

## Impact template (REF3a)

<b>Institution:</b> University of Cambridge
<b>Unit of Assessment:</b> 8
<p><b>a. Context</b></p> <p>The UoA has an exceptional track record in translating both basic and applied research into practical solutions that impact on human health, industry, society, the environment and the UK and global economy. Drug discovery and molecular biology are two key areas that have been impacted by our research during the census period. Collaborations, joint research projects, consultancy and training activities with industry have fostered economic growth and performance, and the UoA's enterprise activities and support for local SMEs have played an important role in the economic competitiveness and vibrancy of the Cambridge Phenomenon. Researchers from the UoA have a demonstrated track record in connecting public policy and services with evidence-based research.</p>
<p><b>b. Approach to impact</b></p> <p>The approach for encouraging impact at Cambridge, and in this UoA in particular, is characterised by strong support for technology transfer, industry engagement, public communication and influence on policy, combined with a generous IP policy.</p> <p><b><u>Commercial and Industrial Impact</u></b></p> <p>Staff are encouraged to make use of the University's vehicle for technology transfer <b>Cambridge Enterprise (CE)</b>, which delivers a range of technology transfer, consultancy and seed fund services. Chris Abell was instrumental in establishing CE in 2006, serving on the Board of Directors to 2011 and remaining active throughout in promoting technology transfer both within the UoA and across the University.</p> <p>Since 2008 three <b>new spin-out companies</b> were formed from research and technologies developed in the UoA. <b>Sphere Fluidics</b> (C. Abell and W. Huck, 2010), winner of the 2013 ACES pan-European award for academic spin-outs, exploits microdroplet technology developed from a Basic Technology Grant. <b>Cambridge EpiGenetix</b> (S. Balasubramanian, 2012) arose from world leading research into DNA sequencing. <b>Aqdot</b> (C. Abell, R. Coulston, O. Scherman, J. Zhang, 2013), winner of the RSC Emerging Technologies Competition 2013, is a novel encapsulation technology based on a Science publication. Between 2008 and 2013, <b>three companies</b> were started by PhD and postdoctoral researchers previously associated with the UoA: <b>Designer Bioscience</b>, <b>Epistemeo</b> and <b>Praxis Pharma Tech Ltd</b>. These add to our growing list of successful spin-out and parent companies that are continuing to commercialise our research: <b>Astex</b>, <b>Cambridge Display Technology</b>, <b>Illumina</b>, <b>Ionscope Ltd</b>, <b>S.Amit Speciality Chemicals Pvt. Ltd</b>, <b>Takeda</b>, and <b>iThemba Pharmaceuticals</b>.</p> <p>Academics in the UoA also make an impact with industry via participation on <b>company Scientific Advisory Boards (SABs)</b> and <b>Company Directorships</b>. Nine members of the UoA serve on the following SABs: Astex; Discuva Ltd; Lhasa UK; Illumina Inc; Biotechnol Inc; the Saudi Basic Industries Corporation (SABIC); Aqdot; International Flavors and Fragrances; Pfizer Pharmaceutical Sciences and Schlumberger. Four members of staff hold directorships: C. Abell, Sphere Fluidics; R. Glen, Lhasa UK and CCDC; S. Balasubramanian, Cambridge Epigenetix Ltd; and G. Bernardes, Domatoca Global Solutions SA.</p> <p>The UoA has 3 <b>Enterprise Champions</b> who provide CE with an essential communication channel to and from the UoA. Two of the UoA champions, David Klenerman and Stephen Elliott, have direct personal experience of licensing, creating spin-out companies and consultancy. The success of this approach is highlighted by the following figures for the period under assessment: CE worked with 27 members of staff in the UoA, resulting in 25 patent applications. A further 18 revenue-generating licenses were signed and 28 consultancy agreements were signed. These consultancy agreements covered the automotive, safety, diagnostics, oil and gas, health care, consumer goods, pharmaceutical and biotechnology industries. The numbers provided are a minimum estimate, as many staff perform consultancy work not mediated through CE.</p> <p>The UoA is distinguished by the success of our <b>Industry Sponsored Institutes and Centres</b>. The <b>Unilever Centre for Molecular Informatics</b> (1999 – present), a pioneering centre for chemical</p>

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informatics based in the Department of Chemistry, has secured repeated funding from Unilever. Since 2000, the UoA has been a partner in the **BP Institute for Multiphase Flow** based in Cambridge. The BPI focuses on fundamental problems in multiphase flow. Building on this successful collaboration, in 2013 we became one of 5 partners in the **BP International Centre For Advanced Materials**. A recent exciting development, reflecting the UoA's commitment to energy research, was the establishment in 2012 of the **Christian Doppler Laboratory for Sustainable SynGas Chemistry**, which involves the Austrian oil and gas company OMV. One of our impact case studies, '*Liquid Assisted Grinding*', arose from our collaboration with industry via the **Pfizer Institute for Pharmaceutical Materials**.

