



## Academia, industry and the NHS: collaboration and innovation

Meeting report

### **The Academy of Medical Sciences**

The Academy of Medical Sciences promotes advances in medical science and campaigns to ensure these are converted into healthcare benefits for society. Our Fellows are the UK's leading medical scientists from hospitals and general practice, academia, industry and the public service.

The Academy seeks to play a pivotal role in determining the future of medical science in the UK, and the benefits that society will enjoy in years to come. We champion the UK's strengths in medical science, promote careers and capacity building, encourage the implementation of new ideas and solutions – often through novel partnerships – and help to remove barriers to progress.

### **The Academy's FORUM with industry**

The Academy's FORUM is an active network of scientists from industry and academia, with representation spanning the pharmaceutical, biotechnology and other health product sectors, as well as trade associations, Research Councils and other major charitable research funders. Through promoting interaction between these groups, the FORUM aims to take forward national discussions on scientific opportunities, technology trends and the associated strategic choices for healthcare and other life-science sectors.

The FORUM builds on what is already distinctive about the Academy: its impartiality and independence, its focus on research excellence across the spectrum of clinical and basic sciences and its commitment to interdisciplinary working.

### **Acknowledgements**

This report provides a summary of the discussion at the FORUM meeting on 'Academia, industry and the NHS: collaboration and innovation' held in November 2009. The Academy warmly thanks the Chairman, speakers and delegates for their participation and for their input into this report.

The Academy gratefully acknowledges the support of Sanofi Pasteur for this event. For further information please contact Dr Robert Frost, FORUM Manager, [robert.frost@acmedsci.ac.uk](mailto:robert.frost@acmedsci.ac.uk).

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## Foreword

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Medical research is enjoying a phase of significant scientific opportunity as advances in knowledge over the past decade yield novel insights into the biology of disease. Furthermore, developments in the lab are proceeding alongside rising demand for medicines as the population ages and new medical needs emerge.

Capitalising on these opportunities and translating new understanding into innovative therapeutics provides well established benefits for both patients and the economy. However, this period of discovery has met changing financial times and an era in which the costs of drug development have risen while fewer new drugs are launched. The nature of medicine has also shifted and seen a move from 'blockbuster' drugs for common diseases to targeted treatments for less common conditions.

There is increasing recognition that addressing new economic and scientific challenges will require a model of drug development that draws on strengths from across sectors and requires organisations to collaborate to share expertise, skills and resources. In the UK we have the individual building blocks for this model in our world class universities, hospitals and life science companies. The future of a flourishing life sciences sector lies in putting these elements together and integrating efforts across traditional strengths. By exploring synergies and seizing opportunities for joint working across these sectors, UK medical science can look to attract the whole research and development chain for new medicines, medical devices and diagnostics to these shores. For this objective to be achieved however, medical research must continue to be properly supported. Steps must be taken to address existing challenges in drug development and streamline a regulatory framework that is impeding both public and private sector research.

The Academy's FORUM exists at the interface between academia, industry and the NHS and works to promote interaction and discussion among researchers from across the sectors. In November 2009, we held a meeting looking specifically at 'Academia, industry and the NHS: collaboration and innovation'. The meeting brought together researchers from across the sectors to showcase the importance of collaboration, promote relevant initiatives and funding schemes and explore some of the barriers and levers to partnership activity.

This report captures the discussion and key messages from that meeting. Many of the speakers acknowledged that steps have recently been taken to support UK medical science, but also agreed that utilising the competitive advantage offered by our universities, life science companies and the NHS, will require new ways of working. Financial pressures must not erode the exciting relationships that have been established and opportunities must be taken to improve the culture of collaboration and form flexible arrangements that benefit all parties.

The Academy looks forward to continuing its role in bringing scientists from across the sectors together with research funders and policy makers, to stimulate an environment that ensures that collaboration and innovation can prosper.



**Professor Sir John Bell FRS HonFREng  
PMedSci**

President, Academy of Medical Sciences



## Summary

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The Academy of Medical Sciences held a meeting in November 2009 to showcase and review the opportunities for research collaboration across industry, academia and the NHS. The meeting brought together representatives from across the pharmaceutical industry, the NHS, governmental bodies and research funders, with academics spanning the spectrum of biomedical research. This report details the discussions of the meeting and highlights key messages and areas for development.

### Challenges

The life sciences community currently faces a number of challenges. These include the increasing cost-per-unit of new drug development, a diminishing research and development pipeline, and increasing financial pressures on the public sector. Delegates identified the current high level of governance and regulation surrounding medical research as a further barrier hampering the progress of research in the UK. Taken together, these challenges were identified as delaying the availability of new medicines to the health care sector and slowing the development of the medical research sector as a whole.

Much has been done in recent years to transform the UK research environment and support the translation of research through initiatives set up by the National Institute for Health Research (NIHR) and the Office for the Strategic Coordination of Health Research (OSCHR). However, delegates highlighted the need for further improvements to the translational research landscape and the importance of greater alignment and partnership across sectors in overcoming the current challenges.

### Key messages

Delegates emphasised a need to build on the UK's strong base in basic medical science by facilitating the translation of research through innovative partnerships and greater cross-sector working. Researchers from across academia, the NHS and industry must work towards an environment that nurtures innovation and supports the sharing of expertise and early stage research data, builds on previous public investments and embeds research as a core component within the NHS. Support for basic research must be maintained, and all sectors should continue to inspire the next generation of talented researchers to provide the knowledge and highly skilled workforce of tomorrow.

To enable the UK research base to continue to grow and develop across all sectors, a number of key messages emerged. These include the need to:

- Seize opportunities for flexible collaboration across sectors and establish appropriate funding structures and incentives to facilitate translation and increase the mobility of investigators across sectors.
- Improve the culture of collaboration and build a mutual recognition that industry, academia and the NHS are credible, equal scientific and clinical partners.
- Form collaborations that result in a mutually beneficial exchange of ideas and people and improve training for academic, NHS and industry researchers.
- Ensure new financial pressures do not erode nascent relationships between universities and the NHS.
- Create a proportionate, risk-based regulatory framework for medical research involving humans that is fit for purpose and facilitates research, whilst ensuring patient and public safety and appropriate accountability.

- Foster an environment that supports home-grown biotechnology companies, attracts and retains pharmaceutical companies to the UK, and encourages the establishment of new firms.
- Develop suitable frameworks for collaborative agreements that facilitate innovation, through the appropriate and realistic handling of background and emergent Intellectual Property.

### **Benefits**

Increased and flexible partnerships between researchers from across academia, industry and the NHS will provide benefits across all sectors and enable a new model of innovation

to emerge. Investigators within the academic sector will gain through invaluable access to research resources and additional guidance in drug development and clinical testing. Industry will gain through greater availability of early stage research allowing expansion of the number of 'druggable' targets, and through the availability of NHS data that can be used to improve the safety of medicines and increase patient recruitment. The NHS will gain from earlier access to new and better ways of preventing, diagnosing and treating disease. Developing a culture of continuous improvement and collaboration through research will build the profile and reputation of the NHS, helping to attract and retain high calibre staff.

## 1 Introduction and overview

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In November 2009, the Academy of Medical Sciences held a meeting to bring together researchers from across academia, industry and the NHS to showcase the importance of cross sector collaborations, promote relevant initiatives and funding schemes, and explore some of the barriers and levers to partnership activity.

This report captures the key themes and issues raised during the meeting including:

- UK strengths in medical science and applied health research and the new opportunities and challenges facing traditional approaches to drug development (see chapter 2).
- New ways of working within and across sectors to increase the scale and pace of scientific discovery and translation (see chapter 3).
- Steps to build and strengthen infrastructure for clinical research and partnership activity (see chapter 4).
- Initiatives to enhance expertise, address the gap in skills and facilitate greater cross-sector mobility (see chapter 5).

At the meeting, leading figures from across the sectors highlighted successful examples of cross sector partnerships and described a new model of innovation in which stakeholders are increasingly working together to maintain the UK's leading position in the life sciences. In addition to emphasising the value of collaborations across industry, academia and the NHS, speakers also stressed the importance of creating a wider 'ecosystem' in which innovation is incubated, gaps between sectors are bridged, research is underpinned by appropriate regulation and effective new medicines are taken up throughout the NHS (see chapter 6).

Building on past Academy work to promote career pathways and support future scientific leaders, a key objective of this meeting was to bring together young researchers from across medical disciplines and promote engagement between researchers from academia and industry. This desired mix of attendees was successfully achieved, with over 220 delegates attending from across the sectors.

This report summarises the key themes from the meeting and is aimed at researchers currently involved in collaborative work, scientists who may undertake partnership work in the future, and policymakers and funders supporting UK medical science. Throughout the report, information is provided on relevant funding initiatives and web links are included for those seeking further and updated information.

At the meeting, each presentation was followed by lively discussion as the audience questioned speakers further on their personal experiences of basic and translational research and collaborative work. It was during these sessions that speakers gave further insight into the barriers and levers to collaborative research and offered their own hopes and concerns for the future (see chapter 7).

Many of the speakers acknowledged the important steps that have recently been taken to support UK medical science, but also agreed that utilising the competitive advantage offered by our universities, life science companies and the NHS, will require new ways of working. The future of a flourishing life sciences community lies in collaboration and partnership. Uniting researchers and expertise from across sectors will be crucial to seizing new scientific opportunities, reaping the rewards of public investment in medical research and developing the UK's position as the best country in the world for medical research.



## 2 Building on UK strengths

The UK life sciences sector is unique in being able to draw on world class universities, a strong pharmaceutical and biotechnology sector and one of the largest single healthcare systems in the world (see table 1). No other country enjoys the outstanding opportunities for research represented by these assets, and the benefits of supporting these areas of strength are well established. Excellence in research leads to better medical care, attracts investment and industries, and improves healthcare services. The UK's history of supporting medical research has generated considerable rewards. For example, the UK generates over 10% of the world's clinical science and health research outputs, with 1% of the world's population and attracts almost 10% of the world's pharmaceutical research and development (R&D) funding.<sup>1</sup>

### 2.1 New opportunities

Advances in biological research over the past decades have generated countless insights into the pathophysiology of disease. Excitement in scientific discovery is discernable across a broad spectrum of research disciplines, and new knowledge has come together with technical capability in areas where the UK leads the world. At the same time, the nature of a medicine is changing and we are seeing a clear shift from focusing largely on small molecules to the development of antibodies, large molecules, nucleic acid technologies and stem cells. As these modalities change, so industry needs to evolve and adopt a new approach that is better suited to advancing small scale projects (at least in the early stages) across multiple disease areas (see section 3.2).

