



BBSRC Strategic Training Partnerships: Adding Value to Postgraduate Training

**An opportunity for DTP and ICP Managers to
consider how best to train the next generation**

 **@BBSRC #BBSRCTrainingPartnerships**



© ThinkStock



BBSRC Training Partnership Forum 2015

Thistle Marble Arch Hotel, 54 Bryanston Street, London, W1H 7EH

Contents

- Welcome & Introduction	2
- Programme	4
- Background	8
- DTP Partners	10
- ICP Partners	70
- Speaker Biographies	105
- Delegate List	112
- Notes	115

Welcome & Introduction

Welcome to the BBSRC Training Partnership Forum 2015 – *BBSRC Strategic Training Partnerships: Adding Value to Postgraduate Training* – an event which brings together for the first time BBSRC’s key training partners from academia and industry to network and share good practice on delivering world-class doctoral training in partnership. Importantly, discussions at this meeting will inform the development of a new BBSRC Training Partnership Framework (TPF) which will serve as a guide to BBSRC and its community on how we will manage and monitor our training investments.

Developing the TPF is a crucial exercise for many reasons. In the context of uncertainty surrounding public sector budgets, it is more important than ever that BBSRC – as an investor in research and training on behalf of the UK public – sets a clear and transparent direction for how it will invest UK taxpayers’ money in the most responsible and productive way possible. It is imperative that our shared duty of care towards our students is highlighted and indeed nurtured. The TPF will provide a template for how we will monitor and capture the benefits realised from these investments, and help the BBSRC community understand what is required when applying for Training Grants.

The TPF cannot be shaped by BBSRC alone. BBSRC’s key training partners – with whom we have worked closely and successfully for many years – are crucial stakeholders in this process, and without your continued commitment to training world-class bioscientists in partnership, BBSRC would not meet its core objective to supply excellent, highly-skilled people to the UK economy. BBSRC therefore welcomes the valuable input of its training partners, drawing on their many years’ experience in delivering doctoral training.

This Forum will provide plenty of opportunity to engage with BBSRC and partners and we hope you agree that we have pulled together a stimulating programme. The event begins with a plenary session intended to set the scene for the discussions that lie ahead over the two days of this meeting. You will hear from myself (BBSRC Executive Director of Innovation and Skills) and Dr David Sweeney (Director of Research, Education and Knowledge Exchange at the Higher Education Funding Council for England) on the UK postgraduate training landscape and how the Research Councils and Higher Education Funding Councils work in partnership to deliver this in the dual-support system. You will also hear from Professor Jerry Roberts (University of Nottingham) and Professor Stuart Dunbar (Syngenta) for their perspective on leading successful Doctoral Training Partnership (DTP) and Industrial CASE Partnership (ICP) programmes, respectively, reflecting both the differing and aligned challenges and opportunities in academia and industry. Day One concludes with an

interactive networking session followed by a talk from BBSRC's Chief Executive, Professor Jackie Hunter, who will present a pre-dinner talk on *"Training Future Generations in Partnership: What Next?"*

On Day Two in the morning plenary you will hear from Dr Harry Kelly of GSK who will describe some new and innovative approaches being developed for doctoral training between GSK and the University of Strathclyde, followed by a presentation from Professor Gary Lye from University College London who will share his perspective of managing a successful EPSRC Centre for Doctoral Training (CDT) and the lessons learned from this.

The remainder of Day Two will be dedicated to developing the principles to underpin the TPF with essential delegate input. Together, in facilitated sessions, we will consider 'Good Practice in Training' – focussing on defining the key elements that enable the successful training of students as cohorts and as individuals – alongside 'Good Practice in Management and Governance', where we will establish the key determinants associated with managing and monitoring a Training Partnership.

Our attention will then turn to topics requested for discussion ahead of this forum by the DTPs and ICPs, namely 'Managing Student Placements' and 'Managing Intellectual Assets associated with BBSRC Training Partnerships'.

The Forum will conclude with a final plenary discussion led by BBSRC's Head of Skills and Careers, Dr David McAllister, who will summarise the key recommendations to emerge from these discussions and next steps.

On behalf of BBSRC I would like to take this opportunity to thank you for attending this important event and for all your contributions in informing the development of our new TPF.



A handwritten signature in black ink that reads "Celia Caulcott".

