Proposal for a policy on the use of animals and tissue samples in experiments in the Department of Engineering

Dr Timothy O'Leary, Dr Michael Sutcliffe & Professor Daniel Wolpert in consultation with Philip Guilford, Dr Martin Vinnell (Director of Health and Safety, University of Cambridge) and bioengineering faculty (Drs Alexandre Kabla, Athina Markaki, Michelle Oyen, Shery Huang and Thierry Savin).
17 May 2016

Executive summary

There are tremendous and growing research and funding opportunities at the intersection between Engineering and the Biosciences. These opportunities are, in some cases, beyond reach without the use of animals and animal tissues. Many Bioengineering departments routinely engage in such work.

The Department of Engineering's current restrictions on experiments involving animals are jeopardising the future of the bioengineering theme without offering any benefits. The proposal is that we move our position to:

- remove the statement that no animal research takes place on Department premises from our grant applications
- openly promote our existing and future work that involves animals in news stories, job adverts, etc., as we would any other of our research, and in compliance with the University's commitment to the Concordat on Openness on Animal Research - http://tinyurl.com/htdps76
- allow colonies and undertake experiments on our premises that involve invertebrates such as nematode worms, waxworms, sea slugs and fruit flies that are not covered by the Scientific Procedures Act or the University's animal welfare policy
- when a research project requires it, register our premises as a designated site and establish specific procedures whereby:
    - colonies of zebra fish can be kept on site and experiments on zebra fish can be undertaken
    - mice or rats can be transferred from the University's central husbandry facilities to be humanely terminated within hours of arrival in a cordoned off lab so that their tissue can be used in experiments that demand live tissue
- include the above in the Bioengineering theme's requirements for the Move West and liaise with other department's at West Cambridge to consider shared facilities and expansion of our current capabilities.

The Department's bioengineering theme

In 2004, the Department of Engineering launched a strategic theme in Bioengineering (originally called Engineering for Life Sciences). This theme has proved extremely successful. It now engages 30 academic staff. All of the six divisions are represented. The total value of current research grants exceeds GBP10M. Research outputs and impact made a significant high-quality contribution to the REF submission. 69 undergraduates attended at least one bioengineering module in their third year and 48 did so in their fourth year. Externally, Cambridge is home to a world leading cluster of

biotechnology industries and this is set to expand with the arrival of Astrazeneca's headquarters and Illumina's European headquarters during the next couple of years. Industrial ties to our Bioengineering theme represent significant future opportunities for investment and education.

In short, there is considerable potential for further significant growth, but many fast-growing, accessible and highly relevant research areas are presently excluded due to current policies.

To provide context, our main national competitors such as Imperial and Oxford, as well as all major US Bioengineering Departments have substantial research involving the use of animals and animal tissue, typically involving established model organisms such as nematode worms, fruit flies and mice. This kind of research is routine and essential for many areas of bioengineering, including but not limited to, neural engineering, tissue mechanics, bio-inspired flight and locomotion, nanoscale engineering of drug delivery vehicles and biosensors, bioenergetics and biomaterials.

Appended to this proposal are two letters of support from senior faculty in leading bioengineering departments (Krishna Shenoy, Stanford and Holger Krapp, Imperial College). Both letters emphasize that animal research is routine and essential to bioengineering.

Our current approach to the use of animals in experiments

Our current stance is that experiments involving live animals not are permitted on the Department's premises. We require a statement to this effect in our grant applications. This approach means that our bioengineering academics conduct such experiments off site or work with collaborators who undertake the experiments and provide results, entailing obvious practical, academic and logistical disadvantages and denying research groups full autonomy over facilities. Researchers are, of course, free to publish their work, but the Department has been reluctant to run news stories with explicit references to work involving animals. The approach has also affected the way in which we advertise posts. In summary, the current stance on animals substantially limits the research we can engage with, adds inconvenience and costs to ongoing research, creates an impediment to recruitment, and stands in the way of public engagement, but offers no benefits in terms of animal welfare or Departmental image.

Experiments involving preserved tissue samples and cell cultures are allowed on site, providing the work is conducted in the appropriate class of laboratory and health and safety procedures are followed, as would be the case with any kind of laboratory work. The use of human tissue is subject to additional regulation. Harvesting tissue from animals by terminating on-site is not permitted, precluding research involving living tissue such as neurons and cardiac tissue.

