Dear Lord Krebs,

1. Key points:

   - Medical research charities are an integral part of the UK’s medical research sector and are major investors in regenerative medicine.

   - Regenerative medicine is generally at the basic stage of research but some charities are funding clinical trials of stem cell therapies. It is important that public investment in a broad science base continues to underpin future innovation.

   - Charities invest at all stages of the therapy development pathway and can direct funding to areas that lack investment from other sources. Charities often partner with industry to de-risk their investment into new unproven areas of research such as regenerative medicine.

   - Regenerative medicine poses unique challenges to regulation, which must be designed to allow a proportionate and flexible approach as novel therapies are developed.

   - The public stands to benefit hugely from regenerative medicine but must be able to have confidence in regulation and should be at the heart of its development. With their link to patients and supporters, charities can facilitate this.

   - UK patients are at risk from unproven therapies being offered abroad. Charities are a trusted source of information for patients seeking information and advice.

   - For the UK’s advantages in regenerative medicine to deliver, the Government must continue to invest in people and research as well as develop a regulatory and commercial environment that promotes research and innovation.

2. The Association of Medical Research Charities (AMRC) is a membership organisation of the leading medical and health research charities in the UK. AMRC has 125 member charities that together invested over £1 billion into UK research in 2011/12, equating to approximately one third of all public expenditure on medical and health research. Our members are focused on
benefiting patients and many have strong patient groups allied to them, they are the voice of these patients and of the 11 million members of the public who expressly choose to support medical research through donations every month.1

3. We welcome this timely focus on regenerative medicine as a promising field of research for future therapies. AMRC contributed evidence to the BIS/DH report, Taking stock of regenerative medicine, which acknowledged that “charities constitute an integral part of the UK’s medical research sector and have invested strongly in regenerative medicine”2, and also the subsequent strategy, launched by the research councils (MRC, EPSRC, BBSRC and ESRC) and the Technology Strategy Board (TSB), to guide UK investment in the field for the next five years.3 Both documents provide a sound summary of the state of regenerative medicine in the UK today and make recommendations that should be taken forward.

4. We echo the conclusions of these two documents: that the UK should pursue a strategy to support the full spectrum of emerging regenerative technologies, develop the commercial environment to support their development and future-proof regulation so it is not to become a barrier to advances in regenerative medicine. We also agree that the research is generally at an early stage and so fundamental research investment is essential alongside strategies to encourage translation. A joined up approach “from bench to bedside” is required to deliver new therapies to patients as soon as possible. Like the research councils and TSB3, charities are addressing the distinct needs of the different stages of the therapy development pathway and should be considered key partners in developing and delivering the UK strategy.

How does the UK rank internationally in regenerative medicine? What are the UK’s strengths and weaknesses in the field? Who are the major funders?

5. Like all fields of science, regenerative medicine is an international endeavour, with most researchers working in collaboration both with UK-based partners and those overseas. A relatively liberal approach to stem cell research and strong science base make the UK an attractive place to conduct research into regenerative medicine.

6. From 2005-2009, 29 AMRC members invested a combined total of almost £38 million into regenerative medicine. In the years 2005-2008 investment was on average £6 million per year, but it significantly increased in 2009 to £13 million.4

7. Within the AMRC membership, the charities investing greatest in regenerative medicine are those dedicated to diseases for which it holds the greatest potential for new treatments. For example, the nature of early stage multiple sclerosis – that it is caused by a defective immune system potentially amenable to bone marrow-derived stem cell treatments – means that significant advances have been made in the attempt to develop treatments using regenerative medicine. The MS Society is exceptionally active in the field as a result. The UK is a leader in stem cell research in MS and a majority of stem cell trials are either led by or involve a UK-based researcher. Other countries that are playing a major role in stem cell research for MS include Italy, Canada and Australia, although the US is catching up.

8. CASE STUDY: The MS Society is currently co-funding with the UK Stem Cell Foundation an early stage clinical trial of a regenerative therapy. It is funding the UK arm of an international phase 2 trial of patient-derived mesenchymal stem cells (MSCs) with the aim of limiting damage.