Dr Celia Caulcott, Executive Director, Innovation and Skills, BBSRC

BBSRC Training Partnership Forum 2015



Programme

Tuesday 24 February 2015

12:30 *Registration and Lunch*

14:00-16:00 Session One: Setting the Scene

[Chair: David McAllister, BBSRC]

In this opening plenary session, delegates will hear several talks that address the workshop themes and set out its objectives. This will include high-level strategic presentations on postgraduate training in the UK, and more focussed talks on the experiences of delivering DTP and ICP programmes from BBSRC and its training partners.

14:00	Welcome: Training in Partnership	[Celia Caulcott, BBSRC]
14:15	UK Postgraduate Training Landscape	[David Sweeney, HEFCE]
14:45	A DTP Perspective	[Jerry Roberts, University of Nottingham]
15:15	An ICP Perspective	[Stuart Dunbar, Syngenta]
15:45	Discussion	
16:00	<i>Tea / Coffee / Check in</i>	

17:00-19:00 Session Two: Models for DTP and ICP Postgraduate Training

This pre-dinner session is for DTP and ICP Programme Managers to pitch their respective training programmes using posters, laptops, handouts etc. This will enable delegates to network and share good practice in programme delivery.

17:00	Exhibition and Networking
18:30	BBSRC Chief Executive Jackie Hunter <i>"Training Future Generations in Partnership: What Next?"</i>

19:00 *DINNER*

Wednesday 25 February 2015

08:25-13:45 Session Three: Good Practice in Training Partnerships

[Chair: David McAllister, BBSRC]

This session will explore BBSRC's partnership model of postgraduate training and seek to understand the common core principles of good practice. It will deliver a series of recommendations for BBSRC to incorporate into a Training Partnership Framework.

08:30 Innovative Collaborative Training Models [Harry Kelly, GSK / Strathclyde]

09:00 Lessons from the EPSRC CDT Programme [Gary Lye, UCL]

9:30-11:30 Theme 1: Good Practice in Training

Structure

This session will begin with a plenary introduction from both chairs. Delegates will then be assigned to one of two groups which will be asked to consider either topics [A] or [B] below. Within each topic group, delegates will be further split into four smaller teams to discuss all questions posed for each topic. Following this, each team will spend 5 minutes on each question adding their main points to discussion boards in turn, thus building on the previous teams' contributions. All delegates will reconvene for a final plenary session aiming to seek a consensus view on how best to train students and their cohorts.

09:30-09:50 Plenary Introduction (both Chairs)

09:50-10:20 Discussion (2 separate rooms addressing A or B – split further into 4 teams)

10:20-10:30 Tea / Coffee available

10:30-11:00 Conclusions (each team shares its conclusions)

11:00-11:30 Plenary Summary (both groups reconvene and Chairs share findings)

[A] Training the Cohort *[Chair: Chris Thomas (University of Birmingham)]*

1. What cohorts are you building?
2. What benefits does a cohort-based approach bring?
3. What challenges does a cohort-based approach present?
4. What principles underpin successful cohort-building and support?

[B] Training the Individual *[Chair: Isolde Haeuser-Hahn (Bayer)]*

1. How do we deliver high quality cohort-based training that is tailored to individual requirements and balances the needs of all stakeholders (e.g. students, supervisors, organisations, the general public)?
2. How do we get the balance right: structured versus unstructured learning?
3. How do you ensure the high-quality supervision of students?
4. Core and professional skills training: what are we trying to achieve and how do we deliver it?

11:30-13:45 Theme 2: Good Practice in Management and Governance

12:15-13:00 Lunch

Structure

This will comprise two sessions aiming to seek a consensus view on how best to manage and capture the impact arising from a training partnership.

Delegates will begin by capturing the key elements that underpin the successful management of a training partnership [C]. Each table will consider a single question and then report their conclusions back to the rest of the audience in a plenary session.

After lunch, delegates will reconvene for a plenary discussion – based on the outputs from discussions [A], [B] and [C] – on how best to capture the impact of a Training Partnership and monitoring their progress [D].

[C] Managing a Training Partnership [Chair: Richard Borman (GSK)]

1. What management and administrative structures work best and why?
2. What are the key elements in ensuring that high-quality students, from the widest possible pool, are attracted and recruited into your programme?
3. How should BBSRC add value to your training partnership?
4. What are the most effective ways to communicate and share good practice with your partners and other stakeholders?
5. What impact can a training partnership have in the wider community, including other research organisations, industry, business, the public and society?