**Table 1 UK assets in the life sciences**

<b>Academia</b>	<b>Industry</b>	<b>NHS<sup>2</sup></b>
First-class universities, four of which are in the top six of a major international league table. <sup>3</sup>	Strong medical life science industries, including two of the world's largest pharmaceutical companies.	The world's largest publicly-funded health service, providing cradle-to-grave care for 61 million residents.
Over 30 previous winners of Nobel Prizes for biomedical research.	Created nearly a quarter of the world's top 100 medicines. <sup>4</sup>	One of the largest purchasers of life science products in the world, spending around £15 billion a year on goods and services.
The most productive nation in the G8 in terms of citations per researcher. <sup>5</sup>	Employ an estimated 25% of all those that work in the medical biotechnology sector in Europe. <sup>6</sup>	The fourth largest single employer in the world: the NHS employs more than 1.7 million people. Of those, just under half are clinically qualified.

<sup>1</sup> Department for Innovation, Universities and Skills (2009). *International comparative performance of the UK research base*. [http://www.bis.gov.uk/assets/biscore/corporate/migratedD/publications/I/ICPRUK09v1\\_4](http://www.bis.gov.uk/assets/biscore/corporate/migratedD/publications/I/ICPRUK09v1_4)

<sup>2</sup> Further details are available from <http://www.nhs.uk/NHSEngland/thenhs/about/Pages/overview.aspx>

<sup>3</sup> Times Higher Education (2009). *Top 200 world universities*. <http://www.timeshighereducation.co.uk/hybrid.asp?typeCode=438>

<sup>4</sup> Association of the British Pharmaceutical Industry (2004). *Innovating for a healthy tomorrow*. [http://www.abpi.org.uk/publications/pdfs/annual\\_report\\_05.pdf](http://www.abpi.org.uk/publications/pdfs/annual_report_05.pdf)

<sup>5</sup> Department for Innovation, Universities and Skills (2009). *International comparative performance of the UK research base*. [http://www.bis.gov.uk/assets/biscore/corporate/migratedD/publications/I/ICPRUK09v1\\_4](http://www.bis.gov.uk/assets/biscore/corporate/migratedD/publications/I/ICPRUK09v1_4)

<sup>6</sup> UK Trade and Investment (2009). *Strength and opportunity*. <http://www.berr.gov.uk/files/file53947.pdf>

New scientific opportunities are, however, occurring at a difficult time for a life sciences community that is attempting to tackle:

1. *The challenge of translating ideas from basic and clinical research into new treatments.*  
Despite the UK's strengths in basic science, there has traditionally been a significant gap in translating ideas from basic and clinical research into the development of new products and approaches to the treatment of disease and illness. In recent years, a number of steps have been made to improve the UK's translational landscape (see box 1).
2. *Research and development (R&D) productivity gap.*  
The commercial sector is experiencing challenging times with regard to its R&D pipeline. Despite increasing industrial expenditure on R&D, the number of new molecules for clinical use has not kept pace and attrition rates remain very high. Challenges around the development of new medicines are compounded by the expiration of patents on many older medicines, leading to loss of profits through increased generic competition.
3. *Increasing bureaucracy and a challenging regulatory and governance framework.*  
There is widespread and increasing concern that medical research is being jeopardised by a regulatory and governance framework that has become unnecessarily complex and burdensome. Since the meeting, the Academy of Medical Sciences has

been commissioned by the Government to undertake an independent review to make recommendations that will increase the speed of decision-making, reduce complexity and eliminate unnecessary bureaucracy and cost.<sup>7</sup>

4. *Rising healthcare costs and low uptake and appraisal of new medicines.*  
Strengths in basic and translational research have resulted in the UK creating a quarter of the world's top 100 medicines.<sup>8</sup> However, this expertise in advancing knowledge and developing new treatments has not been matched by an ability to effectively and efficiently deliver the benefits to patients. To capitalise on UK strengths, efforts to improve the translational landscape need to be complemented by work to help pull through new medicines and technologies. Approaches to evaluate new drugs must continue to evolve to accelerate the speed of appraisals and bring new medicines to the NHS in a cost-effective manner.

## 2.2 Collaboration and innovation

It is now widely recognised that overcoming the significant challenges highlighted above will increasingly require greater alignment and partnership between stakeholders and innovators. In recent years there has been a welcome increase in cross-sector engagement. Steps already taken to adopt a more integrated approach must be built upon and new initiatives introduced to encourage organisations to share expertise, skills and resources.

### Box 1 Recent initiatives

Over recent years, several initiatives have been implemented to improve translational research in the UK. Significant improvements have resulted from the establishment of the NIHR and the formation of OSCHR. OSCHR has promoted coordination of the strategies of the Medical Research Council (MRC), NIHR and health research in the devolved administrations, and driven greater coherence across the spectrum of UK health research (see section 3.3).

<sup>7</sup> Academy of Medical Sciences (2010). *Review of the regulation and governance of medical research*. <http://www.acmedsci.ac.uk/p47prid80.html>

<sup>8</sup> Association of the British Pharmaceutical Industry (2004). *Innovating for a healthy tomorrow*. [http://www.abpi.org.uk/publications/pdfs/annual\\_report\\_05.pdf](http://www.abpi.org.uk/publications/pdfs/annual_report_05.pdf)

The formation of a new Office for Life Sciences (OLS) in January 2009 acknowledged this trend, bringing together stakeholders from across government, academia and industry to promote innovative partnerships and consider steps to attract and retain the life sciences

industry in the UK. Lord Drayson, then Minister of State for Science and Innovation, spoke at the meeting and highlighted that genuine collaboration between representatives from industry, NHS and academia had been central to the actions initiated by the OLS (see box 2).

### **Box 2 The Office for Life Sciences<sup>9</sup>**

The Government's OLS was established in January 2009 and marked a new way of bringing together government departments (including the Department of Health, the Department for Business, Innovation and Skills and the Treasury) and facilitating a constructive dialogue with representatives from industry and the life sciences community. The OLS was tasked with developing solutions across four key areas:

- The NHS as an innovation champion.
- Building a more integrated life sciences industry.
- Access to finance and stimulating investment.
- Marketing the UK life sciences industry overseas.

Published in January 2010, 'Life Sciences 2010: deliver the blueprint' described progress made against this objective and highlighted new measures including:

- A Patent Box, applying a reduced 10% rate of corporation tax to patent income from April 2013, to strengthen incentives for companies to invest in innovative activity and locate in the UK.
- An Innovation Pass designed to give patients earlier access to promising licensed medicines.
- The UK Innovation Investment Fund to provide finance to high-tech businesses, including start-ups and spin-outs.
- A national marketing programme to promote UK life sciences, attract inward investment, and build our reputation overseas is underway and will continue in 2010.
- Other initiatives arising from OLS are described throughout the report.<sup>10</sup>

<sup>9</sup> Further details are available from <http://www.bis.gov.uk/ols>

<sup>10</sup> Office for Life Sciences (2009). *Life science blueprint*.  
<http://www.bis.gov.uk/assets/biscore/corporate/docs/l/10-542-life-sciences-2010-delivering-the-blueprint.pdf>



## 3 Innovative approaches to research and development

Organisations across academia, industry and the NHS are looking at new ways of supporting basic science and increasing the scale and pace of discovery. At the meeting, speakers outlined new initiatives and activities supported by medical charities and research funders that are emerging and highlighted steps taken to facilitate research within the NHS. Delegates heard how the traditional pharmaceutical model is evolving and looking towards external partnerships.

### 3.1 Academia

Our universities have a world-leading track record in discovery and the advancement of new knowledge. As highlighted in Table 1, over 30 Nobel Prizes for biomedical research have been awarded to UK researchers. This strength in fundamental research must be maintained and, as described below, lies at the heart of new therapies and attracting international pharmaceutical investment to the UK. Delegates stressed that UK research funders must continue to support basic science, however, there has also been an increase in recent years of public funders supporting translational research. In chapters 4 and 5 respectively, examples will be given of initiatives to build infrastructure and enhance skills for translational and collaborative research. The focus of this next section is on the research itself and highlights how more flexible approaches to funding partnership work have become an integral part of the research agenda.

#### 3.1.1 Supporting basic research

While there has been an increase in supporting translational research and collaborative partnership, research funders continue to recognise that fundamental basic research underpins the translational agenda. At the meeting numerous presentations highlighted

the need to continue to support basic science which is at the heart of:

#### *New approaches to therapy*

KuDOS Pharmaceuticals provides an example of a 'spin-out' company established on a concept born from a basic science discovery.<sup>11</sup> KuDOS emerged from the academic laboratory of Professor Steve Jackson FRS FMedSci, Gurdon Institute, University of Cambridge. Studying DNA damage and repair, the discovery of a group of DNA protein kinases that mediate DNA double-stranded break repair led to a concept that inhibition of DNA repair could be applied as a therapeutic target for disease.

#### *Collaboration between academia and industry*

The Division of Signal Transduction Therapy (DSTT) is a unique collaboration between scientists in the MRC Protein Phosphorylation Unit, the College of Life Sciences at the University of Dundee and five of the world's leading pharmaceutical companies, namely AstraZeneca, Boehringer Ingelheim, GlaxoSmithKline, Merck-Serono and Pfizer.<sup>12</sup> The collaboration is founded on a basic understanding of kinases and phosphatases and their role in cell signalling. The collaboration is dedicated to helping the participating companies accelerate the development of potent and specific inhibitors of protein and lipid kinases and phosphatases with therapeutic potential for the treatment of disease.

#### 3.1.2 Facilitating translation

As well as continuing to support basic science, in recent years public funders have taken a more proactive role in supporting translational research. At the meeting delegates heard presentations from representatives from the MRC and Wellcome Trust on new schemes that:

<sup>11</sup> Further details are available from <http://www.kudospharma.co.uk/>

<sup>12</sup> Further details are available from <http://www.lifesci.dundee.ac.uk/dstt>

- Support experimental medicine research: for example, the MRC has launched a series of strategic initiatives to enhance the development of biomarkers, human and animal disease models, and disease-based sample collections.<sup>13</sup>
- Strengthen R&D: by developing research methodology and focusing on translational bottlenecks.
- Accelerate innovation: by seeding drug discovery and progressing interventions into late phase II and phase III clinical trials.

