



National Centre  
for the Replacement  
Refinement & Reduction  
of Animals in Research

2013

# Annual Report

Pioneering Better Science

# Foreword

Over the last year, we have concentrated on our key strengths in bringing communities together, in fostering new science and innovative problem solving, and establishing new collaborations. This report summarises some of our highlights from 2013.

We have demonstrated that first class science and the 3Rs can go hand-in-hand and as a result we have seen demand for our resources increase again in 2013. We have responded to this with new funding opportunities to support 3Rs infrastructure and networking, and new strategic partnerships, including an exciting collaboration with the Technology Strategy Board to commercialise 3Rs technologies. In 2013, we committed £8 million for research and training, worked with 48 companies from across the globe on data sharing initiatives and increased the number of journals endorsing our reporting guidelines from 176 to 335.

Our 3Rs strategy addresses major scientific and business challenges including translating research into economic growth, tackling serious diseases and reducing drug attrition. At its core is a commitment to minimise animal use and suffering and it is this which makes the NC3Rs unique.

Animal research will continue to be one of the most contentious issues in science. This was certainly the case in 2004 when the NC3Rs was launched. Since then, as a result of our work, there has been a shift in the level of scientific engagement in the 3Rs and the ethos around animal research has started to change. The key challenge now is maintaining this momentum at a time when budgets are tight.

The landscape continues to evolve and in 2014 we are planning a ten year forward look to examine the role of the NC3Rs in an environment that is very different to where we started. We will continue to work hard to ensure that the NC3Rs stays at the forefront of delivering a 3Rs agenda that addresses societal concerns about animal use and supports the health and wealth of the nation.

**Dr Vicky Robinson, Chief Executive**  
**Professor Stephen Holgate CBE, Board Chair**





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# Highlights

## New Infrastructure for Impact funding scheme launched

In 2013 we launched the Infrastructure for Impact funding scheme. This funds equipment, networking and data sharing, complementing our existing research-focused funding mechanisms. Four awards were made totalling £1.3 million. The awards include a systematic review and meta-analysis resource to help improve the design of animal studies; a database for sharing materials and knowledge across the UK breast cancer research community to avoid unnecessary repetition of *in vivo* studies; multi-centre and multi-user imaging for cancer and trauma studies; and an online teaching and training resource for refinement (for example, the use of anaesthesia, and recognising pain and distress). In total we received 16 applications for the competition, making the success rate for the scheme 25%.

We also committed £2.3 million for project and pilot study grants. A total of 14 awards were made; five project grants and nine pilot study grants with success rates of 11% and 22% respectively of the total applications received. 79% of the grants awarded focus on replacement, 7% on reduction and 14% on refinement. The awards cover a wide range of areas from applying the 3Rs to malaria infection studies in mice to using the fruit fly to investigate the role of glial cells in neurodegeneration. A full list is given in the Annexes.

In November, we published the second review of our research portfolio, focusing primarily on project grants. In the report, we illustrate the impact of the awards we have made in terms of the 3Rs, new scientific and technological discoveries, and policy and regulatory changes. We provide quantitative and qualitative metrics of impact across all grants, including a bibliographic analysis and detailed case studies.

## New funding for the CRACK IT Challenges competition

CRACK IT Challenges is a collaborative funding competition designed to address scientific or business needs with a 3Rs theme by connecting the industrial, academic and small and medium-sized enterprise (SME) sectors. The focus is on developing marketable products or processes. Challenges are posed by sponsors and are put to the scientific community for solving. Funding is provided by the NC3Rs with sponsors committing co-funding and/or in-kind contributions such as access to compounds and equipment. The competition is run in two stages: Phase 1 supports six month proof-of-concept studies of up to £100k, with a maximum of four awards made per Challenge. The awardees subsequently compete for Phase 2 funding of up to £1 million per Challenge. For both phases, awards take the form of milestone-driven contracts rather than grants.

In 2013, there were five CRACK IT Challenges and seven sponsors. This included for the first time sponsorship from a charity, Alzheimer's Research UK, who provided £350k of co-funding towards a Challenge to develop a human stem cell-based neuronal assay for predicting the efficacy of drugs targeting tau, the protein which forms the hallmark neurofibrillary tangles observed in Alzheimer's

disease. The other four Challenges focused on cardiac toxicity, nephrotoxicity, infectious diseases and chronic pulmonary inflammatory disease. A list of the Challenge sponsors is given below. The competition was run through the Technology Strategy Board's (TSB) Small Business Research Initiative with a total budget of £7 million. This includes £2 million from the TSB, a doubling of its contribution compared with the previous year.

A total of 32 applications were received for the Phase 1 competition. Seventeen awards were made, totalling £1.6 million, with almost half of the successful teams including one or more SME partners. Decisions on Phase 2 awards will be taken in July 2014.

This year also saw the award of Phase 2 funding for the 2012 CRACK IT Challenge competition, with co-funding from the Medical Research Council (MRC). Awards totalling £1.4 million were made for two of the four Challenges; *PREDART*, the development of non-mammalian assays for developmental and reproductive toxicity, and *Rodent Little Brother*, a non-invasive approach for measuring the activity and behaviour of mice in their home cage.

A list of awards is provided in the Annexes.

Title	Theme	Sponsors
UnTangle	Alzheimer's research	Alzheimer's Research UK, Janssen, Lilly
InPulse	Cardiotoxicity	GlaxoSmithKline
Inhalation Translation	Chronic pulmonary inflammatory disease	GlaxoSmithKline, Huntingdon Life Sciences, Pfizer
Nephrotube	Nephrotoxicity	GlaxoSmithKline, Pfizer, Roche
Virtual Infectious Disease Research	Infectious diseases	NC3Rs

## New funding to support the CRACK IT Solutions technology partnering hub

CRACK IT Solutions is a technology partnering hub designed to provide a platform for researchers and companies to showcase technologies and products with 3Rs potential. The aim is to identify new partners to help further develop, validate and adopt the technology being showcased. In 2013, five new technologies were promoted through CRACK IT Solutions, three from SMEs and two from academia.

To catalyse collaborations between Solution providers and potential end-users, a new funding scheme was introduced with awards of up to £30k over 12 months. In 2013, five CRACK IT Solutions grants totalling £150k were awarded, with an additional £112k of external funding secured from end-users and Solution providers.

The scheme supported collaborations between academia and industry, SMEs and academia, and between SMEs. A list of awards is provided in the Annexes.

One of the technologies showcased and supported with a CRACK IT Solutions grant was the use of the social amoeba, *Dictyostelium discoideum*, as a screen for palatability testing in pharmaceutical development. The funding was used to provide proof-of-principle that this non-animal model could correctly identify aversive compounds. Based on this, a collaboration to progress the work is planned between Professor Robin Williams (Royal Holloway, University of London) and GlaxoSmithKline, which is scheduled to start in 2014.