[D] Capturing the Impact of a Training Partnership [Chair: Alison Smith (University of Cambridge)]

Measuring the impact of BBSRC Training Partnerships is crucial to demonstrate the value of investing public money in doctoral training. To this end, BBSRC requires all its training partners to submit annual reports of progress; additionally, the new DTPs will undergo a mid-term review in 2018. In this session, delegates are first asked to consider:

1. What are the broad impacts of doctoral training? Who benefits and how?

BBSRC PhD programmes are expected to deliver various training elements in addition to the focussed student research project, including: structured core bioscience and professional skills training; mandatory placements; and cohort-based activities. Consider:

2. What is the impact of each component of the doctoral training programme? How successful have they been and how do we know this?

The session will conclude with a summary of the key points raised and seek input on how BBSRC can work with its Training Partners to capture the evidence necessary to demonstrate an array of impacts.

13:45-15:40 Session Four: Placements and Student IP

Prior to this meeting DTP and ICP leads were given the opportunity to input into the topics to be covered at this event. This session will focus on two of the most common issues in the feedback: placements and student IP.

13:45-14:35 [E] Managing Student Placements [Samantha Aspinall, University of Leeds]

Placements have become an integral part of BBSRC training programmes in the form of PIPS and CASE placements.

Structure

Delegates will gather for a plenary discussion on how best to manage their placement activities.

Questions to consider will include:

1. How do we manage expectations and gain buy-in from students, supervisors, employers, administrators etc.?
2. How do we ensure that placements are taking place and are appropriate?
3. How are placements structured and managed on a day-to-day basis?
4. How do you engage with and select appropriate hosts? What is the role of the student in this process?
5. What benefits are students experiencing as a result of going on a placement?

14:35-14:50 Coffee

14:50-15:40 [F] Managing Intellectual Assets associated with BBSRC Training Partnerships [Phil Clare, PraxisUnico]

The discussion will seek to establish the key principles of a successful contractual framework for a training programme, using as an example experience gained from Oxford's Systems Approaches to Biomedical Science CDT and other institutional models. The discussion will consider the tensions between the need for confidentiality and the need for openness, the need to create a strong culture of shared problem solving and challenges around the protection and ownership of intellectual property. We will consider the ways in which Training Partners discharge their obligations to look after the interests of their students, and what obligations students have in return. We will consider the variety of ways in which work can lead to impact – which are not always commercial or monetised.

**15:40-16:30 Session Five: Conclusions and Actions [Chair: David McAllister, BBSRC]**

This discussion will wrap-up the event with a summary of the recommendations and considerations for BBSRC on its strategy for studentships and its interactions with programme managers from the participating research organisations. It will also provide the opportunity for delegates to raise extra points.

What principles should guide the establishment, management and development of successful training partnerships?

16:30 CLOSE

Background



Introduction

Excellence in doctoral training is central to BBSRC's mission to supply the UK economy with highly-skilled people. Each year we invest £50M into a diverse portfolio of PhD studentships to build a cohort of doctoral students equipped with cutting-edge research expertise and with broader scientific and professional skills. Our approach to focus on strengthening user-relevant training by dedicating almost half of our studentship portfolio to collaborative CASE awards and by mandating that Doctoral Training Partnership (DTP) students undertake a three-month professional internship puts BBSRC in a unique position in the UK as the only funder of postgraduate research training to require all of its students to experience a placement.

A key feature of our research and training strategy is to forge strong partnerships with and between key Research Organisations in order to create a UK bioscience ecosystem that delivers research and training more effectively and efficiently. Our two principal mechanisms for doing this are DTPs and Industrial CASE Partnerships (ICPs).



There are currently 14 BBSRC DTPs¹, collectively supporting 220 four-year studentships p.a. for three intakes (from October 2012-14). Each DTP works to a Portfolio Agreement, which sets out how they will allocate studentships across BBSRC priority areas. From 2015 there will be 12 Partnerships, collectively training 250 four-year studentships p.a. for five intakes (from October 2015-19).



BBSRC's ICP² competition awards to industry a block allocation of four-year studentships covering several years' intake. The current competition is for a two-year allocation (starting October 2014) made to 10 strategic industrial partners having established track records in collaborative doctoral training with BBSRC. ICP is one of the main ways in which BBSRC funds collaborative training and enables companies to better integrate industrial CASE studentships into their planning.

Forum Objectives

This Forum will bring together BBSRC's key training partner organisations from academia and industry to discuss and inform BBSRC's strategic direction for postgraduate training and to share good practice in programme delivery.

More specifically, it will address why BBSRC uses training partnerships; what makes a successful training partnership; and how to monitor and evaluate the outputs. The Forum will explore the different cultures that exist in BBSRC's constituency, ranging from academia to industry, from large to small organisations, and across disciplines.