As part of the MRC's £250 million additional investment, new funding streams have been developed specifically aimed at accelerating the process of R&D of promising discoveries, through supporting milestone-driven, goal-orientated research. These schemes include the Developmental Pathway Funding Scheme (DPFS) which takes new discoveries and supports their development towards application, to improve healthcare and benefits for patients.<sup>14</sup> Together with DPFS, the Developmental Clinical Studies (DCS) initiative supports early stage clinical studies which are on the development pathway for a new therapeutic, diagnostic, device or public health intervention.<sup>15</sup> Interventions may include drug or cell-based treatments and studies are designed to focus on establishing proof of concept.

The Wellcome Trust's five-year £91 million initiative 'Seeding drug discovery' aims to develop drug-like, small molecules that will be the springboard for further R&D by the biotechnology and pharmaceutical industry in areas of unmet medical need.<sup>16</sup> This initiative is designed to help applicants with a potential new drug target or new chemistry development, to embark on a programme of discovery.

These schemes mark a deliberate attempt by research funders to support translational research. In addition to these, new schemes have been introduced by research funders to specifically create new opportunities for academic-industry collaborations. The MRC Industry Collaboration Awards is one such initiative aimed at supporting collaborative research projects between academic researchers and industry.<sup>17</sup> Crucially these schemes exist at a time when industry is looking to build flexible partnerships with academia and redefine the traditional relationship between the two sectors (see section 3.2).

## 3.2 Industry

### 3.2.1 An evolving industry

The UK has historically enjoyed a vibrant pharmaceutical and biotechnology sector that is the largest in Europe and second only in size to the USA.<sup>18</sup> The benefits of this strong commercial presence are well established, for example, the medical science industries support over 250,000 high-value UK-based jobs and account for the largest share of total industrial R&D spend.

As described in chapter 2, an unprecedented phase of scientific discovery has generated many new opportunities to develop novel medicines, but this is now entering into a challenging time for the pharmaceutical industry. To address these challenges and boost innovation and productivity, pharmaceutical companies have recognised that the industry must evolve its ways of working and develop external partnerships.

<sup>13</sup> Further details are available from <http://www.mrc.ac.uk/Ourresearch/ResearchInitiatives/ExperimentalMedicine/index.htm>

<sup>14</sup> Further details are available from <http://www.mrc.ac.uk/Fundingopportunities/Grants/DPFS/Specification/index.htm>

<sup>15</sup> Further details are available from <http://www.mrc.ac.uk/Fundingopportunities/Grants/DCS/index.htm>

<sup>16</sup> Further details are available from [http://www.wellcome.ac.uk/Funding/Technology-transfer/Awards/Seeding-Drug-Discovery/index.htm?utm\\_source=biopharma&utm\\_medium=printad&utm\\_campaign=sdd](http://www.wellcome.ac.uk/Funding/Technology-transfer/Awards/Seeding-Drug-Discovery/index.htm?utm_source=biopharma&utm_medium=printad&utm_campaign=sdd)

<sup>17</sup> Further details are available from <http://www.mrc.ac.uk/Fundingopportunities/Grants/MICA/Specification/MRC005438>

<sup>18</sup> Office of Life Sciences (2009). *Life science blueprint*. <http://www.bis.gov.uk/assets/biscore/corporate/migrated/publications/o/ols-blueprint.pdf>

In the last decade the traditional 'large pharma' approach, as characterised by centralised control and reliance on internal expertise, has evolved and changed. GlaxoSmithKline (GSK), for example, now has a more flexible structure built around small teams, called Discovery Performance Units (DPU), which can focus on specific disease pathways or technologies such as stem cells and small interfering RNA (siRNA). There are currently 34 units which are either aggregated in a Centre of Excellence for Drug Discovery (CEDD) to provide breadth across a therapy area, or stand alone, because of their specific remit. CEDDs and DPUs can both enter into partnerships and collaborations, but to supplement their activities GSK also has a Centre of Excellence for External Drug Discovery which pursues alliances with small and medium size enterprises for the most promising early-stage assets and innovative technology.<sup>19</sup> Acquisitions and partnerships can easily be accommodated in this model. Across the sector, the move from a fully integrated business model to approaches which have the flexibility to tap into external expertise, has seen an increase in the number of partnerships with academia and in the importance placed on these.

### **3.2.2 Partnering with academia**

Pharmaceutical firms are increasingly seeking flexible partnerships with the biotechnology industry and academia to share risk and access expertise across multiple disease targets. Examples used at the meeting included:

#### *Pfizer and the University College London Institute of Ophthalmology*

Working together to improve understanding and develop stem cell-based therapies for ophthalmic conditions, this partnership brings together the work of university researchers in stem cell ophthalmology with Pfizer's expertise in the design and delivery of therapeutics.<sup>20</sup> Led from UCL by Professor Peter Coffey, the alliance combines the university's strengths in research with commercial experience in executing clinical trials and interacting with regulators.

#### *Manchester Cancer Research Centre and AstraZeneca (MCRC-AZ)*

A strategic alliance to work on the validation and implementation of predictive biofluid, imaging and tissue biomarkers.<sup>21</sup> This partnership is focused on the discovery, development, and clinical implementation of biomarkers to optimise patient benefit from cancer therapy. The use of biomarkers early in the drug development process is intended to reduce the common incidence of drugs failing after large and expensive late trials. As well as developing biomarkers for use in early drug development, the alliance incorporates a joint training scheme for medical oncologists (see section 5.2).

Dr Andrew Hughes highlighted the importance of individual relationships when establishing a partnership such as the MCRC-AZ alliance. Creating one point of contact, building trust and responding quickly to requests were all considered to be crucial to collaborative work.

Following this meeting, in early 2010, a three year alliance between Cancer Research UK's (CRUK) commercialisation and development arm, Cancer Research Technology (CRT) and AstraZeneca was established enabling collaboration between CRT's Laboratories in London and Cambridge and the AstraZeneca Manchester Cancer Research Centre. Researchers will seek to develop small molecules which attempt to target the changes to a cell's metabolism. AstraZeneca will take the most promising projects forward into drug development and CRT will receive royalties on projects taken into clinical development. This is an innovative model, pairing AstraZeneca's drug discovery and development capabilities with CRT's expertise in identifying and progressing new targets selected from CRUK's basic research portfolio. The alliance allows the sharing of risk and increases the potential rewards of creating new anti-cancer treatments.<sup>22</sup>

<sup>19</sup> Further details are available from <http://www.ceedd.com/>

<sup>20</sup> Further details are available from <http://www.ucl.ac.uk/iao/news090424.php>

<sup>21</sup> Further details are available from <http://www.ls.manchester.ac.uk/business/workingwithus/collaborations/casestudies/astrazeneca/University%20of%20Manchester%20and%20AstraZeneca%20article.pdf>

<sup>22</sup> Further details are available from <http://www.cancertechnology.com/news/single/astrazeneca/>

### 3.2.3 Open innovation

The increased emphasis on academic-industry collaborations is part of a bigger shift in the way some firms are working, and is contributing to a new pre-competitive front end to drug development. In many cases, the challenges facing industry have prompted a shift to late-stage projects and to compensate for this, there appears to be a change in attitudes to utilising pre-competitive collaborations and the sharing of early-stage research data. Companies are looking to share early-stage research data and enable scientific discovery by engaging a broader section of the scientific community in the exploration of new findings. Strong public-private partnerships founded on high quality, open and accessible data have the potential to benefit all groups engaged in drug discovery by increasing our understanding of biological processes and helping to decrease the attrition of clinical programmes.

In his presentation, Professor Patrick Vallance FMedSci, described a number of new initiatives being explored by the pharmaceutical industry as part of a broader approach to 'open innovation'. These include:

- Patent pooling: where patents for neglected tropical diseases go into a public pool which can be accessed by those seeking to develop medicines against these diseases.
- New approaches to data sharing: including GSK's Tres Cantos project, which allows academic groups to be based within a pharmaceutical research unit and have access to expertise in early drug discovery.<sup>23</sup>

Pharmaceutical companies have recognised that the industry must evolve and that the shape of the drug pipeline needs to change. Companies need to become better at picking drug targets, better at making early clinical decisions about which molecules to progress and better at doing late stage clinical trials to demonstrate that a new product has a substantial benefit. To drive these changes, industry is increasingly

looking towards flexible partnerships with the biotechnology industry and academia to share risk and access expertise across multiple disease targets. This new approach indicates a shift in the relationship between 'large pharma' and academia and provides an important opportunity for the UK to attract international investment.

### 3.3 NHS

As one of the largest single healthcare systems in the world, the NHS offers the UK a unique strategic advantage as a resource for medical research and innovation. Previously, research within the NHS suffered due to the diversion of money intended for research into direct patient care. As a result, the NHS was often perceived by the academic and commercial community to be a challenging and inconsistent research partner. Over the past four years, several initiatives have sought to increase the standing of the NHS as a location for research and innovation. The most significant improvements have resulted from the establishment of the NIHR with its ring fenced budget and the formation of OSCHR. Several important collaborative entities have also been established to translate ideas across the NHS/university divide and harness the NHS infrastructure for research collaboration with industry.

In recent years, actions have been taken to emphasise the importance of research as a core function of the NHS. This message has been reinforced in the NHS Constitution and NHS Operating Framework and via the requirement for NHS Trusts to publish details of the number of patients involved in clinical research on an annual basis in their Quality Accounts. While acknowledging these positive steps, participants at the meeting highlighted that more can be done to embed research as a core component of NHS activity.

### 3.3.1 Supporting research in the NHS

The NIHR was established in 2006 to create a health research system in which *'the NHS supports outstanding individual researchers, working in world-class facilities, conducting leading-edge research focused on the needs of NHS patients and the public'*.<sup>24</sup>

As part of its activities to strengthen UK health research, the NIHR has:

- Established the NIHR Faculty which provides important support for all NHS professionals who carry out people and patient-based applied health research funded by NIHR. The Faculty is designed to develop research careers, supporting both research leaders and collaborators.<sup>25</sup>
- Made research training awards available to the most promising individuals, covering the entire career pathway from Masters level through to Senior Fellowships.
- Expanded the Health Technology Assessment programme that produces independent research information about the effectiveness, costs and broader impact of healthcare treatments and tests for those who plan, provide or receive care in the NHS.<sup>26</sup>
- Set up the Public Health Research Programme to evaluate the effectiveness, cost effectiveness and broader impact of public health interventions.
- Taken forward initiatives to streamline systems for research management and governance and to reduce bureaucracy.