4 AMRC member research grant database. Search terms “stem cell” OR “tissue engineering” OR “transplant” OR “regeneration” were used to extract relevant grants and manually checked for false positives. These figures do not include capital grants or infrastructure projects.
to, and stimulating the repair of, myelin. The charity is also funding a phase 1b/2a clinical trial of a drug with the potential to stimulate endogenous brain precursor cells to repair myelin damage caused by MS. The charity is also investing in basic research in regenerative medicine.

9. **CASE STUDY:** The British Heart Foundation’s latest fundraising campaign for research, Mending Broken Hearts, focuses on raising £50 million to fund research into regenerative medicine. Their ambition is to be “pioneers in regenerative medicine”. £1 million raised in this appeal was invested in the Scottish Centre for Regenerative Medicine (SCRM), which opened in May 2012 and will carry out cutting edge stem cell research for a number of conditions and be home to world-leading experts. BHF aim to establish one or two further centres for cardiovascular regenerative medicine in Autumn 2013 and are seeking outline bids for awards to support them. A total of £6 million will be available for this initiative, to be invested to complement funding provided by the research councils, for a four-year funding period.

10. **CASE STUDY:** Regenerative medicine is also showing huge potential in the field of ophthalmology. Fight for Sight, the UK’s largest charity funding medical research into sight loss and eye disease, is currently funding 11 projects, totalling nearly £2.8 million, in this area. The charity does not have funding rounds that are specifically targeted at regenerative medicine but as it is an active area of research at universities and hospitals throughout the UK it receives, as part of its annual grants round, numerous world class applications investigating regenerative medicine for the treatment of many eye diseases.

11. Basic research in other fields can also contribute to the development of regenerative medicine. The Wellcome Trust and Cancer Research UK are major investors in basic research investigating stem cell biology and developmental biology. This develops and maintains expertise and resources in the UK, creating a fertile environment from which advances in regenerative medicine can grow. Funding from BBSRC and MRC also has the same effect by strengthening the science base. This is a case for continuing funding for basic research.

**Is the science being translated into practical applications? What treatments are available on the NHS and privately? What is the potential for regenerative medicine in the next 5-10 years?**

12. The field of regenerative medicine is generally at an early stage and the majority of charity funding is for basic research, however, significant progress is being made in translating discoveries into treatments (see also paragraph 8).

13. Charities fund research at all stages of the therapy development pathway, with many targeting funding to stages that are not attracting investment from other public or private sources. A number of our members also have close industry ties and actively seek to establish collaborations or agreements with companies to commercialise promising technologies.

14. **CASE STUDY:** A current research project funded by Restore, the burn and wound research charity, is attempting to improve readily available commercial skin substitutes, such as Integra®, by promoting growth of blood vessels to aid integration of the artificial product with the patient’s own skin. This commercial application stems from fundamental research, also funded by Restore, which determined the conditions necessary to form new blood vessels in the laboratory from endothelial progenitor cells taken from new burns patients.

15. **CASE STUDY:** Professor Anthony Hollander, Arthritis Research UK Professor of Rheumatology and Tissue Engineering at the University of Bristol, developed techniques to form human cartilage from a patient’s own stem cells. The technology contributed to an international collaboration to grow from a patient’s own cells, the first trachea for transplant. Claudia Castillo received the world’s first lab-grown trachea transplant at the Hospital Clínic of
Barcelona in 2008. There have been numerous successful transplants since, including the first for a child, performed at Great Ormond Street Hospital.

16. **CASE STUDY:** Regenerative medicine for the restoration of vision is at a notably advanced stage. The first embryonic stem cell treatment for age-related macular degeneration (AMD) and the related condition Stargardt's Disease, has already started trials in the UK. The therapy was developed by Advanced Cell Therapy, a US company that got regulatory approval to conduct the trial at London’s Moorfields Eye Hospital. The company is also running concurrent trials at several sites in the US.