¹ <http://www.bbsrc.ac.uk/dtp>

² <http://www.bbsrc.ac.uk/icp>

Forum Outputs

This Forum will:

- Establish a Training Partnership Framework (TPF) for BBSRC Training Partnerships
- Identify core principles for successful Training Partnerships
- Increase BBSRC's understanding of the differing needs of its user communities and how to manage these
- Disseminate good practice and encourage networking between Training Partnership Managers and BBSRC
- Influence emerging BBSRC Strategy
- Highlight different models of training delivery

What is the Training Partnerships Framework (TPF) and why do we need it?

The TPF is in essence a good practice guide for our research community on how to most effectively manage BBSRC's training investments. It will build on the RCUK 'Statement of Expectations for Postgraduate Training'³ and BBSRC's 'Industrial Training Strategic Framework'⁴ to explain how we intend to assess, monitor and showcase the BBSRC community's world-class portfolio of research and training.

We will use this Forum to identify the common characteristics of a successful Training Partnership and from there build a set of principles which can be incorporated into the TPF. Once complete, this will be made available more widely to other Research Organisations – including those not currently associated with a BBSRC DTP or ICP.

BBSRC Industrial Training Strategic Framework

Our Industrial Training Strategic Framework describes what industrial training means to us and recognises the importance of working closely with industry in order to achieve impact. It defines the principles which underpin our current and future investment strategies, ensuring that support can be targeted effectively at all career levels.

Core principles:

- Industrial training should encourage and drive culture change in industry and academia through trained people
- Industrial training should complement other forms of training that we support
- Industrial training should recognise the value of interventions at all career stages
- Industrial training should be responsive to the needs of different-sized companies and industrial sectors, as well as to the needs of individuals at different career stages
- Industrial training should be delivered through multi-lateral partnerships with academia and industry
- Our approach to industrial training should recognise the importance of ensuring communication with key stakeholders for maximum dissemination
- The outcomes and impacts arising from industrial training should be captured in order to inform good practice

³ <http://www.rcuk.ac.uk/documents/skills/statementofexpectation-pdf/>

⁴ <http://www.bbsrc.ac.uk/web/FILES/Policies/industrial-training-strategic-framework.pdf>

South West Biosciences DTP

Lead contact: Prof Leo Brady [l.brady@bristol.ac.uk]

Operational contact: Dr Samantha Southern [samantha.southern@bristol.ac.uk]

Website & Social Media: www.bristol.ac.uk/swbio  @SWBio_DTP

Partner organisations (for DTPs): University of Bath, University of Bristol (lead), Cardiff University, University of Exeter, Rothamsted Research

Summary

The South West Biosciences Doctoral Training Partnership (SWBio DTP) comprises the Universities of Bristol (lead), Bath, Cardiff and Exeter, together with Rothamsted Research. This consortium presents a distinctive cadre of bioscience research staff, with established international, national and regional networks and widely recognised and complementary research excellence. Strong collaborations already exist between these institutions including the GW4 alliance and the South West Food Security and Land Research Alliance as well as a substantial number of other doctoral training partnerships and centres.

The primary aim of our partnership is to produce cohorts of highly motivated, excellently trained postgraduates in the BBSRC priority areas of Agriculture & Food Security (AFS) (38%) and World Class Underpinning Bioscience (WCUB) (62%) who will be poised to progress towards leadership positions in academia, industry and allied careers. Our intake across the consortium is approximately 23 students per year.

Expertise and facilities across the partnership allows us to deliver outstanding training in WCUB that ranges from single-molecule studies to cells and tissues to whole-organism and landscape-level studies. In addition, our AFS graduates receive training in next generation sequencing (NGS) approaches to crop breeding and crop protection, training in the niche skills of plant physiology and pathology combined with a thorough understanding of farm animal welfare, disease, agricultural sustainability and land use. The overarching training theme that connects AFS and WCUB is compulsory Exploiting New Ways of Working (ENWW) training, specifically in mathematical, theoretical and whole systems based approaches to problem solving in contemporary biosciences. SWBio DTP also provides training in unique sets of skills in strategically important and vulnerable areas for example, *in vivo* skills training for biosciences research.

Students are initially recruited to broad, interdisciplinary projects, with the opportunity to refine their PhD project through their first year. The first year of the programme offers core skills training and structured taught modules, including training in statistics, bioinformatics and the role of science in society. The taught units are based in a single location and hence enhancing cohort building. The structure of the first year provides a coherent and uniform training programme and an MRes exit route should this be required. This is complemented by two rotation projects in distinctly different disciplinary areas relevant to their project. To help achieve a well-balanced training programme beyond the taught component, cohort training is based around five parallel thematic areas, associated with specific workshops and seminars. This exposes the cohort of students to a broader range of research methods and subject areas, and encourages networking amongst the researchers. In addition, we provide ongoing transferable skills cohort training as it is of equal importance that our graduates are prepared to achieve and lead in a range of careers and not just numerate doctoral graduates equipped for state-of-the-art bioscience research.