### 3.3.2 Translating ideas across the NHS/university divide

The NIHR and Department of Health have also supported individual activities to foster collaboration across the wider NHS and the academic sector. Speakers highlighted the following initiatives:

- Biomedical Research Centres and Units (BRCs and BRUs).<sup>27</sup>
- The Academic Health Science Centres (AHSCs).

- Health Innovation and Education Clusters (HIECs).

The NIHR has created twelve BRCs, based within NHS and university partnerships, to drive progress on innovation and translational research in biomedicine. These twelve centres are made up of five comprehensive and seven specialist BMC's, established with the objective of becoming early adopters of new technologies and treatments, and translating fundamental biomedical research into clinical research that benefits patients. Sixteen BRUs were formed to develop capacity and critical mass in areas of high disease burden and to build on existing research strengths in the NHS and universities. They are working to drive forward treatments in common diseases such as coronary heart disease, hepatitis C, and asthma.

In his presentation, Professor Stephen Smith FMedSci described the formation of the Imperial AHSC through a unique partnership between Imperial College London and the Imperial College Healthcare NHS Trust, itself created by merging Hammersmith Hospitals NHS Trust and St Mary's NHS Trust.<sup>28</sup> Developed in partnership with patient groups, GPs and Primary Care Trusts, the AHSC aims to partner with NHS organisations, public, private, and charitable providers, and develop ways of working with local networks that allow conditions to be treated in the most appropriate settings.

### 3.3.3 Attracting industry

Many of the initiatives described above have been set up to support both public and privately funded researchers. In addition, a number of dedicated schemes are specifically tailored to increase industry interaction with the NHS. Some of the services that the NIHR Clinical Research Network (NIHR CRN) is developing to assist the healthcare industry include:

<sup>24</sup> Further details are available from [http://www.nihr.ac.uk/about/Pages/default\\_old.aspx](http://www.nihr.ac.uk/about/Pages/default_old.aspx)

<sup>25</sup> The Faculty is designed to develop research careers, supporting both research leaders and collaborators. Further details are available from <http://www.nihr.ac.uk/faculty/Pages/default.aspx>

<sup>26</sup> Further details are available from <http://www.hta.ac.uk/>

<sup>27</sup> Further details are available from [http://www.nihr.ac.uk/infrastructure/Pages/infrastructure\\_biomedical\\_research\\_centres.aspx](http://www.nihr.ac.uk/infrastructure/Pages/infrastructure_biomedical_research_centres.aspx), [http://www.nihr.ac.uk/infrastructure/Pages/infrastructure\\_biomedical\\_research\\_units.aspx](http://www.nihr.ac.uk/infrastructure/Pages/infrastructure_biomedical_research_units.aspx)

<sup>28</sup> Further details are available from <http://www.ahsc.org.uk/>

- A 'rapid access, single point of access' to the comprehensive healthcare research infrastructure within the UK.
  - The capacity to provide prompt and reliable assessments of study feasibility through well established links with network study sites.
  - Facilitation of study site activation through the use of standardised agreements and costing processes for studies adopted by the networks.
  - Rapid patient recruitment and delivery of high quality data for clinical studies across the full range of medical conditions, including rare diseases.
  - Guided access for companies to the array of clinical and healthcare research expertise in the UK.
- Accelerated product development through well established collaborations.
- The NIHR CRN North West Exemplar Programme is demonstrating the impact of changes to the environment for clinical research (see box 3).
- The NIHR Office for Clinical Research Infrastructure (NOCRI) has been established to create enduring relationships between the NIHR, NHS, universities and the life science industries, and help companies navigate through the infrastructure to find suitable facilities and collaborators for their research.

### Box 3 NIHR CRN North West Exemplar Programme

The North West Exemplar Programme was initiated by the NIHR NHS/Biopharmaceutical Industry R&D Leadership Forum to collect evidence on the environment for clinical research and as a case study from which learning could be disseminated across the NHS.

The Programme is intended to capture best practice on the delivery of 20 industry sponsored studies running at research sites in the North West. Progress through study set up and delivery at the research sites in the North West is being closely monitored and each study will report a standard set of key performance indicators and metrics, including:

- Delivery to planned time and recruitment target (study and site level).
- Percentage of non-recruiting studies/non-recruiting sites.
- Time from R&D submission to first site approved.
- Time from R&D submission to first patient recruited.
- Time from site approval to first patient recruited.
- Time from submission of Industry Costing Template to agreement of costs.

Following the meeting, the report of Phase I of the Programme has been published. This covers the effective set-up of the Exemplar studies from submission of the R&D form to achievement of First Patient-First Visit.<sup>29</sup> Early results demonstrate reductions in the time taken for approvals and identify the following factors as key to the progress made so far: the role of the Lead Comprehensive Local Research Network as a single point of contact for all sites; rapid and appropriate escalation of issues and barriers; streamlining internal processes in NHS Trusts; and senior support from NHS Chief Executives.<sup>30</sup>

Phase II of the NIHR CRN North West Exemplar Programme continues to monitor recruitment to Exemplar studies, and implement contingency plans for any issues and barriers which may impact on recruitment to time and target.

<sup>29</sup> NIHR CRN (2010). *North West Exemplar Programme Phase 1 – Effective Study Set-Up*.

<http://www.ukcrn.org.uk/index/industry/nwexemplar/docs/mainColumnParagraphs/0/document/NIHR%20CRN%20North%20West%20Exemplar%20Programme%20-%20Phase%201%20Report.pdf>

<sup>30</sup> Further details are available from <http://www.ukcrn.org.uk/index/networks/comprehensive/clrns.html>

## 4 Infrastructure and facilities

In recent years significant attempts have been made to enhance the quality and scale of infrastructure for translational research, as well as support partnerships across sectors. New infrastructure and facilities that support research involving researchers from both academia and industry can encourage cross-fertilisation of ideas and collaboration.

### 4.1 Building infrastructure across the clinical pathway

The following section describes examples of new facilities established by public and private funders that have been targeted across the clinical research pathway. Additional examples are given in box 4.

#### 4.1.1 Experimental medicine

The process of experimental medicine, where investigations are undertaken in humans to identify the cause of disease and test the validity of new discoveries and treatments, underpins translational research. In 2006, £84 million of funding was committed under the umbrella of the UK Clinical Research

Collaboration to build on earlier investment and provide a purpose built environment for experimental research. Priority areas targeted by the scheme included clinical research facilities, enabling technologies (imaging, proteomics, genomics, diagnostics, devices), capacity for early medicinal chemistry and pharmaceutical support. A unique UK network of Clinical Research Facilities now exists to speed up the translation of scientific advances and encourage collaborations between basic and clinical scientists. These multi-user facilities are designed to support both academic and commercial research. They have access to outpatient and inpatient facilities, specialist equipment and laboratories, and to studies conducted according to Good Clinical Practice standards and the NHS Research Governance Framework. Other recent incentives to support experimental medicine include:

- Experimental Cancer Medicine Centres (ECMCs) to develop new cancer treatments and novel biomarkers. A network of 19 ECMCs has been developed through £35million of support from Cancer Research UK and the Health Departments in England, Scotland, Wales and Northern Ireland.<sup>31</sup>

### Box 4 Further examples of new infrastructure

#### ***The UK Centre for Medical Research and Innovation (UKCMRI)***

A national centre for collaborative, interdisciplinary and translational medical research, UKCMRI is a partnership between CRUK, the MRC, University College London and the Wellcome Trust. The building location and design is intended to facilitate important collaborations between the 'cluster' of scientific, academic and hospital institutions located in central London, as well as enabling cross-discipline engagement between researchers focusing on diseases such as cancer, heart disease and influenza.<sup>32</sup>

#### ***GSK Clinical Imaging Centre (CIC)***

Located at the Hammersmith Hospital, the CIC encourages collaborations between industry, Imperial College, other key imaging centres, academic centres and medical schools. Academic and NHS researchers are co-located at the CIC and work together on research that will help to increase understanding of disease processes, determine if a drug reaches and interacts with its intended target and measure downstream responses.<sup>33</sup>

<sup>31</sup> Further details are available from <http://www.ecmcnetwork.org.uk/>

<sup>32</sup> Further details are available from <http://www.ukcmri.ac.uk/>

<sup>33</sup> Further details are available from <http://cic.gsk.co.uk/>

- NIHR BMU's and BMC's (see section 3.3.2).
- The UK Clinical Research Facility network which provides guidance to those working in clinical research facilities and aims to develop a system that will facilitate the sharing of knowledge, expertise and good practice between facilities.

#### 4.1.2 Early clinical studies

Early stage or developmental clinical studies, sometimes considered a subset of experimental medicine, are an important part of the pre-clinical development pathway for new therapeutics. At the meeting, the Academy's President and Chair of OSCHR, Professor Sir John Bell FRS HonFREng PMedSci, announced a new initiative to create Therapeutic Capability Clusters to tackle key challenges during early and exploratory development (phase 1 and 2a human clinical trials).<sup>34</sup> Each of the clusters will comprise several academic/ NHS research centres of excellence that have relevant capabilities in exploratory development programmes. Each cluster will have a single point of contact to coordinate the collective activities of the centres and act as their interface with industry. No other existing cluster, national or international, has focused on early clinical development and experimental medicine in areas of medical need.

In bringing together strengths from across sectors, the Capability Cluster concept encapsulates one of the key themes of the Academy's meeting and is intended to deepen academic-NHS-industry collaboration. They are initially designed to provide a focus for industry researchers to work with academics in tackling early developmental challenges where both the public (NHS and academic) and private (life sciences industry) sectors will gain by working closely together. An additional objective of the clusters, the first of which will be in the areas

of inflammation and immunity, is to promote UK capability and to encourage global industry collaboration with UK health research centres.