A new approach

We need to take a new approach if the bioengineering theme is to flourish. We can be confident of moving forward now that the University Biomedical Support Services is well established to assist with every aspect of compliance, operations and Health and Safety. As with all research, new work must comply with University policies and Home Office regulations. UK regulations on animal use in research are among the most stringent in the world: protected species can only be used when there are no alternatives and ethical/welfare considerations are stringently assessed by the Home Office. The University has established support and infrastructure to ensure we comply with these strict standards. We are further reassured that changes in legislation have been very successful in

controlling extremism among animal rights protestors, which is increasingly rare and does not discourage routine and essential work in other Departments.

Our communications strategy is to ensure compliance with the University's requirements on openness and further ensure that:

- Appropriate terminology is used in discussing use of animals. For example, none of the work would fall under the accepted uses of the terms "vivisection" or "animal testing". These have specific meanings connected to drugs and cosmetics testing, among other things. The University's Research Communications Office (contact: Craig Brierly) can advise on appropriate terminology as needed.
- UAR (Understanding Animal Research, http://www.understandinganimalresearch.org.uk/) is a non-profit organisation that authored the Concordat on Openness. UAR has also published a detailed guide on understanding how and why animals are used in research. This guide is freely available to any member of the Department. Furthermore, the University subscribes to UAR and members of the Department may consult with UAR on communications issues related to animal research.
- The Science Media Centre (http://www.sciencemediacentre.org/) offers consultation Press Releases and media management. Their services are effective in a 'response mode' capacity for specific communications and public relations issues. The normal mode of contact is through the University's Research Communications Office.

A related consideration is workshop, design engineer, and other technical support for experiments involving animals conducted outside the Department. Significant cross-Departmental collaboration is possible by leveraging our expertise and facilities, and such cross-Disciplinary collaboration is the very essence of Bioengineering. However, there will be cases where the difficulty of handling sensitivities to, for example, primate work mean that the potential advantages do not outweigh the disadvantages. We therefore propose that equipment that is recognisably connected to non-human primate work is not permitted on site.

Table 1 (overleaf) summarises the proposal.

Table 1: summary of the proposal

Category	**Examples** Note: The list of examples is far from exhaustive and may be extended as the policy is developed	**Protected by Animal (Scientific Procedures) Act?**	**Covered by the University's animal welfare policy?**	**Live experiments in the Dept** * = Change in current position	**Tissue received from collaborators for experiments in the Dept**	**Experiments outside the Dept with collaborators**
Cells and plants	Yeast	No	No	Continue to allow experiments	Continue to allow experiments	Continue to allow experiments
	Slime amoeba	No	No			
	Arabidopsis	No	No			
Invertebrates	Nematode worm	No	No	Allow colonies to be kept and experiments*		
	Waxworm	No	No			
	Fruit fly	No	No			
	Decapods (e.g. crab)	No	Yes	Allow transfer of animals from facilities elsewhere in the University to cordoned labs on designated Dept. sites for termination within hours, prior to harvesting tissue for experiments on Dept. premises*		
	Cephalopods (e.g. squid)	Yes	Yes	Continue to disallow in the Department		
Non-human vertebrates	Zebra fish	Yes	Yes	Allow colonies to be kept and experiments*		
	Mice	Yes	Yes	Allow transfer of animals from facilities elsewhere in the University to cordoned labs on designated Dept. sites for termination within hours, prior to harvesting tissue for experiments on Dept. premises*		
	Rats	Yes	Yes			
	Rabbits	Yes	Yes	Continue to disallow in the Department		
	Cats	Yes	Yes			
	Dogs	Yes	Yes			
	Ferrets	Yes	Yes			
	Non-human primates	Yes	Yes			
Humans	Humans	N/A	N/A	Continue to allow subject to approval on a case-by-case basis by the Dept ethics committee		

The actions arising from approval of the proposal by the Academic Committee are:

- remove the requirement to state that animal work does not occur on our premises from research grant proposals
- create a specialist team within our ethics committee to provide guidance to researchers on experiments involving animals and animal tissue
- assign an academic (Dr Timothy O'Leary) as the primary link to the University Biomedical Support Service and primary contact point for staff, students and media relations, who will enact the communications plan
- ensure the Director of Research and his team receive training from the University Biomedical Support Service, so that they can provide an informed service, as we openly promote our work that involves animals in our news stories, job adverts, etc., as we would any other of our research, and so achieve full compliance with the University's policy on openness in animal research
- brief the workshops and design engineers
- extend the duties of the Biological Safety Officer to include bio compliance (Dr Michael Sutcliffe will bear the additional bio compliance duties in the interim, while Dr Thierry Savin takes his sabbatical in Michaelmas 2016 and Dr Michelle Oyen provides cover for the safety duties, and Dr Savin will take the unified role on his return)
- when a research project requires it, register our premises as a designated site and establishing procedures whereby:
    - colonies of zebra fish can be kept on site and experiments on zebra fish can be undertaken
    - mice or rats can be transferred from the University's central husbandry facilities to be humanely terminated within hours of arrival in a cordoned off lab for experiments that require live tissue
- consider the above when specifying the Bioengineering theme's requirements for new facilities in the Move West, propose amendments to the above if planning for the Move West creates new useful opportunities, and liaise with other departments at West Cambridge to consider shared facilities and expanding of our current capability.

Krishna V. Shenoy, Ph.D.
Professor, Stanford University & Investigator, HHMI
Director, Neural Prosthetic Systems Lab and Co-director, Neural Prosthetics Translational Lab
Departments of Electrical Engineering and, by courtesy, Bioengineering and Neurobiology

14 May 2016

Dr. Timothy O'Leary
University Lecturer in Information Engineering and Medical Neuroscience
Department of Engineering
University of Cambridge

Dear Academic Committee:

I write to share my experiences and thoughts on the importance of animal work in Bioengineering. At Stanford we have a wide range of research that involves animals and animal tissues, ranging from biomechanics to neural engineering.

Much of this work leverages the enormous progress in understanding the biology of so-called model systems (e.g., Drosophila and rodents) in increasingly quantitative terms. Much of this progress emerged in the last two decades with the advent of genetic tools, quantitative optical imaging and optical perturbation (optogenetics), and other minimally/non-invasive methods for measuring and manipulating physiological activity, especially in the nervous system. As a consequence, we are witnessing an explosion in the number of direct applications of engineering approaches in control, sensing, signal processing, mechanics, fluid dynamics, materials, electrical engineering and data analysis.

My own research and that of my colleagues absolutely requires animals because it focuses on neural dynamics that occur in living tissue. In my case, it would be impossible to design, test and develop components of neural prostheses (medical systems that translate brain signals into control signals for prosthetic devices) and the significant real-time analysis of data without direct access to living mammalian nervous systems. It is also upon these basic neuroscience and pre-clinical animal model studies that the US Food and Drug Administration has approved our pilot clinical trial aimed at ultimately helping restore lost motor function to people with paralysis.

Elsewhere in our Department, animal models present huge engineering opportunities to understand principles at work in nature and to develop medical and bio-inspired applications – not to mention

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access to considerable biomedical funding (US NIH, NSF, DARPA, HHMI, and private foundations). Even in our highly collaborative institution, an inability to work with animals and their living tissue on site would significantly hinder this work and in many cases make it effectively impossible.

In summary, animal work is routine across many disciplines and in my view it is now an essential component of a serious Bioengineering program.

Sincerely,

Imperial College London

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Dr. Holger G. Krapp
Professor of Systems Neuroscience

Engineering
University of Cambridge

16 May 2016

Regarding: Animal research in Bioengineering

Dear Academic Committee

Your colleagues requested my views on the importance of animal research in Bioengineering. As a representative of the Faculty of Engineering on the Central Biological Services Management and Strategy committee at Imperial I am happy to provide a statement regarding the fundamental significance of animal experimentation.

Imperial's Bioengineering Department has a number of groups that use animals such as rodents and insects in their research, including my own. This is increasingly common at the interface between life sciences and physical/engineering sciences. In my work, the blowfly and other flying insects, represent important examples of systems that solve a wide range of challenging engineering problems such as energy efficient flight control, multimodal sensing, and, in the nervous system in particular, low power computation. It is impossible to study these aspects without having on site access to the living organism itself. To advance biomedical/robotics technology, even so-called 'simple' organisms such as nematode worms and insects are useful models and are crucial for our understanding of how to manipulate biological systems and interface them with artificial systems. These organisms are sufficiently complex to address questions of general interest, while being simple enough to obtain conclusive answers. There are enormous and growing opportunities in Bioengineering, many of which require the integration of animal research with analytical and theoretical work to fully exploit the synergistic potential of timely cross-disciplinary approaches that bridge the gap between life sciences and engineering.

With kind regards,

Dr Holger G. Krapp
Professor of Systems Neuroscience, Department of Bioengineering