## New cross-funder collaboration to commercialise 3Rs technologies

One of our main objectives since the NC3Rs was launched has been to support a pipeline of 3Rs science and technology. This has provided the foundations for the next step – to support innovation and entrepreneurship by taking new models, tools and technologies from the research base through to commercialisation. During 2013, we worked with the TSB on a new collaboration to explore the market potential of non-animal technologies and the economic impact for the UK, reflecting the changing landscape for pharmaceutical and chemical development and the opportunity for the UK to build on its strengths in this area.

As part of this process, the TSB compared the business potential of over 150 emerging technologies. To help build the case for non-animal technologies, the NC3Rs and TSB jointly hosted two workshops to discuss with experts from a range of sectors the disruptive potential of technologies such as microfluidics, 3D organ cultures and mathematical modelling. This led to non-animal technologies being selected as one of four new areas for investment by the TSB through its 'Emerging Technologies and Industries' programme.

In November, a £4 million call funded by the NC3Rs and TSB plus the Engineering and Physical Sciences Research Council (EPSRC), the Biotechnology and Biological Sciences Research Council (BBSRC) and the Defence Science and Technology Laboratory, was launched for business-led feasibility studies on how non-animal technologies can be applied and commercialised in the UK. The competition is open to large companies and SMEs, with academic partners where they strengthen the collaboration. Feasibility projects of up to £250k will be funded. To support the competition, the NC3Rs and TSB have hosted regional consortia building workshops across the UK. The first awards will be made in May 2014. The competition forms part of a larger initiative with the NC3Rs and TSB continuing to collaborate with other funders on a national programme on the business development of non-animal technologies.

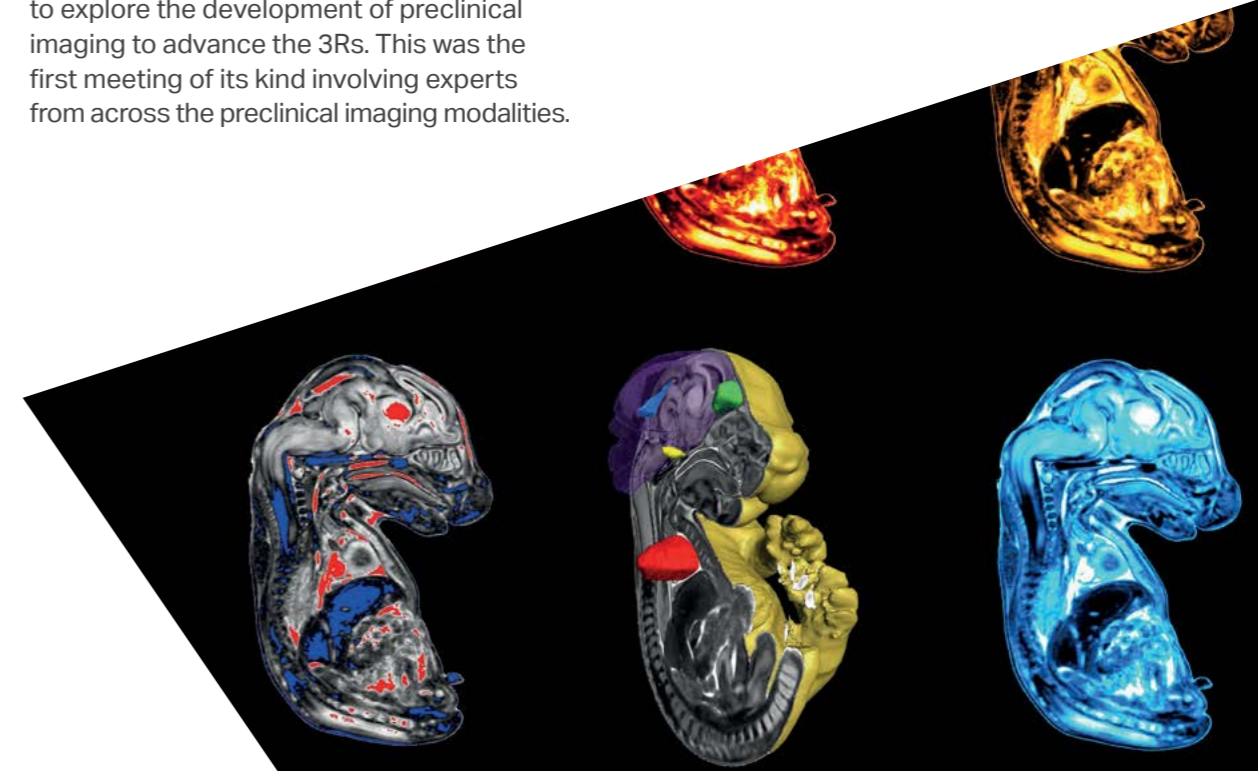
## New research strategy for the 3Rs potential of imaging technologies

Imaging technologies, such as magnetic resonance imaging, have been used effectively across a range of disciplines and therapeutic areas to reduce and refine the use of animals by allowing longitudinal studies to be performed in the same animals and earlier humane endpoints to be adopted to minimise suffering. There is still, however, an opportunity to maximise the 3Rs benefits of imaging, particularly with regard to replacement.

In June, we hosted a joint workshop with the TSB-funded Electronics, Sensors and Photonics Knowledge Transfer Network (ESP KTN) to bring together the UK's preclinical imaging community – biologists and imaging technology manufacturers – to explore the development of preclinical imaging to advance the 3Rs. This was the first meeting of its kind involving experts from across the preclinical imaging modalities.

Based on the workshop, key research themes were identified as part of a 3Rs strategy to enhance the use of preclinical imaging and address current technological limitations. The six themes formed part of a £1 million strategic call launched by the NC3Rs in August which included tracking cell fate and distribution, 3D gene expression profiling, imaging bioengineered tissues, molecular imaging of the biodistribution of drugs including macromolecules, improving sensitivity and resolution, and phenotyping genetically modified mice.

The competition closed in October with 26 applications submitted. Funding decisions will be made in March 2014.



## New human tissue initiatives to replace animal use

In May, together with the Medicines and Healthcare products Regulatory Agency (MHRA), we convened an expert working group to explore opportunities for the wider adoption of human tissue-based approaches to replace animal use in the safety assessment of new drugs. The working group has 28 members, including 14 from pharmaceutical companies and seven from international regulatory agencies. The initial priority for the group has been to assess the current use of human tissue through a survey of the international safety pharmacology

community. This has identified regulatory and supply issues as key barriers to use and these will form the main focus of the group in 2014.

Our expert working group on asthma models has also been investigating the use of human tissue to replace animal use, as part of a collaboration with Asthma UK, the Human Tissue Authority and the UK Respiratory Research Collaborative. A similar approach has been taken with an initial survey being conducted to assess the extent of current use and perceived barriers.