#### 4.2 Clinical research infrastructure and facilities

As new innovations progress through the clinical pathway, researchers become increasingly dependent on access to patients. As described in section 3.3, the NHS provides a unique resource for clinical studies for researchers from both the public and private sectors. Perhaps the most comprehensive of the new infrastructures introduced is the NIHR CRN (as mentioned in section 3.3.3), which provides a route through which new clinical studies can be developed, to increase participation in clinical studies and help recruit participants to time and target. Managed by the NIHR Clinical Research Network Coordinating Centre (NIHR CRNCC), the English network consists of Topic Specific, Primary Care and Comprehensive Clinical Research Networks:<sup>35</sup>

- The Six Topic Specific Clinical Research Networks cover cancer, diabetes, dementias and neurodegenerative diseases, medicines for children, mental health and stroke. Each network has formed clinical study groups to coordinate activities and ensure the development of a balanced portfolio of work.<sup>36</sup>
- The Primary Care Research Network aims to increase patient recruitment and expand clinical research in primary care. The network consists of eight Local Research Networks covering the whole of England.<sup>37</sup>
- The Comprehensive Clinical Research Network works alongside the Topic Specific and Primary Care Research Network to provide infrastructure support for all disease areas.<sup>38</sup>

<sup>34</sup> Further details are available from [http://www.nihr.ac.uk/about/Pages/Office\\_for\\_Life\\_Sciences\\_call.aspx](http://www.nihr.ac.uk/about/Pages/Office_for_Life_Sciences_call.aspx)

<sup>35</sup> The National Institute for Health Research Clinical Research Network (NIHR CRN) supports clinical research and helps to facilitate the conduct of trials and other well-designed studies within the NHS. Further details are available from [http://www.crncc.nihr.ac.uk/about\\_us/about\\_us](http://www.crncc.nihr.ac.uk/about_us/about_us)

<sup>36</sup> Further details are available from [www.ncrn.org.uk](http://www.ncrn.org.uk), [www.ukdrn.org](http://www.ukdrn.org), [www.dendron.org.uk](http://www.dendron.org.uk), [www.mcrn.org.uk](http://www.mcrn.org.uk), [www.ukmhrn.info](http://www.ukmhrn.info), [www.uksrn.ac.uk](http://www.uksrn.ac.uk)

<sup>37</sup> Further details are available from <http://www.ukcrn.org.uk/index/networks/primarycare.html>

<sup>38</sup> Further details are available from <http://www.ukcrn.org.uk/index/networks/comprehensive.html>

## 5 Developing and supporting a world-class biomedical workforce

Throughout the meeting, scientists and research funders stressed the importance of a world-class biomedical workforce. To enable the development of innovative new medicines not only must we create the right infrastructure and adopt new ways of collaborative working, we must also create supportive environments that foster and inspire talented researchers.

The importance of a highly skilled workforce was stressed throughout the presentations:

- Professor Stephen Jackson FRS FMedSci attributed much of his success to having high-quality people in a good environment and highlighted the importance of empowering younger scientists and rewarding their attempts to innovate (see section 3.1.1).
- In his presentation on the DSTT, Professor Sir Philip Cohen FRS FMedSci described the importance of bringing together leading researchers from across sectors and

promoting interaction by basing industry scientists within the academic environment to aid technology transfer (see section 3.1.1).<sup>39</sup>

- Lord Drayson highlighted recent steps taken by Government to address skills gaps and encourage industry, universities and funders to work together to build a world class biomedical workforce.
- Speakers from both the Wellcome Trust and MRC described steps that their organisations have taken to nurture and develop a pool of talented bioscience professionals.

One of the key objectives of the Academy of Medical Sciences is to develop the research leaders of the future. The Academy's UK-wide mentoring and outreach scheme has an innovative portfolio of activities that support this aim, helping to develop the next generation of leading scientists (see box 5).

### Box 5 Academy Mentoring and Outreach Scheme

A clinical academic career brings challenges, opportunities and rewards. Most individuals are still in clinical training as they embark on their research career and therefore have multiple, and often competing, demands on their time. The Academy's UK-wide Mentoring and Outreach Scheme aims to provide support and guidance to clinical trainees as they embark on the academic pathway and progress to establish an independent research career alongside their clinical responsibilities. The schemes expanding portfolio, developed over the last eight years, includes both one-to-one mentoring and a range of outreach activities.

#### ***One-to-one mentoring***

Mentoring is available to postdoctoral clinical academics, specifically Clinician Scientist Fellows and research-active Clinical Lecturers. Aspiring clinical academics select a mentor from the Academy's 980-strong Fellowship, who represent the UK's leading medical scientists from hospitals and general practice, academia, industry and public service. Trainees participating in the scheme particularly value the opportunity to gain personalised, confidential and independent advice from a senior figure outside their institution, specialty or even area of research. There are currently 215 mentor-mentee pairs.

<sup>39</sup> Further details available from <http://www.lifesci.dundee.ac.uk/dstt>

**Outreach activities**

Outreach activities, which include a programme of regional events, promote academic medicine to medical students and support and inspire clinical academic trainees at all stages of training. Events provide opportunities for individuals to network with senior colleagues and peers. They also offer a forum for knowledge transfer and encourage debate on issues around funding and professional development.

For further information, contact [mentoring@acmedsci.ac.uk](mailto:mentoring@acmedsci.ac.uk) or visit [www.acmedsci.ac.uk/mentoring](http://www.acmedsci.ac.uk/mentoring). The scheme is generously funded by the NIHR and NHS Education for Scotland.

**5.1 Addressing gaps**

The UK must sustain a world-class biomedical workforce with the full range of skills needed to advance understanding and develop novel treatments for major diseases. The OLS Blueprint outlined a package of actions to ensure current and future generations of scientists, clinicians and technologists have the core skills needed to pursue a career in industry, academia or the NHS.<sup>40</sup> Following the meeting in December 2009, OLS established the Industry and Higher Education Forum. The aim of this forum is to enable employers, universities and public sector funders to agree what specialised course content is needed to ensure that undergraduates and postgraduates undertaking relevant degrees and courses, such as biological sciences, gain the necessary skills and knowledge to pursue a research career in life sciences.

The Industry and Higher Education Forum is supported by a Forum Advisory Group which brings together strategic and operational delivery representatives from Government, industry, the Department of Health, academia, and public sector bodies, such as relevant Sector Skills Councils and Research Councils. In addition, Forum Task and Finish Teams will be established to tackle particular areas where there is:

- Limited analysis of the skills gaps.
- A need to seek the views of specialists and experts to understand the current and future skills requirements.

- A need to take action to address the skills gaps.

As well as the formation of the Forum Task and Finish Teams to address the critical skills gaps in the UK, the MRC has made provision for two Higher Education Institute-led flagship training programmes in clinical pharmacology and pathology. These programmes are supported by £1.85 million each, made available through reprioritisation within the MRC's research career awards budget.

**5.2 Facilitating mobility**

The Academy of Medical Sciences has long promoted relations between academia and industry through the work of its FORUM and through dedicated activities to promote careers for biomedical scientists and clinicians in industry.<sup>41</sup>

The UK's world-class position in medical science is underpinned by a first rate workforce. A key ingredient for success is collaboration between academia and industry; it is this interface that fuels the process by which new scientific ideas are brought into clinical application. The mobility of researchers is an important part of this interface; exchanging skills, forging opportunities and promoting mutual awareness. The following schemes were cited at the meeting as encouraging integration across sectors.

<sup>40</sup> Office of Life Sciences (2009). *Life sciences blueprint*. <http://www.bis.gov.uk/assets/biscore/corporate/docs/l/10-542-life-sciences-2010-delivering-the-blueprint.pdf>

<sup>41</sup> Further details are available from <http://www.acmedsci.ac.uk/p23.html>

### **5.2.1 Wellcome Trust Interdisciplinary Training Programme for Clinicians in Translational Medicine and Therapeutics**

This flagship scheme established four high-quality integrated research training programmes for clinicians in translational medicine and therapeutics.<sup>42</sup> The programmes have been developed around a unique partnership between academic and industrial partners with support for the programmes provided to the host institutions by GlaxoSmithKline, Wyeth Research, Roche, AstraZeneca, Sanofi-Aventis, and PTC Therapeutics. The Fellowships are embedded in the Wellcome Trust PhD Programme and the aim is to produce a cadre of clinicians with the expertise to design and conduct studies to develop and evaluate novel therapies in humans. Across the scheme, projects will range from the innovative characterisation of disease phenotypes or validation of potential new drug targets to the development of biomarkers and early proof-of-concept drug studies.

### **5.2.2 MRC People Exchange Programme and Industrial CASE Studentships**

The MRC Exchange Programme and Industrial CASE studentships seek to foster flexible working with industry and build long-term industry-academic partnerships.

#### *MRC People Exchange Programme, Research Leader Fellowships*

These facilitate the exchange of knowledge and skills and forge successful partnerships between industry and academia.<sup>43</sup>

#### *MRC Industrial CASE studentships*

These provide PhD students with valuable experience within the context of a mutually beneficial collaboration between academic and industry research programmes. As part of that commitment the MRC will be funding approximately 35 individual Industry CASE PhD studentships, to be taken up in 2010, with the aim to award at least five of these to small and medium sized enterprises.<sup>44</sup>

### **5.2.3 The CRUK-AZ medical oncology training scheme**

This scheme has been jointly funded by Astra Zeneca and CRUK and enables Clinical Research Fellows (CRFs) to learn about early clinical trials in cancer treatments from both an academic and industry perspective.<sup>45</sup> Fellows receive training in phase I trials and translational research, including biomarker discovery and clinical trial methodology. The scheme provides CRFs with access to state of the art facilities and allows them to move between the sectors while also receiving clinical support and attending a weekly oncology clinic.

<sup>42</sup> Further details are available from <http://www.ncl.ac.uk/biomedicine/postgrad/clinical/wellcome/>, <http://tmat.medschl.cam.ac.uk/>, [http://www1.imperial.ac.uk/medicine/teaching/postgraduate/pgclinical/wellcomegsk\\_tmt\\_programme/](http://www1.imperial.ac.uk/medicine/teaching/postgraduate/pgclinical/wellcomegsk_tmt_programme/), <http://stmti.mvm.ed.ac.uk/>

<sup>43</sup> Further details are available from <http://www.mrc.ac.uk/Fundingopportunities/Fellowships/PEP/index.htm>

<sup>44</sup> Further details are available from <http://www.mrc.ac.uk/Fundingopportunities/Studentships/IndustrialCASE/index.htm>

<sup>45</sup> Further details are available from <http://www.ls.manchester.ac.uk/business/workingwithus/collaborations/casestudies/astrazeneca/Faculty%20of%20Life%20Sciences%20and%20AstraZeneca%20article.pdf>



## 6 Bridging gaps and creating an innovation ecosystem

This report has so far focused on steps to foster innovation, develop a world-class workforce and build the necessary infrastructure to support translation. Many of the initiatives described have incorporated new approaches to partnership and are designed to integrate UK strengths across sectors.

