building
7. lack of support for foundational and speculative research
8. Lack of funding for fundamental science
9. Funding - if research becomes more and more industry driven then non-profitable avenues of research will start to be neglected
10. That research is ethical and meaningful, not only in its design but also in the critical evaluation and dissemination of the results.
11. The narrow access to research money and the amount of moeny I see wasted
12. Transparency about what individual research does and doesn't tell us about an issue.
13. Long-term effects of present criteria of REF for social science creativity
14. Academic scientists are overly dependent on external funding, and this uncertainty might be preventing many from pursuing valuable, long-term but career-risky research agendas.
15. Openness, transparency and rigor of research. Specifically the effect this is having on results and how researchers adapt to increasing expectations both internally (from the institution) and externally (such as funding bodies).

University of Exeter

1. Short term contracts and lack of any institutional career support at postgrad and postdoc level. In no other sector of society would it be acceptable to deliver projects taking into account the exploitation (using the publish or perish doctrine) of the people delivering it (quotes from PIs: 'dissemination happens after the grant')
2. Commercialization
3. Short-term contracts
4. Short employment contracts, non-permanent posts
5. Availability and flexibility of positions Short-term nature and therefore insecurity of positions
6. Science funding is process driven and much great science gets strangled at birth because the pressures on academic are such they dare not be brave and in any case would not be able to get the work funded. So called blue skies research is impossible. We are so driven by the REF, you can't afford to take risks.
7. lack of cohesive and clear plan for enabling research networks to develop long term.
8. Availability of FEC funding
9. Funding
10. Creativity is being stifled, high risk high reward science is just not getting funded.
11. How many great research ideas/questions are stranglled at birth by the grant application competition, if you are in the club/established/ticked the right boxes the science seems to be almost secondary. I came into science to think deeply and develop ideas and contribute to the sum of knowledge, not to be

part of scientific beauty pagent, where it seems often the gloss is more important than the real substance. For all the 'blue sky' rhetoric, if you are young and bright, you look at the system as it is now and think 'I don't want to have to prostitute myself and inflate my ideas to please the funders, I should be trusted and judged honestly by my peers'. Consequently if things do not change UK/EU science will stagnate with old tired ideas and a generation of cynical scientists who are playing this game because it is the only way to survive, the new blood and fresh ideas will have fallen be the wayside. Great discoveries are made when you are free to explore and we would all be wise not to forget that.

12. Concentration of research funding
13. short term contracts; discrimination against staff on fixed term contracts
14. Use of metrics for academic reputation and career progression which solely value a) number of publications; and b) amount of funding successfully won. These factors are far removed from contribution to knowledge, communication of research, engagement with people within and beyond the academic community, and maintaining high scientific standards and discourage pursuit of activities beyond those specifically focussed towards narrow research metrics. We have elevated the measurement beyond the outcome, and this is a very unhealthy and unrewarding status for the current UK scientific research environment.
15. No job security

Cambridge University

1. The academic environment can't compite against the industry environment due to huge differences in salaries. Housing is becoming more expensive and academics can't afford to have their own house any more.
2. Rigid intellectual property strategies and agreements.
3. Lack of Government funding.
4. The "bench to bed" process and funding
5. Oversupply of PhDs and postdocs leading to a bottleneck in the career path. That this may put good candidates off from embarking on a scientific research career.
6. Competition for funding
7. funding
8. Use of metrics to assess quality.
9. Pyramid scheme - so many trainees, so few jobs.
10. "publish or perish"
11. The interference of funding constraints and short-view publishing pressures on the ability to conduct long-view, "blue sky" research
12. Lack of freedom in research, the reduction in funding in areas deemed not to be important enough, and the lack of general public understanding about the importance of research
13. RCUK has attempted to decrease the number of applications for research grants by mandating internal selection by research institutions. This has led to an additional layer of reviews whereby researchers not only have to convince external reviewers, but also those within their own department. Inevitably, this has led to a concentration of power on Heads of Department, whereby they are able to decide which applications are put forwards. This is likely to decrease the range and innovativeness of research applications, as those that meet the Head of Department's research interests are favoured. This is particularly important for schemes that fund early career researchers, who are most likely to have novel research interests and least likely to have the