Top six perceived barriers to uptake of human tissue approaches in safety pharmacology



- Inadequate supply and characterisation of tissues
- Perceived regulatory acceptance
- Practicalities of using fresh tissue/stem cells
- Obtaining correct ethical consent documentation
- Inter-individual variability
- Logistical issues e.g. transport, shelf-life

Drivers for human tissue use in safety pharmacology



- Human models are more relevant
- Poor predictivity of animal models
- Lack of suitable animal models
- Cost
- Other

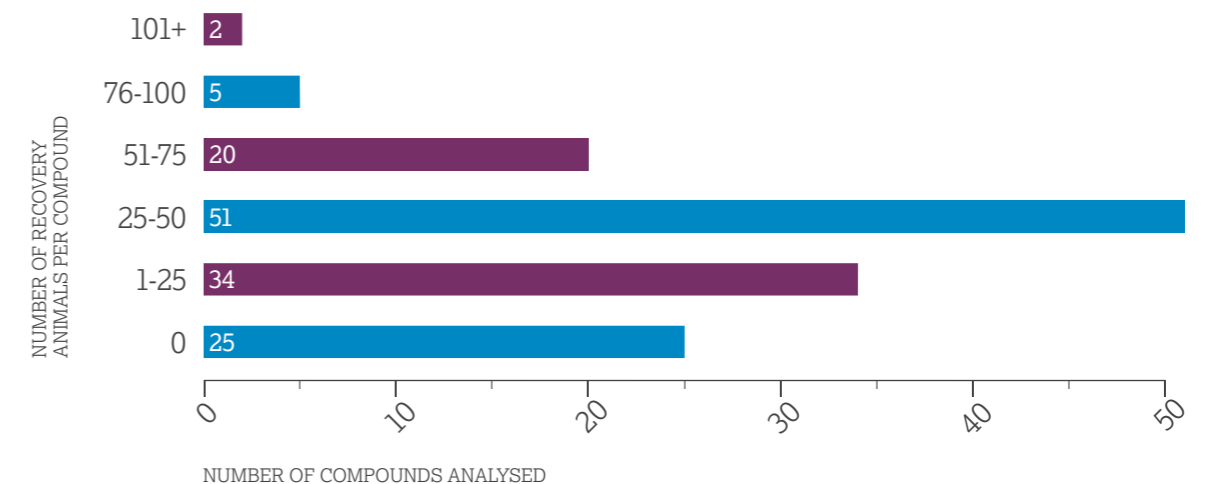
## New recommendations to reduce the use of recovery animals

During 2013 we completed the analysis of data collected as part of our joint programme with the MHRA to consider opportunities to reduce the use of recovery animals in pharmaceutical development.

Recovery animals – rodents, dogs and non-human primates – are used in many toxicology studies to determine whether it is possible to recover from any adverse effects caused by the drug being tested. A global expert working group with representatives from 32 organisations, half from Europe and half from the USA, including pharmaceutical and biotechnology companies, contract research organisations and regulatory authorities, has facilitated data sharing with the NC3Rs acting as the ‘honest broker’.

We have focused on study designs and the impact the inclusion or exclusion of recovery animals has on internal and regulatory decisions. We have analysed a large data set provided by 22 companies on 137 compounds (including 53 biologicals and 78 small molecules) and 259 studies. This showed that there was wide variation in when and why recovery animals were included, with the number of recovery animals used per compound ranging from zero to over 100. The analysis has provided the basis for evidence-based recommendations to support a change in company practice and regulatory requirements to allow a reduction in the use of recovery animals for studies conducted prior to first-in-man clinical trials. The recommendations will be published in 2014.

Variation in the use of recovery animals



## New method to culture hepatocytes from adult mouse stem cells awarded 3Rs Prize

The annual international NC3Rs Prize has been awarded to Dr Meritxell Huch for a publication in *Nature* that describes the first successful expansion of mouse liver stem cells into 3D structures that resemble functional liver tissue.

For decades scientists have attempted to regenerate hepatocytes but until now no laboratory has been successful in identifying and growing such cells in culture. The mouse has traditionally been the only method for the study of stem cells during tissue regeneration.

Dr Huch and colleagues, from the Hubrecht Institute for Developmental Biology and Stem Cell Research, The Netherlands, have identified a marker (Lgr5<sup>+</sup>) for a particular class of stem cells that become active when the liver is damaged. Isolating these cells in a novel liver culture system results in the infinite expansion of long-lived mouse hepatocytes that could be used for high-throughput drug screening, toxicology safety studies and research on liver regeneration, replacing the use of mice. Clinically, the application of the technology to human hepatocytes has enormous potential for the regeneration of damaged livers and treatments for patients with liver diseases.

The £20k prize, which is sponsored by GlaxoSmithKline, is for an outstanding contribution to scientific and technological advances in the 3Rs, published within the last three years. We received 22 applications, with over half from researchers outside of the UK.

Two highly commended awards have also been made for publications describing an opportunity to reduce rodent use in biomedical research through the development of a new method to culture macrophages, and

the development of a biocompatible skull implant for cognition studies in non-human primates that significantly improves animal welfare.

### Winner

#### Dr Meritxell Huch

Hubrecht Institute for Developmental Biology and Stem Cell Research. Presently at The Gurdon Institute, University of Cambridge.

Huch M, Dorrell C, Boj SF, van Es JH, Li VSW, van de Wetering M, Sato T, Hamer K, Sasaki N, Finegold MJ, Haft A, Vries RG, Grompe M, Clevers H (2013). *In vitro* expansion of single Lgr5<sup>+</sup> liver stem cells induced by Wnt-driven regeneration. *Nature* 494: 247–252.