However, translating new knowledge into benefits for patients, society and the economy, is also dependent on addressing some of the gaps between sectors and creating the right regulatory and policy environment in which innovation can flourish. Throughout the meeting speakers highlighted the importance of sustaining an innovation ecosystem that both supported and enabled collaboration. Key elements described included:

- The importance of a strong biotechnology sector and public funding initiatives to support technology transfer from universities.
- Streamlined regulation and governance.
- Appropriate mechanisms to support the uptake and diffusion of new medicines.

### 6.1 Incubating innovation

The approach being adopted by 'large pharma' companies not only indicates a shift in their relationship with academic researchers but also an increasing dependency on a strong biotechnology sector.

The importance of biotechnology firms is illustrated by the proposal to create a unique drug development bio-incubator that will initially be home to around 25 companies. Described at the meeting and announced in October 2009, the Stevenage Bio-Incubator is supported by £12 million from the Strategic Investment Fund, alongside funding from the East of England Development Agency, the Technology Strategy Board, the Wellcome

Trust and GlaxoSmithKline.<sup>46</sup> The objective is to create a hub for early-stage biotechnology companies that will attract inward investments, spin-outs and start-ups. The incubator provides one high profile vision of how specialist equipment, services and knowledge can be shared amongst companies to benefit drug development.

Biotechnology firms play a vital role at the nexus of an innovation ecosystem that draws on collaboration and partnership to drive forward development. However, this shift by pharmaceutical firms to increasingly invest outside their own 'four-walls' occurs at a time when the UK biotechnology sector is vulnerable and losing its international lead. The number one problem facing UK biotechnology firms is access to finance required for research and development, working capital requirements and protecting intellectual property.

The quality of innovation being fed into the biotechnology sector can also be improved, helping reduce risk and compress development times. The meeting attendees heard how UK universities are a unique strength and are an important source of compounds and technologies that have commercial potential. While the programmes described in section 3.1 are a positive step, more needs to be done to support universities in thinking strategically and in incubating a portfolio of products for longer, to increase their attractiveness to venture capital and the pharmaceutical industry. Strong and coherent programmes to support early phase innovation in universities will leverage further inward investment in the UK and bridge the gap between idea generation and commercial financing. A number of schemes already exist to facilitate technology transfer and fund the space between academia and industry including the MRC's Developmental Pathway Funding Scheme.<sup>47</sup>

<sup>46</sup> Further details are available from <http://www.bnet.com/blog/sterling-performance/uk-biotech-gets-a-big-boost-from-gsk/3536>

<sup>47</sup> Further details are available from <http://www.mrc.ac.uk/Fundingopportunities/Grants/DPFS/index.htm>

## 6.2 Regulation and governance

A number of speakers expressed their concern that medical research is being unnecessarily hampered by complex and over burdensome regulation. This is adversely affecting UK medical innovation in both the private and public sectors and ultimately driving research abroad. Medical research involving patients must be subject to robust regulation, but this regulation must be proportionate to the risks involved. The combined regulatory requirements of the EU Clinical Trials Directive, European Medicines Evaluation Agency, Medicines and Healthcare products Regulatory Agency (MHRA), NHS ethics committees, R&D offices in NHS Trusts, the National Information Governance Board and other agencies are stifling UK R&D.

Speakers welcomed recent initiatives to reduce the regulatory burden on research, through schemes such as the Integrated Research Application System and the NIHR Coordinated System for gaining NHS Permission (CSP). However concerns remain across the sectors (academia, industry, NHS and medical research charities) such as:

- The increasing cost and duration of clinical trials.
- The delays caused by meeting requirements of various regulations.
- Complexity due to interfaces between different regulatory systems and agencies.

As mentioned in section 2.1, since the meeting the Academy has been commissioned by the Department of Health to undertake a review of the regulation and governance of medical research.<sup>48</sup>

## 6.3 Uptake and appraisal of new medicines

Strengths in basic and translational research have resulted in the UK creating a quarter of the world's top 100 medicines.<sup>49</sup> However, this expertise in advancing knowledge and developing new treatments has not been matched by an ability to effectively and efficiently deliver the benefits to patients. For example, a recent study on the uptake of new cancer drugs found that the UK has slower uptake of these innovative products compared to other European nations.<sup>50</sup> In the UK, products launched in the last five years make up a smaller share of the market than that in many other countries, including Germany, the US, Italy, Australia and Canada.<sup>51</sup>

In the discussion following the presentations, members of the audience highlighted the need to improve the uptake of innovative medicines. Recently proposed by the OLS, the Innovation Pass is an important part of a broader agenda to provide earlier patient access to innovative medicines. The Academy's submission to the Department of Health's Innovation Pass consultation in February 2010 highlighted the need to use a range of instruments, including streamlining regulation, flexible pricing and public procurement strategies.<sup>52</sup> Other important initiatives include the MHRA's proposed scheme to allow earlier access to certain new medicines before they achieve regulatory approval and NICE's patient access schemes to allow high cost drugs to be available via the NHS.<sup>53,54</sup>

<sup>48</sup> Academy of Medical Sciences (2010). *Review of the regulation and governance of medical research*. <http://www.acmedsci.ac.uk/p47prid80.html>

<sup>49</sup> Association of the British Pharmaceutical Industry (2004). *Innovating for a healthy tomorrow*. [http://www.abpi.org.uk/publications/pdfs/annual\\_report\\_05.pdf](http://www.abpi.org.uk/publications/pdfs/annual_report_05.pdf)

<sup>50</sup> Jonsson B and Wilking N (2007). *A global comparison regarding patient access to cancer drugs*. *Annals of Oncology* **18** (Suppl 3), 1-78.

<sup>51</sup> Association of the British Pharmaceutical Industry (2009). *Drug evaluation in the UK – Have we got it right?* <http://www.nice2009.co.uk/Richard%20Barker%20Presentation%20Day%202.pdf>

<sup>52</sup> Academy of Medical Sciences (2010). *Department of Health consultation on the Innovation Pass Pilot*. <http://www.acmedsci.ac.uk/p100puid178.html>

<sup>53</sup> Further details are available from <http://www.mhra.gov.uk/Howweregulate/Medicines/MISGNewTechnologiesAdvisoryPanel/Earlieraccesstonewmedicinesintheuk/CON065736>

<sup>54</sup> Further details are available from <http://www.nice.org.uk/aboutnice/howwework/paslu/patientaccessschemesliaisonunit.jsp>

## 7 A new model: opportunities and challenges

This report began by highlighting the UK's unique strengths across academia, industry and the NHS. During the meeting we heard from representatives across these sectors. Speakers from some of the UK's top universities, renowned public research funders, research-intensive medical science industries and the NHS gave a series of compelling talks. Presentations covered success stories of collaborative R&D; showcased new initiatives to support translational research, build infrastructure and foster a world class workforce; and explored some of the barriers and levers to partnership activity.

This meeting informed the Academy's report 'Reaping the rewards: a vision for UK medical science', published in early 2010, which calls upon the Government to put our strengths across academia, industry and the NHS to work as the engine of Britain's future prosperity (see box 6).<sup>55</sup> The report stresses that, supported by the right policies, medical science can reap the rewards of being uniquely positioned to attract the whole R&D chain for new medicines to the

UK and deliver exceptional health, economic and social benefits. At the meeting delegates heard how collaboration between government, universities, research funders, the NHS and industry is essential to achieving this vision, to:

- Fully realise the potential from recent investment in UK translational research.
- Overcome challenges in drug development through sharing expertise, skills and facilities.

Opportunities and new initiatives presented by research funders such as the MRC and Wellcome Trust to support translation and collaborative work need to be seized. Steps introduced through the NIHR to open up the NHS to increased research activity also need to be utilised and built upon. Seizing the opportunities presented through investment in UK translational research will require input from across sectors to facilitate new ways of stimulating the discovery and development of new drugs.

### Box 6 Reaping the rewards: a vision for UK medical science

The recent financial crisis offers an opportunity for the UK to rebalance its economy towards a medical science sector that can drive economic growth and meet future health challenges. To reap the rewards from recent generous support for medical science, the UK must tackle the following seven important challenges:

1. To benefit patients the NHS must become a willing participant in health research.
2. The regulatory environment is driving medical science abroad.
3. Innovative incentives must firmly root the medical science industries in the UK.
4. Publicly funded health research needs further coordination.
5. Public health challenges must become cross-departmental priorities.
6. Health research should be used as a driver of foreign policy and international development.
7. The UK must sustain and grow its world-class biomedical workforce for our knowledge economy.

<sup>55</sup> Academy of Medical Sciences (2010). *Reaping the rewards: a vision for UK medical science*. <http://www.acmedsci.ac.uk/p99puid172.html>

### 7.1 A new model of innovation

Many innovations in medical science have followed a common path through which discoveries made from publically funded research conducted in academia were translated into drugs by pharmaceutical companies. The idea of innovation being a linear transition from ideas born in universities, to new products developed in industry and then used by clinicians is, however, an oversimplification that bears little resemblance to the iterative process of discovery and development described by speakers at the meeting.

Throughout this report, examples have been given of a more integrated approach which better reflects the innovation process and is dependent on bringing together the building blocks of medical research. We have highlighted how:

- Academic researchers, supported by new funding initiatives, are both engaging in basic science and looking to fuel translational research, often in partnership with others.

- Industry is increasingly investing in research performed in academic settings to complement its own efforts and drive forward innovation across a broad range of disease targets.
- The NHS, through the NIHR, is looking to utilise its advantages as a resource for innovation and establish itself as a partner for research with both the public and private sector.

Table 2 below captures some of the changes within sectors that have made increased collaboration possible. In combination, these changes have begun to facilitate a shift to a new operating model and speakers throughout the event highlighted opportunities to maximise cross sector strengths and deliver:

- A new front end to the discovery process where companies join forces with academics to answer scientific questions in a precompetitive environment.
- An improved development phase, facilitated by increased involvement of the NHS as a health research collaborator.