The UoA encourages **secondments** to and from industry. Key secondments from industry to the UoA have included: [text removed for publication]. Staff from the UoA have been on secondments to the following companies for **training or technology transfer** activities: BASF and Eli Lilly (Bender Group); BP and Castrol (Clarke Group); CEGX (Balasubramanian Group); DOW, Industrial Research Limited, ICR, Leo-Pharma, Mettler Toledo (Ley Group); Global Phasing (Nitschke Group); and Tripos and Unilever (Glen and Goodman Groups).

The UoA secured funding from the University Research Policy Committee in 2011-2013, to develop new strategic **interactions with industrial partners**, with a focus on long-term strategic partnerships. Key examples include showcasing events, workshops and symposia with: DOW Chemicals (2011); Unilever (2011); SABIC (2012 & 2013); Schlumberger Cambridge (2012); Sumitomo Chemical Corporation and Cambridge Display Technology (2013); and Umicore (2013). These interactions have led to a range of collaborations aimed at solving industry-focused challenges. The UoA has hosted a wealth of other topic specific workshops, training and lectures courses with industry, some under the auspices of the Department Corporate Associates Scheme.

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The UoA also provides an important support resource for industry and SMEs via the provision of **Analytical Services** including NMR (17 companies), mass spectrometry (19 companies), elemental analysis (8 companies) and X-Ray (8 companies) over the REF period.

**Impact on Society**

**Influencing Public Policy and Government.** The UoA strongly encourages its staff to play a leading role in advocating and influencing research policy. For example, Clare Grey is a member of the Emerging Technologies Panel of the **World Economic Forum**; John Pyle is one of 4 international chairs on the **WMO Scientific Assessment Panel**; and Steve Ley is a member of the **EPSRC Strategic Advisory Network**. The UoA's extensive work in the area of environmental change is covered by the '*WMO Scientific Assessment of Ozone*' impact case study. As a member of the **Greater Cambridge Growth Board**, Jeremy Sanders frequently meets government ministers, advocating support for infrastructure around research and development. Furthermore Julian Huppert, who completed a PhD in the Department of Chemistry, is the MP for Cambridge and one of the main advocates in parliament for pushing science and research up the government's agenda. The UoA also benefits from links to the **Centre for Science and Policy**, which helps the sciences and technology to serve society by promoting engagement between researchers and policy professionals.

**Public and Educational Outreach.** The UoA makes notable contributions in the area of outreach. The 2012 Royal Institution Christmas Lectures were delivered by Peter Wothers, recipient of the 2011 Royal Society of Chemistry President's Award for his outstanding contribution to public outreach, and the 2013 Nyholm Education Prize. The UoA is a regular partner and host for national chemical sciences educational activities including: the Salters Festival of Chemistry for year 7 & 8 students; the Salters Chemistry Camp for year 10 students; Headstart for year 12 students; and the Princes Teaching Institute Summer Schools for teachers. In 2009 the UoA hosted the International Chemistry Olympiad, the first time ever held in the UK; and in 2011, the UoA launched the Cambridge Chemistry Challenge, an innovative web-based competition for aspiring chemists of any age and a written exam for UK students in Year 12. The popular undergraduate

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textbook, *'Chemical structure and reactivity: an integrated approach'* was published by two members of the Chemistry Department, James Keeler and Peter Wothers, in 2008. The University of Cambridge runs the largest free science festival in the UK, attracting over 35,000 visitors per year. Chemistry is a major contributor to the science festival, supported by a generous donation from the Walters Kundert Charitable Trust.

**Communicating our Research.** The **University Office of External Affairs and Communications** and the **University Centre for Personal and Professional Development** provide support and media training to staff. Highlights and examples from each of the years under assessment of academics communicating the impact of their research include: David Spring radio interview on the BBC Material World about his research into bacteria (2008); Christopher Dobson's work with the Royal Society of Chemistry publicising how his research involving fruit flies has impacted on our understanding of Alzheimer's (2010); BBC coverage of Clare Grey's research into the reasons why lithium batteries in laptops and mobile phones may overheat and catch fire (2010); Jason Chin explaining his work in synthetic biology and reprogramming a key part of an animal's genetic code on the BBC News and World Service (2011); Neil Harris interview by Jonathan Leake from the Sunday Times for a story on global warming (2012); BBC coverage of Shankar Balasubramanian's research and the observation of quadruplex DNA in human cells (2013).

**Training for Impact**

The UoA and University have a number of mechanisms for fostering entrepreneurship, e.g. Cambridge Enterprise, the Centre for Entrepreneurial Learning and Judge Business School. There are also a number of student societies such as Cambridge University Entrepreneurs (CUE) and i-Teams Cambridge. A Chemistry PhD student, Jhing Zhang, who was president of CUE (2011-2012), went on to found Aqdot and won the Women's Entrepreneur Award at the 2013 Rice Business Plan Competition.