### Highly commended

#### Dr Gyorgy Fejer

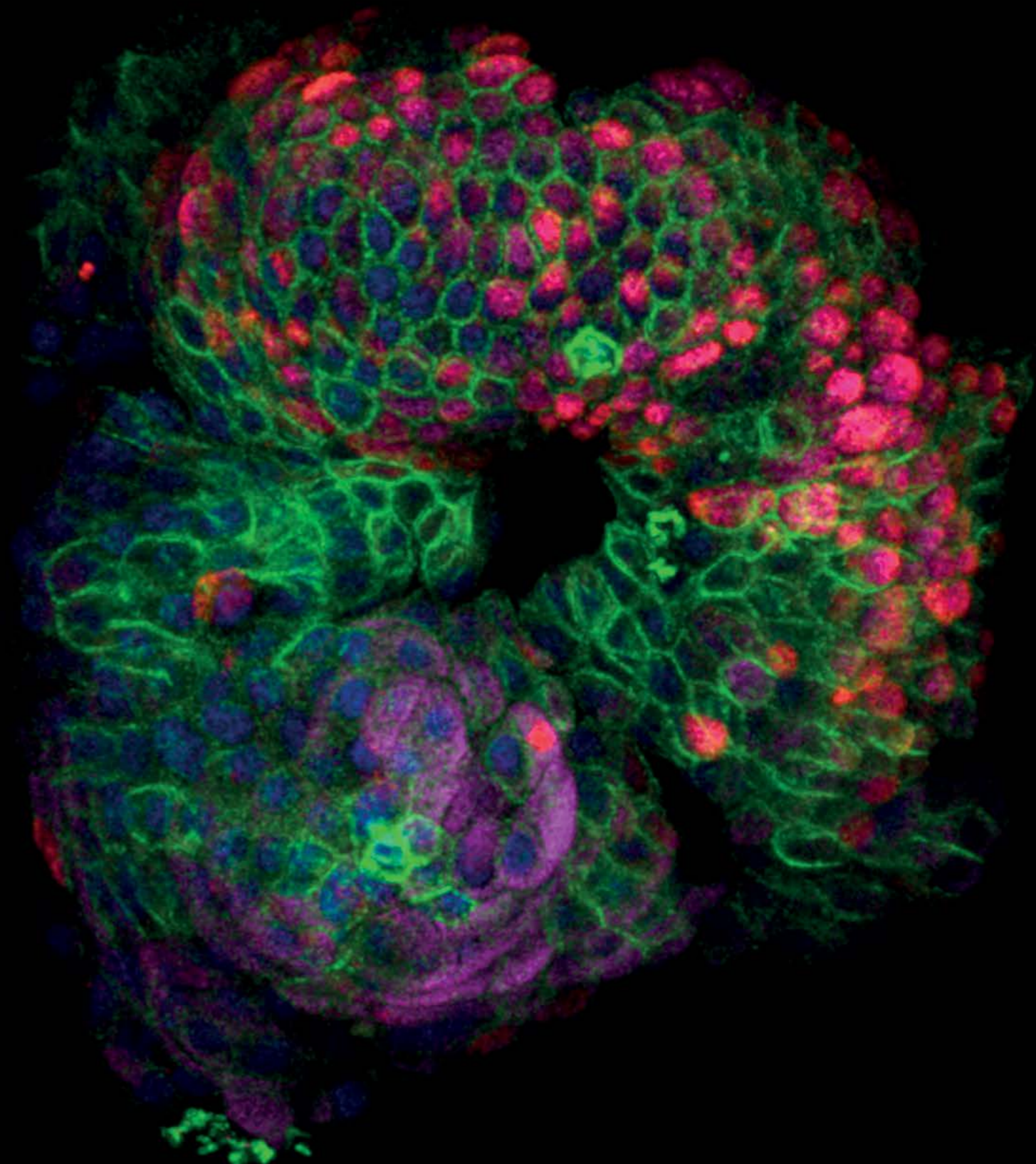
University of Plymouth

Fejer G, Wegner MD, Györy I, Cohen I, Engelhard P, Voronov E, Manke T, Ruzsics Z, Dölken L, Prazeres da Costa O, Branzk N, Huber M, Prasse A, Schneider R, Apte RN, Galanos C, Freudenberg M (2013). Nontransformed, GM-CSF–dependent macrophage lines are a unique model to study tissue macrophage functions. *PNAS* 110(24): E2191–E2198.

#### Dr Daniel Adams

University of California, San Francisco

Adams DL, Economides JR, Jocson CM, Parker JM, Horton JC (2011). A watertight acrylic-free titanium recording chamber for electrophysiology in behaving monkeys. *J. Neurophysiol* 106: 1581–1590.



Liver organoid in culture

## New global initiative on microsampling to influence company and regulatory practice

The development of analytical methods which allow the analysis of very small blood samples (referred to as microsampling) taken from rodents during toxicology studies can eliminate the use of satellite animals for toxicokinetic analysis as those in the main study group can be used for multiple blood sampling without compromising animal welfare. In recent years microsampling has become increasingly used by many companies in early studies such as those for dose range finding. Nevertheless there is reluctance to use it for toxicology studies because of perceived regulatory hurdles and concerns that sampling will compromise key endpoints such as haematology. This means that the full reduction potential of microsampling, which could halve the number

of animals used for regulatory toxicology purposes, has yet to be realised. To address this, in May, we organised a workshop to consider the scientific, practical and regulatory issues around microsampling. The output of the workshop has been accepted for publication in *Drug Discovery Today*.

We have subsequently established an expert network with 42 members from 33 organisations (including pharmaceutical companies and regulatory authorities) to provide an evidence base for the wider use of microsampling. This will be used to inform discussions on microsampling which have recently been initiated by the ICH – the body which is responsible for the international harmonisation of pharmaceutical regulations.

Microsampling can reduce by up to half the use of rodents in toxicity studies



## New partnership on the 3Rs with the medical research charities

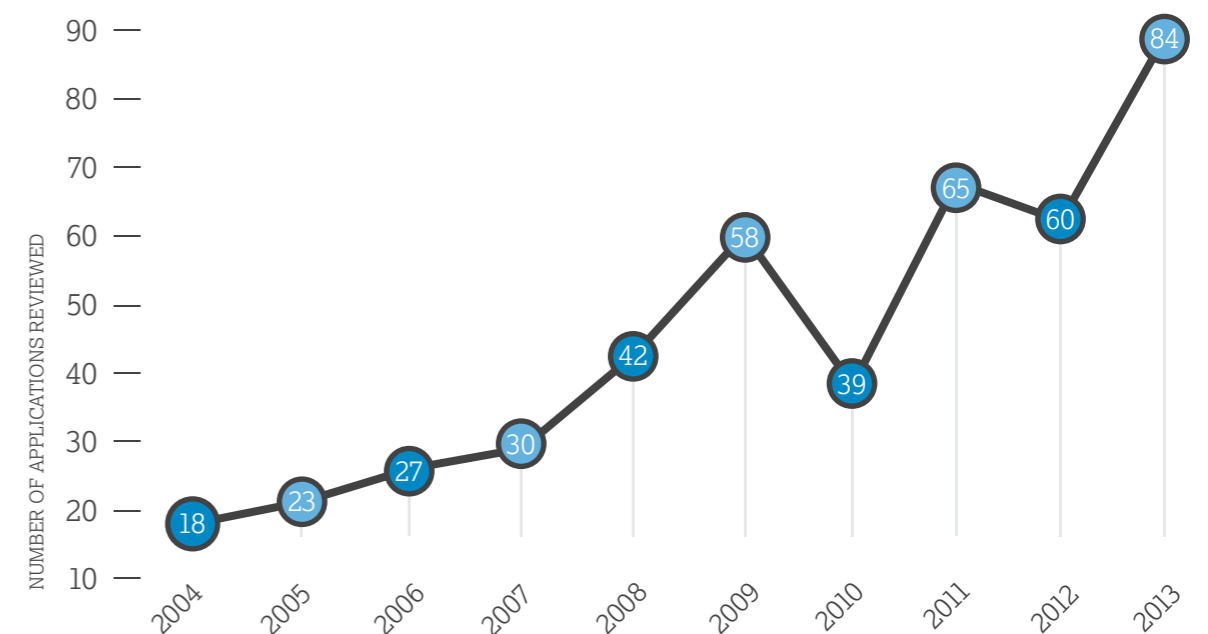
For many years, we have worked with the MRC, BBSRC and Wellcome Trust to ensure the 3Rs are fully embedded in the peer review of research proposals involving animals. This year, we began a new strategic partnership with the Association of Medical Research Charities (AMRC) to assist more of its members in promoting the 3Rs in the research they support. In April, we held a joint workshop for charity research management and policy staff to explore changes to peer review processes, grant conditions and policies in terms of the 3Rs, which were subsequently ratified at the AMRC annual general meeting in November.