political capital to support them. Importantly, there are no records of which applications are not sent out for external review, so it is not possible to check which research areas are not being put forwards.
14. short term contracts
15. short-termism in the government and consequently government funded sponsors
16. we aren't funding innovation, we are funding safe ideas.
17. Incentive structure completely wrong
18. Planning ahead
19. The competitive nature of both jobs and research funding leaves very little space for blue-skies research (because there is a need for impact and implications in all applications), and it is difficult for younger researchers to find a secure foot on the ladder.
20. A periodic tendency, often driven by political interests for funding of fashionable ideas or names at the cost of quality science.
21. Equality
22. Competition from other countries for skilled people and funding
23. Poor management - waste of money, focus on blind quantity (just to generate a lot of data) instead of quality (good science).
24. Lack of pure curiousity driven work
25. Pressure to publish in high impact factor journals to get a permanent job
26. shrinking of funding, loss of talent
27. I moved to UK quite recently... so thus far I don't have a specific concern about the UK scientific research environment.
28. The high ratio of scientists at junior/postdoc/unestablished level to those in established/permanent positions.
29. Lack for funding for long term research projects.
30. Lack of reproducibility
31. To be competitive, obtain funding and secure a tenure position a huge amount of time needs to be invested between the age of 25-45. People with young families cannot invest as much time as people without. Which means that this process does not always select the best scientist.
32. Obtaining research grants after "so-called" retirement
33. Funding issues
34. lack of progression and the insecurity of holding a long term job
35. Not specific to UK: Due to high competition, scientific fraud - ruins other researchers career due to wasted time and money. Also, people are afraid to speak up if they discover scientific fraud, due to retaliation fears and loss of 'good image'
36. The lacking of funding in the best areas for research growth

University of Edinburgh

1. Being objective and being able to influence UK gov policies in way that is beneficial for society
2. A culture of caution
3. Lack of transparency and engagement
4. Perceived /regulatory barriers to research being undertaken, driven by misunderstandings/confusion/lack of knowledge about what is in fact, actually required.
5. sloppy and bad practice ruining the validity of scientific research
6. interdisciplinary and association btw academic & industries
7. Under-funding of social science aspect of science's innovation and impact on people life (I am health!)

8. If Scotland becomes independent how will the research councils work, funding streams etc? Getting onto the ladder from a non traditional start. Most academics might do a PhD then a post doc and develop their research strategy from the start. For people like me who have been a clinician and and then an applied psychology trainer, my research career didn't really begin to take off until around 2008 or so, 8 years after I received my professional practice doctorate. I am now hitting my stride in terms of publications, strategy and ideas, but many schemes of funding are not open to me because I am not an early career researcher and am not well enough established to be a research leader
9. money

Queen's University Belfast

1. Inadequate research funding promotes cronyism in grant review boards
2. Code of conduct for RCTs in social sciences.
3. Centralisation of government funds around a small number of institutes with the potential for exclusion of others.
4. Equal funding opportunity
5. Ensuring scientists continue working in a research environment, academic or industrial.
6. Increased competition for funding.
7. funding
8. decrease the pollution
9. The pressure to publish
10. Lack of funding
11. Focus on how much money we bring in as an end in itself, at the expense of encouraging excellent and inspiring research ideas - not all research needs huge amounts of money, and the focus on this devalues less expensive research. Relatedly, lack of appropriate (and different) impact and funding targets between very different schools / faculties to reflect the type of research they do.
12. Impact
13. Lack of funding
14. Increasing workload and expectations
15. Managed and quantified research environment leads to unintended consequences that undermine science itself. There is no true appreciation for the research performed; only the resulting KPIs matter.

Newcastle University

1. Why some professors could work over 60 hours per week?
2. No yet, thanks.
3. what difficult to get post-doc job in UK
4. are we competing in different market (between researcher and faculty staff)? faculty aim for students and researcher aim for research fund?
5. Can we improve diversity among scientists without challenging the funding requirements for early career scientists to be regularly and internationally mobile?
6. How can favouritism/bias be avoided in funding and publishing?
7. Does the culture of scientific research lack culture? As an artist I am constantly seeking new and innovative ways of working that will further develop my practice (for example using new technologies to turn visual information into sound or using live algae in a breathable sculpture) whilst

also questioning the ethical implications of my own work and those whom I collaborate with. To that extent my work is not dissimilar to that of a scientist. There are a number of groups such as Wellcome and Leverhulme that encourage relationships between science and art, but often the relationship becomes based on communication of scientific outcomes rather than a true partnership focused on either ethical reflection or the creation of original ideas. What is the panel's opinion on working in partnership with artists as researchers, as a means to both generate new forms of research and to provide diverse reflections on existing scientific research?

8. How does one combat the harmful effects of the "corporitazation" of academia to preserve creativity and quality?
9. Do we need to work harder to improve the career recognition, resourcing and dissemination of interdisciplinary research?
   How can we restore the value of careful reflective research over short-term studies to satisfy a current fad?
10. What is wrong with old-fashioned intellectual curiosity? To what extent does having to be able to justify your existence as an academic by the amount of money you are likely to generate curtail intellectual curiosity?

Manchester University

1. Constrained funding which compromises scale and scope of research and creates an environment that is not conducive to innovation.
2. Lack of funds for research
3. That is could be better regulated
4. Clarity and understanding of research regulatory frameworks by those working within research settings. Pros and cons of strict regulation and the issue of the research drain to developing countries to circumvent regulatory hurdles.
5. That the personal need to publish in high impact journals seems to outweigh the importance of ethical research in some cases the detrimental effects of competition for funding and desire for promotion on the quality of science.