The UoA has also teamed up with Cambridge Enterprise to run the **EPSRC Industry Engagement Forum** aimed at encouraging early career researchers to think more broadly about potential societal and economic benefits arising from their research interests and to understand how they may increase collaborations with industry. Companies are invited to join PIs, PDRAs and PhD students for a one-day session, exploring how to align research interests with real commercial problems. The first of these workshops was held with BP in 2012 and the second in 2013 with Pfizer.

**Industry Supported Studentships** The department has trained 133 industry-sponsored PhD students since 2008. Avidin Biosciences (1), Astra Zeneca (15), AWE (7), BASF (1), Boc Edwards (1), Boehringer Ingelheim (2), BP (13), Dupont (1), Elan Pharma International Ltd (15), Eli Lilly (1), GlaxoSmithKline (17), Guidance Monitoring (1), Illumina (1), Ingenza Ltd (1), Janssen Pharmaceutica (1), Johnson Matthey (2), Kodak (1), Lhasa Limited (1), MedImmune (1), Merck Sharp & Dohme (1), Micromass (1), Microsoft (1), Novartis (1), Organon (1), Pfizer (17), Procter & Gamble (1), Reaxa (1), Sanofi-Aventis (2), Schering (1), Schlumberger (3), Shell (1), Syngenta (4), and Unilever (15).

**c. Strategy and plans**

The UoA will continue to support impact as described in section (b). The relocation of the Astra Zeneca global research and development centre and corporate headquarters to Cambridge is a major opportunity for the UoA to develop an integrated relationship with a major pharmaceutical company.

In 2012, the Department undertook a strategic review of our **Doctoral Training**, and via the EPSRC Centres for Doctoral Training, our Impact Acceleration Account, explained below, and the recent appointment of a Graduate Studies Co-ordinator, we will further strengthen transferable skills student training and engagement with users of our research. As part of our review of doctoral training, the following aspirations emerged: increased and integrated industrial engagement for the duration of the PhD training through activities such as industrial mentoring of students, industry placements, industry workshops and industry forums as described in section (b).

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The UoA is a major recipient of the EPSRC **Impact Acceleration Account (IAA)** to the University. The University of Cambridge has recruited an Impact Acceleration Co-ordinator who will work with the Knowledge Transfer and Research Facilitators across departments. The IAA will provide vital additional support for **impact training, industry secondments, student placements and follow-on funding** to help fund the early stages of commercialisation of technologies. The UoA is particularly keen to increase **secondments** to and from industry to the Department and is currently involved in a University project that is addressing best practice in secondments and exploring ways of providing additional support for secondments.

With IAA funding, in October 2013 the UoA will run the first of a series of **Roadmapping** workshops in collaboration with CE and the Institute for Manufacturing. This activity is targeted at research groups who are doing work which might have commercial potential but who have not yet clearly formulated the best way to maximise the impact of their work. These workshops involve early stage researchers and the group leaders.

During this assessment period, the UoA made two key appointments to support research and impact: a **Research Grants Advisor** (2009) to reduce the administrative burden on staff, allowing them to focus on research and delivering impact; and a **Research Facilitator** – Dr Isabelle de Wouters (2010) who has been crucial in developing our relationships with industry, our success in recent large grants, and in facilitating inter-institutional, multidisciplinary collaborations. From November 2013 a project officer with a focus on developing and implementing our communication strategy, a key area in delivering impact, will support these posts.

**d. Relationship to case studies**

The UoA has submitted 7 impact case studies, each of which has direct bearing on the UoA's approach to impact. A number of factors have contributed to the creation of these impacts, but broadly, the cases can be associated with the following activities:

- 1) **Significant Joint Projects with Industry and Embedded Laboratories:** The '*Liquid Assisted Grinding*' case study arose from our ongoing collaboration with Pfizer via the Pfizer Institute for Pharmaceutical Materials.
- 2) **Workshops and Collaborations with Industry:** The [text removed for publication] case study details how a series of workshops with [text removed for publication] in 2004 led to a research collaboration that had a direct impact on their [text removed for publication] business. The '*Chem4Word*' case study arose as a direct collaboration with Microsoft.
- 3) Three of the case studies involve spin-out companies created with the support of **Cambridge Enterprise**; these are Astex ('*Structure Guided and Fragment-Based Drug Discovery*'), Solexa ('*Sequencing Nucleic Acids: From Chemistry to Medicine*') and Reaxa ('*Enabling Methods for Cleaner Chemical Synthesis*').
- 4) **Influencing Public Policy and Government:** The '*WMO Scientific Assessment of Ozone*' case study demonstrates how research from this UoA has directly influenced legislation.