Member charities will be joining the major UK research funding bodies in adopting guidelines developed by the NC3Rs, such as *ARRIVE* and *Responsibility in the Use*

*of Animals in Bioscience Research*; the latter was updated and reissued in 2013 to reflect changes to the UK's animal research legislation. Charities will refer research proposals involving the use of non-human primates, cats, dogs and equines to the NC3Rs for 3Rs review to help ensure that all opportunities to minimise animal use and improve animal welfare are identified. Eighty-four such reviews were performed for the MRC, BBSRC and Wellcome Trust in 2013, taking the total number carried out to date to 446.

During 2014 we will deliver a programme of tailored support and resources, including a second workshop, to assist member charities in making changes to their processes and practices in advance of an AMRC peer review audit in 2015.

Number of grant applications reviewed by the NC3Rs on behalf of the major funders







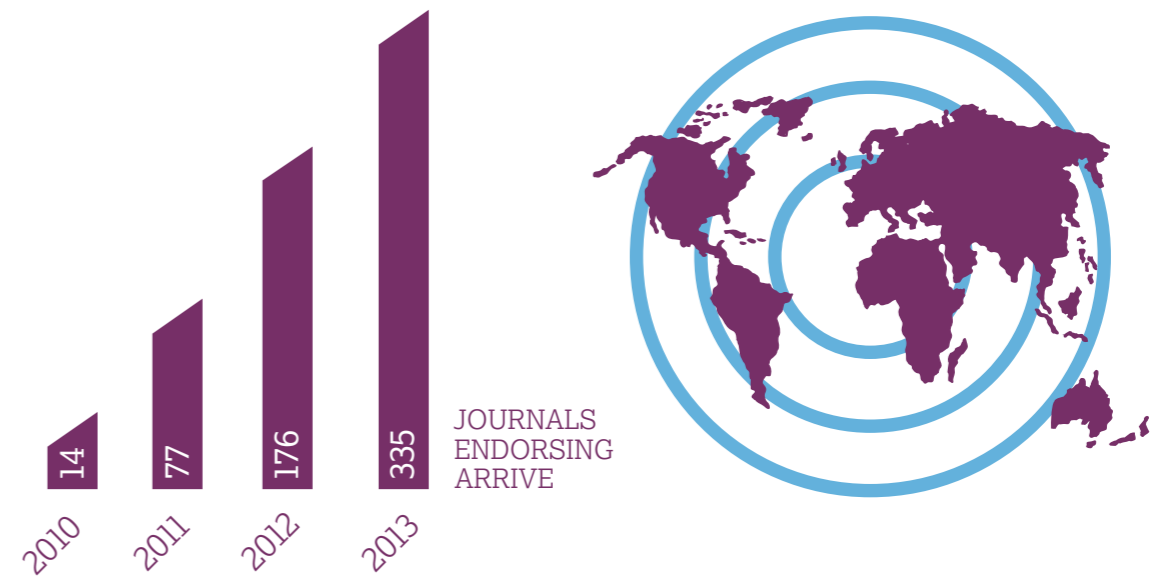
## New call to universities to support the better reporting of animal studies

In September, we published a call for universities to formally adopt the ARRIVE guidelines, which were developed by the NC3Rs to improve the reporting in the scientific literature of research involving animals. The call was part of our wider strategy to encourage uptake and use of the guidelines by researchers, funders, journals and institutions. To date 22 universities have committed to incorporating the ARRIVE guidelines into local policies and practice.

During the last year, the number of journals endorsing the ARRIVE guidelines has increased by 90% from 176 to 335, including some of the highest impact journals. We will continue to work to increase this number

during 2014. Changing reporting practice will require a cultural shift and we are collaborating with a number of the journals which have signed up to the guidelines to help embed them in their peer review processes.

International interest in the ARRIVE guidelines continues to grow and we are currently in the process of translating the guidelines into Chinese and Portuguese to reflect the growing science base within the so-called BRIC nations, Brazil, Russia, India and China. The guidelines were re-formatted in 2013 into a pocket-sized reference – over 2,500 copies have been distributed to researchers in 22 countries.