*What regulatory barriers and challenges to innovation are there in this inter-disciplinary field? How can these be overcome?*

17. Clinical trials of cell therapies pose unique challenges to classic drug trial designs. They have a high level of uncertainty as there are particular difficulties in predicting potency for cells which, unlike drugs, have the potential to multiply. Furthermore, they tend to be stratified – focused on particular forms of a disease – meaning they affect a small population, making it difficult to recruit the numbers of participants required for traditional trials. (see also paragraph 29)

18. More adaptive licensing approaches are being developed which may offer solutions to some of these problems and prevent regulation from becoming a barrier to medical advances. To move to a more adaptive system will require a strategic change to how we regulate; future regulation must be developed with an eye to the need to be flexible and able to evolve to suit innovative technologies. The novel and untested aspects of regenerative medicine, and in particular stem cell therapies, understandably rouse public interest and in some cases concern. The public must be able to feel confident in the regulation and application of groundbreaking research and treatments. Adaptive licensing takes a more flexible and proportionate approach to risk, patients must be involved in discussions to define the right point on the risk-benefit spectrum for novel therapies.

19. **CASE STUDY:** A recent citizens’ jury convened by the University of Glamorgan and Genetic Alliance UK, found that patients were adept at understanding the higher risks associated with therapies for rare or serious conditions and want the chance to take those risks in pursuit of care or cure.

20. We welcome the government’s plan to establish a group of experts drawn from government, regulators, the NHS, industry, and the academic and third sector communities to discuss healthcare regulation issues including the development of new initiatives and innovations. We urge this group to be ambitious in its proposals.

21. We also welcome the establishment of the Health Research Authority (HRA) as part of a reform and streamlining of the regulatory system. If successfully implemented, this will benefit a great deal of health-related research, including regenerative medicine. Overly-complex approval systems, often involving multiple committees that meet at uncoordinated intervals, currently lead to delays in research getting underway. We are pleased that the HRA appears to be taking a proactive approach to streamlining the regulatory process and we look forward to seeing how these positive changes affect medical research.

22. Regenerative technologies share many of the same barriers to commercialisation as other interventions, these include most notably the “valley of death”, whereby researchers and small
and medium sized enterprises find it difficult to obtain investment for the development of products that are not yet proven to be effective. The novel and sometimes controversial nature (in the case of embryonic stem cells) of regenerative therapies adds to the perception of risk among investors, as does ambiguity in patent law for inventions involving stem cells.

What is the current and potential value of the sector to the UK economy?

23. Regenerative medicine will help patients and their families who suffer from a range of debilitating and fatal diseases. This will have huge implications for the health and wellbeing of the UK population.

24. **CASE STUDY:** In recently-published research it was reported that human stem cells can partially restore hearing to deaf gerbils.\(^8\) This research, partly funded by Action on Hearing Loss, is an early stage in understanding how we might use regenerative medicine to restore human hearing. Such a treatment would be of huge value to UK health and wealth. Hearing loss affects one in six of the population, and tinnitus one in ten. The prevalence of these chronic conditions increases with age – half of all people over 60 have a hearing loss. With an ageing population, the number of people affected by hearing loss and tinnitus is set to soar. Both hearing loss and tinnitus can have profound effects on quality of life. By 2030, hearing loss will be ranked the ninth most disabling condition globally, just two ranks below chronic obstructive pulmonary disease. Both hearing loss and tinnitus can result in feelings of isolation and depression, reduced physical and psychological wellbeing, and social withdrawal.\(^9\)

Is the Government doing enough to attract investment in companies working in this area? What business models are most appropriate to support development in this area?

25. Medical research charities are an asset to the UK research and development environment. With flexible funding models, charities are able to target money to where it is needed to correct market failure, often supporting promising early stage research before the technology is proven and when financial risks for industry may be higher.

26. **CASE STUDY:** In 2007, the UK spent £1.34 on research into hearing loss for every person affected. This compares to £14.21 for sight loss, £21.31 for diabetes, and £49.71 for cardiovascular research.\(^10\) Charitable funding for hearing loss research is therefore meeting an area of high unmet need. The Action on Hearing Loss Translational Research Initiative for Hearing (TRIH) supports research with a strong commercial potential that is likely to attract follow-on funding at the conclusion of the grant and is open to academic institutions or small/medium enterprises (SMEs).\(^11\) Demonstrating the unique qualities of the charity sector, it offers funding and partnership opportunities to allow industry to enter hearing research in a low-risk way, provides a research hub to coordinate and link up research efforts, and engages patient support for, and participation in, clinical trials for hearing loss and tinnitus globally. Cell-based therapies to restore hearing are defined within the scope of TRIH and feature in the research strategy of Action on Hearing Loss.\(^12\)

What can the UK learn from international competitors about supporting the development and commercialisation of regenerative medicine?