**Table 2 A new of model of innovation**

<i><b>Academia</b></i>	<i><b>Industry</b></i>	<i><b>NHS</b></i>
<ul style="list-style-type: none"> <li>• New funding strategies focusing on translational research.</li> <li>• Targeted funding for R&amp;D projects addressing unmet needs or bottlenecks in R&amp;D.</li> <li>• Increasing partnership between public and private funders.</li> <li>• Schemes to promote mobility of researchers between sectors and interdisciplinary training for clinicians.</li> </ul>	<ul style="list-style-type: none"> <li>• 'Large pharma' looking to externalise and diversify through flexible partnerships as firms look to externalise R&amp;D.</li> <li>• Move towards open innovation.</li> </ul>	<ul style="list-style-type: none"> <li>• Ring-fenced budget.</li> <li>• Creation of the NIHR.</li> <li>• University/NHS partnerships.</li> <li>• Embedding a research culture.</li> </ul>

## 7.2 The benefits of collaboration

Successful collaboration and innovation offers collective benefits to the health and wealth of the UK. Professor Stephen Jackson FMedSci concluded his presentation on the commercialisation of academic science and the success of Kudos Pharmaceuticals by listing the beneficiaries of this work. UK Plc had gained in terms of venture capital funding, multinational investment and the creation of over 200 jobs. In turn, the Kudos employees were gaining from the success of the company, with a significant percentage of sale proceeds going to staff. Finally, breast and ovarian cancer patients were benefiting from the new treatments, with exciting potential opportunities in other cancers and disease areas such as stroke and heart-attack.

As described throughout the report, the benefits of collaboration are shared across the sectors and include the aspects outlined below.

### 7.2.1 Benefits to academia

Collaborations with industry can provide academic researchers with invaluable access to:

- Research resources such as high throughput technologies, diagnostics, small molecule libraries, GMP facilities and manufacturing.
- Expertise in methodology and support to guide development and clinical testing.

### 7.2.2 Benefits to industry

Pharmaceutical firms are increasingly looking towards flexible partnerships with the biotechnology industry and academia to share risk and access expertise across multiple disease targets. The benefits of partnering with academic researchers include:

- Greater understanding of proof of concept, and proof of mechanism through studies with academic partners.
- Access to research that may seem premature for pharmaceutical investment, allowing expansion of the number of 'druggable' targets.

- Improvement in the protocols used to evaluate new classes of medicines by refining approaches for measuring pathway function, identifying surrogates of disease and selecting appropriate patient populations.

Utilising the opportunities presented by new infrastructure within the NHS provides industry with a complementary set of advantages, including:

- A single point of access to the one of the largest healthcare systems in the world.
- Access to data to improve the safety of medicines, to better understand the causes of disease, to identify research participants and to locate patients who would benefit most from targeted health interventions.
- Patient recruitment and delivery of data for clinical studies across the full range of medical conditions, including rare diseases.

### 7.2.3 Benefits to the NHS

The primary benefit to the NHS is the faster development of new drugs and interventions that offer improved treatments for patients. Advantages of increasing participation of the NHS in research and greater partnership with scientists from academia and industry include:

- Earlier access to new and better ways of preventing, diagnosing and treating disease, hence providing more effective and efficient interventions which enable the NHS to drive up quality and increase productivity.
- Participation in research by health care professionals creates a culture of continuous improvement in the care they provide.
- Health care professionals who participate in research not only use the results of their own research to improve the care they provide but are more likely to adopt and use evidence of best practice from research conducted elsewhere.
- Patients treated at hospitals which participate in clinical trials have better outcomes.

- Participation in research builds the profile and reputation of the NHS Trust, helping to attract and retain high calibre staff.
- Benefits for clinicians and researchers, including the opportunity to develop new skills and expertise.

### 7.3 Next steps

At the meeting, attendees heard how clinical research can be enhanced through successful collaborations, and have highlighted a number of steps taken to support and assist collaboration. As illustrated in the examples throughout this report and in the benefits listed above, the most beneficial partnerships facilitate exchanges of knowledge and collaboration between sectors. The old model whereby funding simply passes from industry to academia has been redefined. More now needs to be done to encourage productive partnerships and, in the process, attract international companies to the UK. Throughout the meeting a number of important actions were highlighted, that need to be taken to improve the number and productivity of collaborative partnerships. These include:

- Seizing opportunities for flexible collaboration across sectors and establishing appropriate funding structures and incentives.
- Improving the culture of collaboration and building a mutual recognition that industry, academia and the NHS are credible, equal scientific and clinical partners.
- Forming collaborations that result in a mutually beneficial exchange of ideas and people and improve the training for academic, NHS and industry researchers.
- Ensuring new financial pressures do not erode new relationships between universities and the NHS. The positive steps that have been taken must be sustained.
- Creating a proportionate, risk-based regulatory framework for medical research involving humans that is fit for purpose and facilitates medical research, whilst at the same time ensuring patient and public safety, as well as appropriate accountability.
- Foster an environment that supports home-grown biotechnology companies, attracts and retains pharmaceutical companies to the UK, and where entrepreneurs are encouraged to establish new firms.
- Developing suitable frameworks for collaborative agreements that facilitate innovation through the appropriate and realistic handling of background and emergent Intellectual Property and involve the NHS in tripartite arrangements which take into account the specific research governance provisions that this requires.

## Appendix I: Meeting programme

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### **Academia, industry and the NHS: collaboration and innovation**

Friday 27 November

Royal Society, 6-9 Carlton House Terrace, London SW1Y 5AG

#### ***Welcome and introduction***

Professor Sir John Bell FRS HonFREng PMedSci, President, Academy of Medical Sciences

#### ***Open innovation: new models of academic industry interaction***

Professor Patrick Vallance FMedSci, Vice President, Drug Discovery, GlaxoSmithKline

#### ***The Division of Signal Transduction Therapy (DSTT): a model for collaboration between academia and industry***

Sir Philip Cohen FRS FRSE FMedSci, Director, MRC Protein Phosphorylation Unit

#### ***Opportunities to deliver translational research through partnership***

Dr Chris Watkins, Medical Research Council, Translation Theme Leader

#### ***Translating ideas across the NHS/university divide: a unique Academic Health Science Centre***

Professor Stephen Smith FMedSci, Imperial College Healthcare NHS Trust

#### ***Personal perspectives: the highs and lows of cross-sector collaboration***

Chaired by Dr Geoff Watts FMedSci, science and medical journalist

Panel members:

- Dr Louise Wood, Head of NHS Research Infrastructure and Industry R&D Relations, Department of Health
- Professor Andrew Hughes, Director of Discovery Medicine for Cancer and Infection, Astra Zeneca
- Dr Ailiki Taylor, Epidemiology Director, Amgen

#### ***Promoting innovation and collaboration across academia, industry and the NHS***

Lord Drayson, Minister of State for Science and Innovation

#### ***The Wellcome Trust: how a charity engages with industry and the NHS***

- Dr John Williams, Head of Clinical Activities, Wellcome Trust
- Professor Morris Brown FMedSci, Professor of Clinical Pharmacology, University of Cambridge

#### ***Commercialisation of basic research: from Ku to KuDOS; and new approaches to cancer therapy***

Professor Stephen Jackson FRS FMedSci, Head of CRUK Laboratories, University of Cambridge

The Academy gratefully acknowledges the support of Sanofi Pasteur for this event.

## Appendix II: Meeting attendees

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Professor David Abraham, Director of Research, UCL  
 Dr Saliha Afzal, Biomedical Research Centre Manager, KCL  
 Miss Beenish Akhtar, Clinician, Birmingham Heartland's Hospital, Birmingham  
 Ms Akunna Akpan, Biomedical Research Centre Manager, Guy's and St. Thomas' Hospital  
 Dr Adil Akram, Academic Clinical Fellow, St. George's, University of London  
 Dr Chandan Alam, Director, Business Development, William Harvey Research Institute, QMUL  
 Professor Robin Ali FMedSci, Human Molecular Genetics, Institute of Ophthalmology, UCL  
 Mr John Allen, PhD Student/Audiologist, University of Oxford  
 Dr Emre Amirak, Clinical Research Fellow, National Heart and Lung Institute, ICL  
 Dr Becky Andrew, Business Development Manager (Health), KCL Business Ltd  
 Miss Chrystalina Antoniadou, PhD Student, University of Cambridge  
 Mr Hutan Ashrafian, Wellcome Trust Research Fellow, ICL  
 Dr Gillian Auld, Business Development Officer, University of Aberdeen  
 Dr Kirsty Bannister, Post-Doctoral Researcher, UCL  
 Dr Helen Baxendale, Senior Lecturer/Honorary Consultant, Institute of Child Health, UCL  
 Dr Andrew Beavil, Senior Lecturer/Research Group Leader, KCL  
 Professor Sir John Bell FRS HonFREng PMedSci, President, Academy of Medical Sciences  
 Dr Christopher Bell, Postdoctoral Researcher, University College London Cancer Institute  
 Dr Angelyn Bethel, Senior Clinical Researcher, University of Oxford  
 Dr Neeraj Bhala, MRC Health of the Public Fellow, University of Oxford  
 Miss Georgia Black, PhD Student, KCL  
 Dr Helen Bodmer, Head, MRC and Health Research Team, BIS  
 Dr Laura Boothman, Policy Officer, Academy of Medical Sciences  
 Professor Marina Botto FMedSci, Professor of Rheumatology, Imperial College London  
 Dr Geoff Boxer, Laboratory Manager, University College London Cancer Institute  
 Dr Julia Boyle, Director, Surrey Clinical Research Centre, University of Surrey  
 Dr Orit Braha, Research Assistance, OCDEM, University of Oxford  
 Miss Jennie Brown, PhD Student, University College London  
 Professor Morris Brown FMedSci, Professor of Clinical Pharmacology, University of Cambridge  
 Professor Thomas Brunner, Group Leader, Radiobiology Research Institute, University of Oxford  
 Dr Kevin Buchan, Manager, External Opportunity Evaluation, GE Healthcare  
 Ms Amanda Buttery, Biomedical Research Centre Training Fellow, Inst. of Gerontology, KCL  
 Mrs Susan Burningham, Executive Assistant, Academy of Medical Sciences  
 Dr Suzanne Candy, Director, Biomedical Grants and Policy, Academy of Medical Sciences  
 Dr Juan Pablo Casas, Senior Lecturer, London School of Hygiene and Tropical Medicine  
 Dr Selim Cellek, Translational Research Project Manager, University College London  
 Sir Iain Chalmers FMedSci, Editor, James Lind Library, James Lind Initiative  
 Dr Yu-Mei Chang, Research Administrative Coordinator, University of Oxford  
 Mr Keith Chantler, Director Academic Affairs and Innovation, Manchester BRC  
 Ms Melanie Chevin, Business Development Executive Coordinator, ICL  
 Mr Andre Chow, Academic Clinical Fellow, ICL  
 Dr Olga Ciccarelli, Wellcome Advanced Fellow, Institute of Neurology, UCL  
 Dr Rachel Clough, Clinical Training Fellow, KCL  
 Sir Philip Cohen FRS FRSE FMedSci, Director MRC Protein Phosphorylation Unit, Dundee