11 JOURNALS REPUBLISHED ARRIVE

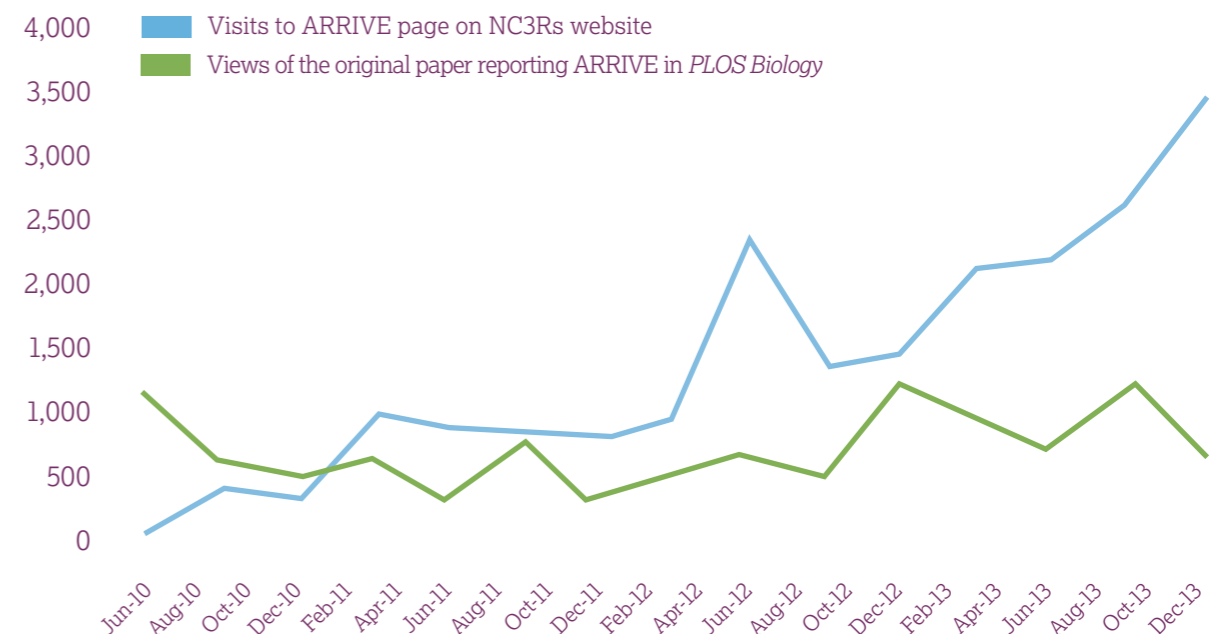
22 EDITORIALS ON ARRIVE

10 MAJOR FUNDERS SUPPORT ARRIVE

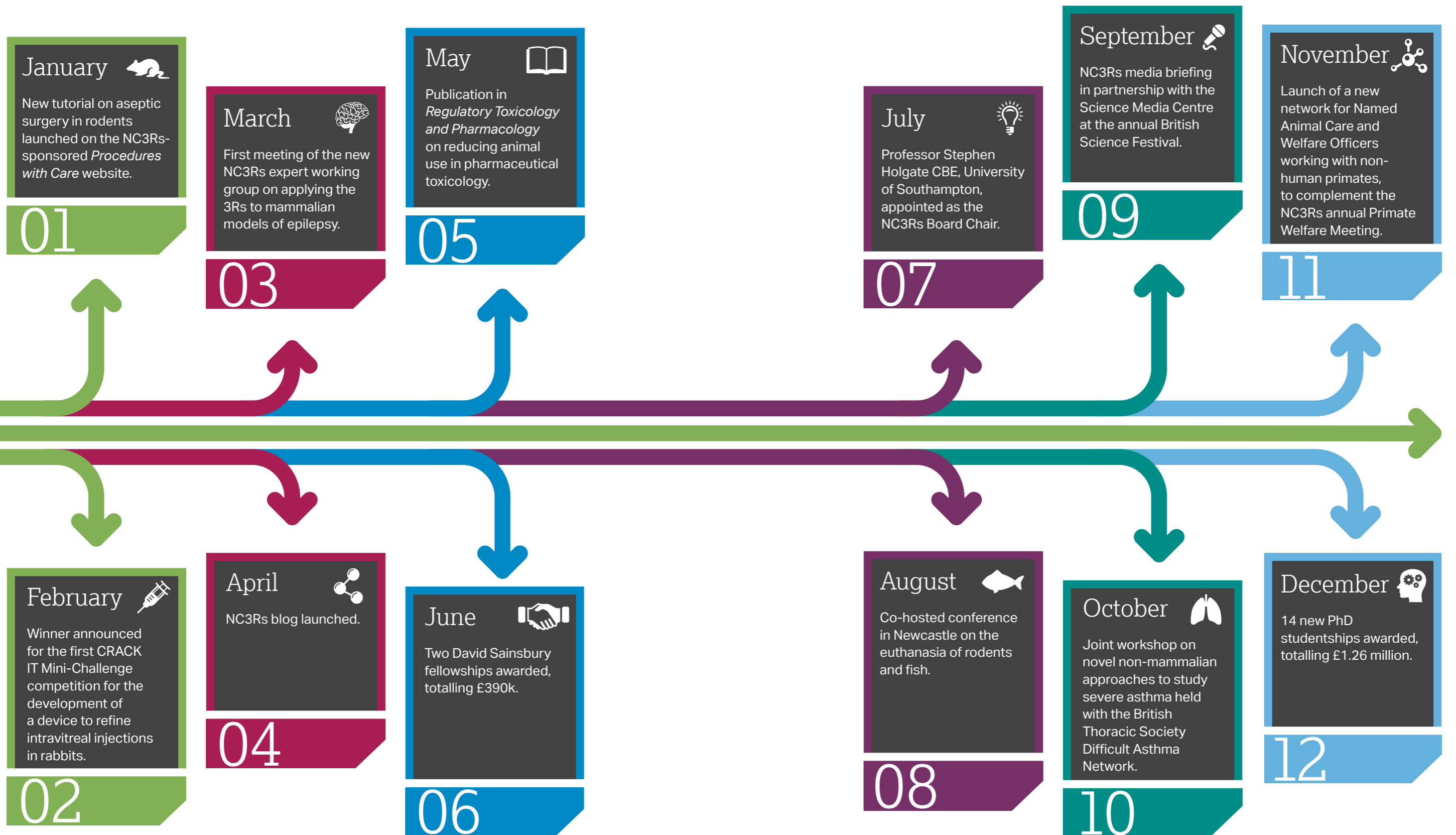
22 UNIVERSITIES SUPPORT ARRIVE

2500+ POCKET GUIDES SENT TO

22 COUNTRIES



# 2013 at a glance



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- NC3Rs events
- PhD Studentships
- David Sainsbury Fellowships
- Project grants
- Pilot study grants
- Infrastructure for Impact grants
- CRACK IT Challenges
- CRACK IT Solutions
- NC3Rs Board members
- NC3Rs staff
- Financial summary
- NC3Rs funders
- Acronyms

# Annexes



# 3

## NC3Rs events

In 2013, we held 16 events attended by around 1,400 delegates. A list of the events is provided below.

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### **Symposium: NC3Rs science review**

26 February

Annual event providing a scientific review of the NC3Rs programmes, research funding and future plans.

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### **Symposium: Applying mathematics to 3Rs problems**

15 – 18 April

Joint event with the EPSRC-funded Mathematics in Medicine Study Group to connect mathematicians and biologists with the aim of solving problems which if addressed could replace or reduce the use of animals.

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### **Workshop: How can charities support the 3Rs in animal research?**

24 April

Joint event with the AMRC to explore how medical research charities can use peer review to ensure the highest standards and implementation of the 3Rs in the research they support.

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### **Workshop: Overcoming the barriers for uptake of microsampling techniques in regulatory toxicology**

18 June

Joint event with the ESP KTN to showcase the latest advances in preclinical imaging technologies and their application from a 3Rs perspective.

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### **Symposium: NC3Rs/Society of Biology 3Rs annual event**

19 June

Joint event with the Society of Biology to showcase scientific advances which improve the utility and efficiency of animal models, reduce reliance on *in vivo* research through the use of new technologies and approaches, and maximise laboratory animal welfare.

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### **Workshop: Non-animal technologies**

25 July and 21 August

Two workshops held in collaboration with the TSB to establish the readiness of new technologies to be commercialised to replace animal use.

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### **Symposium: Newcastle consensus meeting on laboratory animal euthanasia**

9 August

Co-organised with Newcastle University to establish a consensus view on the humaneness of various euthanasia techniques for rodents and fish.

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### **Workshop: Launch of the CRACK IT 2013 Challenges**

5 September

Formal launch of the 2013 competition, including networking opportunities for potential applicants with industry sponsors.

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### **Workshop: De-bunking the urban myth: rodents don't support biotech programs**

8 – 11 September

In collaboration with Charles River Laboratories, USA, a workshop on species selection based on weight of evidence gathered from pathway and drug actions, rather than generalised regulatory guidance.