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\(^12\) [http://www.actiononhearingloss.org.uk/~media/Documents/Biomedical%20research/Biomedical%20research/2011%20Strategy%20document%202012%20013.aspx](http://www.actiononhearingloss.org.uk/~media/Documents/Biomedical%20research/Biomedical%20research/2011%20Strategy%20document%202012%20013.aspx) [accessed 15 August 2012]
27. The number and diversity of medical research charities in the UK is unique internationally and provides a distinct advantage. AMRC members’ priorities are to develop new treatments for patients and so are able and willing partners in the research and development of regenerative medicine.

28. Charities act as hubs for research, bringing together researchers, clinicians and patients to identify areas of unmet need and agree strategic goals. Even for charities focussed on the UK research sector, conferences and meetings will often have an international attendance. These events offer learning and best practice sharing opportunities, not just for research but also in treatment and regulation.

29. **CASE STUDY:** In 2009, the MS Society hosted an international conference in London, bringing together MS researchers, people affected by MS and funding bodies from around the world to agree a consensus on how stem cell-based clinical trials for MS treatments should be conducted.

30. **CASE STUDY:** Fight for Sight, in partnership with other organisations in the eye sector, is involved in a Sight Loss and Vision Priority Setting Partnership overseen by the James Lind Alliance. The project aims to use the views and experiences of patients, carers and healthcare professionals to determine priorities for research. This helps research deliver products that are of true value to patients and address unmet needs in medicine, the hallmarks of innovation.

31. Charities should be key partners when formulating policies related to regenerative medicine, such as funding strategies and regulatory regimes.

**What risks do UK citizens face when travelling to other countries for regenerative treatments?**

32. With their strong patient links, charities have direct experience of the hopes of patients and also their concerns. Many AMRC members receive inquiries from the public about the possibility of travelling abroad for regenerative medicine therapies and are a valuable source of reliable information. Such inquiries tend to increase following media coverage of medical breakthroughs and potential new treatments.

33. **CASE STUDY:** The MS Society has produced information for MS patients about stem cell therapies in response to enquiries that they have received. In it, the MS Society “strongly discourage people with MS from approaching ‘stem cell clinics’ that are offering ‘stem cell therapies’ outside of an official clinical trial.”

34. **CASE STUDY:** Fight for Sight is aware of patients – mainly children – with optic nerve atrophy from birth who have gone to China for stem cell therapy. The charity has successfully discouraged others that were seeking similar therapies in both China and Germany. The German clinic, called the X-Cell clinic, has since closed but has reportedly re-opened in Lebanon.

35. **CASE STUDY:** With the launch of their high-profile Mending Broken Hearts Campaign, which focussed on regenerative medicine, the British Heart Foundation received an increase in enquiries from individuals who were aware of certain stem cell-based regenerative lung therapies available abroad but not in the UK. Questions were generally based around the safety and costs of such treatments and why these options are not available in the UK.

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36. We believe regenerative medicine has the potential to make a substantial and beneficial impact in a range of disease areas. Medical research charities, with their focus on specific diseases and close links to patient populations, are major stakeholders in the UK’s regenerative medicine strategy. They have expertise across the board, from pioneering research in the laboratory to the needs and concerns of patients, and make a valuable contribution to the research base as well as driving treatments through the development pathway. But charities can only continue to do this in partnership with Government, which plays a vital role in funding education and training, investing in basic and applied research and infrastructure, and prioritises the development of a regulatory environment that promotes innovation.

37. We have many more examples to illustrate the points made in this response. If these would be helpful or if you have any further questions, please contact Becky Purvis, Head of Policy, on 020 7685 2626 or b.purvis@amrc.org.uk.

Yours sincerely,

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