Dr Mike Collis, Chief Executive, Physiological Society  
 Dr Lorna Colquhoun, Head of Research Development, University of Bristol  
 Dr Angela Cooper, Assoc. Director of Research, Royal Brompton & Harefield NHS Foundation Trust  
 Professor Andrew Cope, Arc Professor, Head of Rheumatology, KCL  
 Dr David Cousins, Principal Investigator, MRC Asthma UK Centre, KCL  
 Dr Barney Cox, Technology Transfer Manager, Queens Mary Innovations Ltd  
 Dr Roman Clegg, Academic Clinical Fellow, UCL  
 Dr Dimitra Darambara, Team Leader, Multimodality Molecular Imaging, ICR/RMH  
 Ms Jane Darnbrough, Research Approvals Facilitator, NIHR  
 Dr Elena De Falco, Clinical Scientist Fellow, Institute of Child Health, UCL  
 Ms Emanuele De Rinaldis, Senior Research Fellow, Breakthrough Breast Cancer Research, KCL  
 Dr Anne-Marie Deans, Programme Manager Industry Liaison, MRC  
 Dr Dipok Dhar, Senior Research Associate, University College London  
 Sir Colin Dollery FMedSci, Senior Consultant, GlaxoSmithKline (GSK)  
 Ms Tina Donnelly, Business Manager, Clinical Neuroscience, Institute of Psychiatry, KCL  
 Dr Hal Drakesmith, Beit Memorial Fellow for Medical Research, Weatherall Institute for Molecular  
 Medicine, University of Oxford  
 Lord Drayson, Minister of State for Science and Innovation, BIS  
 Professor Paul Driscoll, Professor of Structural Biology, MRC NIMR  
 Mr Alan Driver, Director of IP Management, NHS Innovations London  
 Dr James M N Duffy, Academic Foundation Fellow, King's College London  
 Dr Simon Eaglestone, Research Manager, The Royal London Hospital  
 Dr Sharon Eastwood, Research Lecturer, University of Oxford  
 Dr Neil Ebenezer, Medical Device Specialist, Medicines and Healthcare Regulatory Agency  
 Dr Malihe Eskandarpour, Postdoctoral Researcher, University College London  
 Dr Mark Farrow, Project Manager, Institute of Neurology, UCL  
 Dr Sarah Fawcett, Clinical Training Fellow, University of Cambridge  
 Dr Robin Fears, Beta Technology  
 Professor Marc Feldmann FRS FMedSci, Division Head, Kennedy Institute of Rheumatology, ICL  
 Dr Olivia Festy, Business Development Manager, Queen Mary Innovation Ltd  
 Professor David Fish, Director UCL Partners, UCL  
 Dr Angela Flannery, Director, Science Policy, AstraZeneca  
 Dr Henry Fok, Academic Clinical Fellow, St. Thomas' Hospital  
 Dr Heather Fortnum, Executive Director, National Hearing BRU, University of Nottingham  
 Dr Robert Frost, FORUM Manager, Academy of Medical Sciences  
 Professor Barry Furr OBE FMedSci, Chief Scientist / Consultant, AstraZeneca  
 Dr Aude Gautier, Postdoctoral Research Associate, Royal Free and UC Medical School  
 Mr Ronnie Georghiou, Senior Business Development Manager, IP Pragmatics  
 Dr Sarah Gibb, Policy Intern, Academy of Medical Sciences  
 Dr Rachel Gibson, Operations Director, Academic Discovery Performance Unit, GSK  
 Mr Peter Gill, Rhodes Scholar, University of Oxford  
 Dr Guvanti Goding, Translational and Applied Research Strategy Coordinator, UCL  
 Dr Mike Grahm, Director of Operations, Barts and The London, QMUL  
 Professor Ian Greer FMedSci, Dean, Hull York Medical School  
 Dr Richard Grose, Lecturer in Cell Biology, Barts and The London, QMUL  
 Dr Alan Groves, MRC Clinician Scientist, ICL

Dr Jim Hagan, Chief Executive Officer, Global Medical Excellence Cluster, KCL  
 Dr Dan Hart, Senior Lecturer in Haematology, Barts and The London, QMUL  
 Dr Douglas Hartley, Wellcome Clinician Scientist Fellow, University of Oxford  
 Ms Naomi Hawkins, Researcher in Law, University of Oxford  
 Professor Sheila Haworth CBE FMedSci, Professor of Developmental Cardiology, ICH, UCL  
 Dr Catherine Headley, Business Development Manager, University of Manchester  
 Mr Nick Hillier, Head of Communications and Corporate Events, Academy of Medical Sciences  
 Professor Aroon Hingorani, Professor of Genetic Epidemiology, UCL  
 Professor Matthew Holley, Head of Biomedical Science Department, University of Sheffield  
 Dr Jill Holliday, Centre Manager, MRC Centre for Transplantation, KCL  
 Dr Michael Vaclav Holmes, PhD Student, UCL  
 Dr Ting Hou, Career Development Fellow, MRC NIMR  
 Dr Kate Hough, Senior Business Development Manager, University of Reading  
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 Professor Andrew Hughes, Professor of Translational Medicine, AstraZeneca  
 Professor Stephen Hunt FMedSci, Professor of Molecular Neuroscience, UCL  
 Dr James Hunt, Laboratory Head, Novartis  
 Dr John Ioannou, Arc Clinician Scientist, Institute of Child Health, UCL  
 Dr Helen Ireland, Translational Research Planning Manager, UCL  
 Professor Susan Iversen CBE FMedSci, Emeritus Professor of Psychology and PVC Special Projects, University of Oxford  
 Professor Stephen Jackson FRS FMedSci Senior Group Leader & Head of CRUK Laboratories, The Gurdon Institute, University of Cambridge  
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 Dr Jason Johnson, BHF Research Fellow, Bristol Heart Institute, University of Bristol  
 Dr Nick Jones, Research Fellow, University of Oxford  
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 Dr Sarah Joseph, Senior Scientist in HIV Prevention, MRC Clinical Trials Unit  
 Ms Jane Juniper, R&D Science Policy Leader UK, AstraZeneca  
 Dr Mark Jurgens, Business Analyst, Roche Products Limited  
 Professor Andrey Karlyshey, Professor of Microbiology, Kingston University  
 Dr Xiayi Ke, Senior Lecturer in Genetic Epidemiology, Institute of Child Health, UCL  
 Dr Karen Kennedy, Head of Strategic Relations, Wellcome Trust Sanger Institute  
 Mr Philip Kong, Founder, D2 Derma Europe Ltd  
 Mr Yuri Kulikov, Clinical Research Fellow, University of Warwick  
 Professor Nicholas La Thangue FRSE FMedSci, Professor of Cancer Biology, University of Oxford  
 Dr Tracy Lane, Postdoctoral Researcher, University of Oxford  
 Dr Joanna Laurson, Career Development Fellow, MRC NIMR  
 Mrs Catherine Lavery, Senior Business Development Manager, Queen Mary Innovation Ltd  
 Dr Geoff Lawton Founder, INMedD  
 Dr Richard Lee, NIHR Clinical Lecturer, University of Bristol  
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 Dr Ines Pineda-Torra, Lecturer in Clinical Pharmacology, The Rayne Institute, UCL  
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 Dr Mark Robertson, R&D Science Policy Director, AstraZeneca  
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 Mr Emlyn Samuel, Policy Officer, Academic Careers, Academy of Medical Sciences  
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 Miss Shafaq Sikandar, PhD Student, UCL  
 Dr Nicole Silvester, Postdoctoral RA, Wales Heart Research Institute, Cardiff University  
 Professor Elizabeth Simpson OBE FMedSci, Emeritus Professor, Transplantation Biology, ICL  
 Professor Stephen Smith FMedSci, Chief Executive of IC Healthcare NHS Trust & Principal, ICL  
 Dr Alan Smith, Chief Scientific Officer, Genzyme  
 Dr David Smith, Postdoctoral Researcher, University of Oxford  
 Mr Laurie Smith, Medical Science Policy Manager, Academy of Medical Sciences  
 Dr Reecha Sofat, Clinical Research Fellow, UCL  
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 Dr John Somner, Clinical Advisor, NICE  
 Dr Latha Srinivasan, Senior Lecturer, ICL  
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 Miss Claire Storey, Academic Clinical Fellow, Newcastle University  
 Dr Colin Story, Project Team Manager, Technology Transfer Group, Isis Innovation Ltd  
 Mr Elia Stupka, Senior Lecturer, Bioinformatics, University College London Cancer Institute  
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 Professor Brian Sutton, Professor of Molecular Biophysics, KCL  
 Mr Daniel Swerdlow, MBPhD Student, UCL  
 Dr Sue Swift, Quality Assurance Officer, Institute of Child Health, UCL  
 Dr Aliko J Taylor, Epidemiology Director, Amgen  
 Dr Christina Thirlwell, Clinical Lecturer, University College London Cancer Institute  
 Dr Brian Thomson, Director of Research, University of Nottingham  
 Professor John Todd FRS FMedSci, Professor of Medical Genetics, University of Cambridge  
 Dr Claire Townsend, Research Fellow, Institute of Child Health, UCL  
 Professor Edward Tuddenham FMedSci Professor of Haemophilia, Royal Free Hospital  
 Dr Cynthia Ugochukwu, Clinical Research Manager, Oxford Biomedical Research Centre  
 Professor Patrick Vallance FMedSci, Senior Vice President, GSK  
 Mr Joshua Vecht, PhD Student, Imperial College London  
 Professor John Warner FMedSci, Professor and Head of Department of Paediatrics, ICL  
 Mr Colin Warriner, Policy Officer, British In Vitro Diagnostics Association  
 Dr Chris Watkins, Translation Theme Leader, Medical Research Council (MRC)  
 Dr Geoff Watts FMedSci, Freelance Science and Medical Journalist

Professor Peter Weissberg FMedSci, Medical Director, British Heart Foundation  
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Dr Pauline Williams, Head of Academic Discovery Performance Unit, GlaxoSmithKline (GSK)  
Professor Pat Wilson, Professor of Medicine, UCL  
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