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### **Workshop: A pathways approach to reducing animal use in severe asthma research**

14 October

Joint event with the British Thoracic Society Difficult Asthma Network to consider the potential for developing pathways-based approaches to severe asthma using human tissue and non-mammalian species.

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### **Workshop: Primate neuroimaging: tools for animal welfare and science**

4 November

Co-organised with the University of Oxford and Newcastle University with funding from the Wellcome Trust to showcase 3Rs advances in imaging technologies and their application in non-human primates.

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### **Workshop: NACWO Networking**

5 November

Informal meeting to bring together NACWOs working with non-human primates to forge a supportive network and share new practices and ideas.

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### **Symposium: Launch of the 2013 Research Review**

20 November

Launch of the second Research Review publication showcasing NC3Rs-funded science.

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### **Workshops: Non-animal technologies consortia building workshops**

10 and 12 December

Two consortia-building workshops held in Manchester and London in collaboration with the TSB to support the new funding competition for feasibility studies on the commercialisation of non-animal technologies.

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## NC3Rs awards

In 2013 we made a total of 54 awards through our various funding competitions. These are listed by scheme.

Scheme	Amount awarded
Project grants	£1,670,259
Pilot study grants	£666,939
PhD Studentships	£1,260,000
David Sainsbury Fellowships	£390,000
Infrastructure for Impact grants	£1,315,253
CRACK IT Challenges	£2,958,248
<b>Total</b>	<b>£8,260,699</b>

## PhD Studentships

Awards were £90k over three years

### Dr Darragh Murnane

University of Hertfordshire

DM-MAP: Drug and Metabolite Microsampling Analytical Platform for preclinical medicines development

### Dr J. Arjuna Ratnayaka

University of Southampton

Exploitation of an *ex vivo* disease model to characterise early events in retinal degeneration

### Professor Margaret MacLean

University of Glasgow

An *in vitro* model to investigate the role of oestrogen and oestrogen metabolism in pulmonary vascular disease

### Professor Catherina Becker

University of Edinburgh

Motor neuron regeneration in larval zebrafish

### Dr Andrew Dilley

University of Sussex

Development of a refined model of neuropathic pain: a model without frank nerve injury

### Professor Liam Grover

University of Birmingham

Creating an *in vitro* model of pathogenic ossification to explore methods for dispersion

### Dr Rachel Lawrence

Royal Veterinary College

Replacing rodent models for investigating the influence of the microbiome upon innate immune responses and resistance to pathogens

## David Sainsbury Fellowships

Awards were £195k over three years

### Dr Maria Eugenia Herva Moyano

University of Cambridge

Development of a sensitive *in vitro* system for anti-alpha-synuclein aggregation drug screening

### Ms Juliane Liepe

Imperial College London

Signalling pathways of leukocyte migration *in silico*

### Professor Chris Secombes

University of Aberdeen

Development of a method for non-lethal sampling from individual fish to investigate host responses to ectoparasites

### Dr Sridhar Vasudevan

University of Oxford

Development of a patient-derived cellular model of circadian disruption in bipolar disorder

### Dr Marc Veldhoen

Babraham Institute

Towards engineering a multi-cell lineage multi-organism intestine

### Dr Grant Wheeler

University of East Anglia

Development of a non-mammalian, preclinical screening tool (FETOX) for predictive Analysis of Drug Safety.

### Professor Robin Williams

Royal Holloway, University of London

Find the target of valproic acid; pioneering the use of a non-animal model for basic biomedical (epilepsy) research

### Professor Colin Willoughby

University of Liverpool

Developing molecular therapies for glaucoma using an *ex vivo* human organ culture system

### Dr Michele Zagnoni

University of Strathclyde

Developing microfluidic systems for high-throughput studies of functional neuronal networks

## Project grants

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### Dr Robert Davies

University of Glasgow

A 3D air-liquid interface airway epithelial cell model to study pathogen interactions within the bovine respiratory tract (£390,050)

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### Dr Manolis Fanto

King's College London

*Drosophila* as a model to understand the role of glial cells in neurodegeneration (£316,462)

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### Dr Julius Hafalla

London School of Hygiene and Tropical Medicine

3Rs of murine models of malaria infection: immunology meets experimental genetics (£317,995)

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### Professor Ian MacKenzie

Queen Mary, University of London

Replacement of murine transplantation assays by 3D *in vitro* substitutes for the assessment of therapeutic responses of cancer stem cells (£344,331)

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### Professor Maria Grazia Spillantini

University of Cambridge

Applying the 3Rs to elucidate the mechanisms of tau pathology using DRG neurons in culture (£301,421)

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## Pilot study grants

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### Professor Catherina Becker

University of Edinburgh

Finding effective analgesics in zebrafish by analysing effects on the nervous system (£73,770)

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### Dr Emily Bethell

Liverpool John Moores University

Attention Bias: A novel method to assess psychological well-being in group-housed non-human primates (£74,114)

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### Dr Bertrand Collet

Marine Scotland Science

Novel approaches to immortalise salmon fish cells (£74,443)

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### Dr Andrew Devitt

Aston University

Towards an *in vitro* system of predictive biomarkers of *in vivo* liposome efficacy (£74,494)

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### Dr Julia Edgar

University of Glasgow

Development of an *in vitro* screening system to minimise animal use in the search for factors that modulate (re)myelination (£73,355)

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### Dr Gyorgy Fejer

University of Plymouth

Establishment of non-transformed, continuously growing, alternatively activated mouse macrophage cell lines (£75,492)

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### Dr Samuel Solomon

University College London

Reducing the number of non-human primates in research by developing a rodent model of selective attention (£72,593)

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### Dr Liku Tezera

University of Southampton

Investigating tuberculosis by engineering human granulomas (£74,450)

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### Dr David Weinkove

Durham University

Using *C. elegans* to produce proteins from parasitic nematodes for research and therapeutic use (£74,223)

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## Infrastructure for Impact grants

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### Professor Paul Flecknell

Newcastle University

Training and teaching resources to underpin implementation of refinement of *in vivo* studies (£64,556)

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### Professor Malcolm Macleod

University of Edinburgh

ivSyRMAF- the CAMRADES- NC3Rs *in vivo* systematic review and meta-analysis facility (£504,931)

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### Dr John Marshall

Queen Mary, University of London

Multi-user, multi-centre MRI to reduce and refine the use of mice in cancer and trauma research (£250,000)

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### Professor Valerie Speirs

University of Leeds

SEARCHbreast: A virtual resource to facilitate sharing breast cancer materials and knowledge to benefit the 3Rs (£495,766)

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## CRACK IT Challenges 2012 – Phase 2 awards

### Rodent Little Brother

**Professor Douglas Armstrong**

Actual Analytics  
£500,000

### ProBE IT

*No funding awarded for this Challenge*

### DRGNET

*Six month extension for both teams. Phase 2 funding will be decided in May 2014.*

### PreDART

**Professor Raymond Pieters**

Institute for Risk Assessment  
Sciences/Toxicology  
£750,000

### Mini Challenge

### RETINAS

**Mr Allen Pearson**

Origin Product Design  
£50,000

## CRACK IT Challenges 2013 – Phase 1 awards

### UnTangle

**Dr Eric Hill**

Aston University  
£95,453

**Professor Maria Grazia Spillantini**

University of Cambridge  
£66,898

**Dr Selina Wray**

University College London  
£99,956

**Dr Christopher Ward**

University of Manchester  
£81,956

### InPulse

**Professor Chris Denning**

University of Nottingham  
£100,000

**Dr Cesare Terracciano**

Imperial College London  
£99,958

**Professor Wolfram Zimmermann**

University Medical Center Göttingen  
£100,000

### Inhalation Translation

**Professor Mark Bradley**

University of Edinburgh  
£98,639

**Dr Ben Forbes**

King's College London  
£81,041

## CRACK IT Solutions 2013

**Dr Josephine Bunch**

National Physical Laboratory  
£99,985

**Dr Victoria Hutter**

University of Hertfordshire  
£55,050

### NephroTube

**Dr Colin Brown**

Newcastle University  
£99,726

**Dr Paul Jennings**

Innsbruck Medical University  
£99,330

**Dr Roisin Owens**

Ecole Nationale Supérieure  
des Mines de St Etienne  
£100,000

**Dr Martijn Wilmer**

Radboud University Medical Centre  
£99,323

### Virtual Infectious Disease Research

**Professor Tom Freeman**

The Roslin Institute, University of Edinburgh  
£84,561

**Professor Paul Kaye**

University of York  
£100,000

**Professor Robin Williams**

Royal Holloway, University of London  
£30,000

Developing an ethical, fast, and inexpensive early-indicator screen for taste aversive and emetic effects of novel chemical entities

**Dr Tamer Mohamed**

University of Manchester  
£30,000

Novel and reliable method to screen for drug cardiac toxicity using human pluripotent stem cell derived cardiomyocytes (hPS-CM)

**Dr Alex Easton**

Durham University  
£29,850

Reducing animal numbers in tasks of memory

**Dr Dan Daly**

Lein Applied Diagnostics  
£30,000

Real Time Confocal Tracking of Ultrasound Mediated Drug Delivery

**Dr Dave Hay**

FibromEd Products Limited  
£30,000

Using physiological levels of fluid shear stress to improve hepatocyte function

## NC3Rs Board members

**Professor Stephen Holgate CBE (Chair)**

*(from July 2013)*  
University of Southampton

**Professor Jamie Davies (Deputy Chair)**

University of Edinburgh

**Dr Phil Botham**

Syngenta

**Professor Margaret Dallman**

Imperial College London

**Dr Lesley Heppell**

BBSRC

**Professor Ian Kimber OBE**

*(Chair until July 2013, member from July 2013)*  
University of Manchester

**Dr Tony Peatfield**

MRC

**Dr Ian Ragan**

Independent

**Dr Vicky Robinson**

NC3Rs

**Dr Malcolm Skingle CBE**

*(until July 2013)*  
GlaxoSmithKline

**Dr Carl Westmoreland**

*(from October 2013)*  
Unilever

**Mr Neil Yates**

University of Nottingham

## NC3Rs staff

**Dr Vicky Robinson**

Chief Executive

### Innovation and Translation Group

**Dr Kathryn Chapman**

Head of Innovation and Translation

**Dr Joanna Edwards**

*(from March 2013)*  
Science Manager

**Dr Anthony Holmes**

Programme Manager, Technology  
Development

**Mr David McCreanor**

*(from April 2013)*  
CRACK IT Administrator

**Ms Colette Roach**

*(from December 2013)*  
CRACK IT Officer

**Dr Fiona Sewell**

Programme Manager, Toxicology and  
Regulatory Sciences (Human Health)

**Dr Cathy Vickers**

*(from January 2013)*  
Programme Manager, CRACK IT

### Research Management and Communications Group

**Dr Mark Prescott**

Head of Research Management and  
Communications

**Dr Rubina Ahmed**

*(on maternity leave from July 2013)*  
Programme Manager, Research Funding

**Dr Virginie Bros Facer**

*(from August 2013, maternity leave cover)*  
Programme Manager, Research Funding

**Dr Katie Lidster**

*(from February 2013)*  
Science Manager

**Miss Suzanne McArdle**

*(from April 2013)*  
Research Funding Officer

**Mrs Hazel McLaughlin**

Research Funding Administrator

**Dr Nathalie Percie du Sert**

Programme Manager, Experimental Design

**Mr Dan Richards-Doran**

Communications Manager

**Miss Emma Stokes**

Website and Design Manager

### Business Support Group

**Miss Maureen FitzGerald**

Events Administrator

**Miss Joanne James**

*(from February 2013)*  
Events Officer

**Mr Jonathan Lind**

Office Administrator

**Ms Ashley Scott**

Business Manager

**Ms Caroline Shriver**

*(from September 2013)*  
Strategic Planning Manager





## NC3Rs funders

The NC3Rs receives funding from the public, commercial and charitable sectors. A list of funders is provided below.

Association of the British Pharmaceutical Industry<sup>2</sup>  
Biotechnology and Biological Sciences Research Council  
Department for Environment, Food and Rural Affairs  
Engineering and Physical Sciences Research Council  
GlaxoSmithKline  
Home Office  
Medical Research Council  
SC Johnson  
Shell  
Syngenta  
Technology Strategy Board  
The Dow Chemical Company  
Unilever  
Wellcome Trust

<sup>2</sup> In accordance with the Association of the British Pharmaceutical Industry's (ABPI) Code of Practice regulating the pharmaceutical industry, the following companies have provided funding to the NC3Rs as part of the ABPI-NC3Rs collaboration: ABPI, AstraZeneca plc., Covance Laboratories Ltd., GlaxoSmithKline plc., Huntingdon Life Sciences Ltd., Eli-Lily and Company Ltd., Pfizer Ltd., and Novartis Ltd.

## Acronyms

3Rs  
Replacement, reduction and refinement of animals in research

ABPI  
Association of the British Pharmaceutical Industry

AMRC  
Association of Medical Research Charities

BBSRC  
Biotechnology and Biological Sciences Research Council

EPSRC  
Engineering and Physical Sciences Research Council

ESP KTN  
Electronics, Sensors and Photonics Knowledge Transfer Network

ICH  
International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use

MHRA  
Medicines and Healthcare products Regulatory Agency

MRC  
Medical Research Council

NACWO  
Named Animal Care and Welfare Officer

SME  
Small and Medium-sized Enterprises

TSB  
Technology Strategy Board

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NC3Rs  
Gibbs Building  
215 Euston Road  
London NW1 2BE

T +44 (0)20 7611 2233  
F +44 (0)20 7611 2260  
enquiries@nc3rs.org.uk  
twitter: @nc3rs

[www.nc3rs.org.uk](http://www.nc3rs.org.uk)  
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