Case study

A case study of a representative SWBio DTP student is Chris Wood. Chris came to Bristol after his first degree in molecular and cellular biology at the University of Glasgow. He had clear interests in protein design and synthetic biology. In his first year, in addition to our core skills training unit, Chris acquired considerable extra skills via our biophysics unit along with the compulsory statistics unit, and the distance-learning SysMIC course based at UCL. For his first year research project rotations, Chris initially joined Professor Dek Woolfson's laboratory (Chemistry) in which he learned how to design self-assembling peptide structures, and in the laboratory their synthesis, purification and characterisation. For his second lab rotation he moved to Professor Leo Brady's structural biology lab (Biochemistry) to learn the basics of protein crystallography. Using some of the peptides he synthesised in his first project, he was then able to go on to crystallise and determine their atomic structures, information that fed back neatly into the design process. These experiences helped him to further refine his ongoing doctoral studies in which he has (i) compiled an online tool for peptide design, and (ii) designed and made novel peptides that assemble to form discrete channels. Throughout this time he has also gained considerable coding experience. The success of his studies is reflected in his publications to date, including a first author paper in *Bioinformatics* (*Bioinformatics* 2014 30 (21): 3029-3035. DOI:10.1093/bioinformatics/btu502) and a co-authored paper in *Science* (*Science* 2014 Vol 346:485-488 DOI: 10.1126/science.1257452). Chris is currently in his third year of SWBio training and no doubt further publications will shortly follow. Chris has also undertaken a PIPS placement with the Centre for Public Engagement (Bristol) which involved developing an engagement activity for school pupils based on the research carried out within his laboratory.

Strategic Focus & Portfolio

The primary aim of our partnership is to produce cohorts of highly motivated, excellently trained postgraduates in the two BBSRC priority areas of Agriculture & Food Security (AFS) (38%) and World Class Underpinning Bioscience (WCUB) (62%). This deliberate focus on just two areas reflects regional strengths in these areas along with a decision to concentrate training specialisms to maximise synergy and cohort building benefits. The majority of our existing BBSRC research funding falls within these priority areas, and the AFS focus benefits from the inclusion of the RR North Wyke Farm (North Devon) within the geographical area of the consortium.

We aim to maintain and further develop our engagement with industrial partners by combining development of individual relationships between academic researchers and users, targeted institutional-industry alliances, and showcasing our existing students through the PIPS scheme and annual conferences. Each institution has an enterprise development office and well-developed strategies for industrial engagement. We have two current CASE partners as part of the DTP: Mylnefield Research Services Ltd and Horticultural Development Company. There are also developing training arrangements with FERA, the Chinese Agricultural University, and the Royal Government of Thailand.

We have built a PIPS portfolio of organisations via a number of different sources including existing CASE and KTP partners and other academic links, as well as graduate opportunities with some of the undergraduate placement providers at the partner institutions. In addition, we have been able to capitalise on the Bath Placement Programme which has been successfully running for more than 30 years. Our diverse PIPS portfolio is driven by the need for a broad range of relevant career experiences in order to offer students a wide choice of options. Example PIPS placements include Exonate Ltd (prioritisation in a drug development pipeline for analgesics), Arkive (science communications and media/education resources), Society of Biology (science policy and compilation of briefing notes), The Met Office (methods for predictive data analysis), University of Bristol Centre for Public Engagement (evaluating approaches for fostering relationships with local schools for science

engagement and also for Widening participation in Higher Education), and Marine Ecological Surveys (database design and implementation).

Unique Selling Point

“SWBio: focussed research rotations supported by taught units in year 1, maximising your research potential.”

The SWBio DTP differs from most other bioscience doctoral training schemes in providing a hybrid scheme that combines the best of traditional project-focussed studies with a supporting but focussed first year with directed rotation projects. Students are initially recruited to broad, cross-disciplinary project areas. They experience two research rotations in year 1 in distinctly different disciplinary areas relevant to their project. This allows students to incorporate the rotation projects within their thesis, hence circumventing the restriction of only three years to complete their thesis research which is typical of many rotation-based programmes. These projects also help students to refine their subsequent research studies within aspects of their project that match their interests. Students additionally complete a series of taught units in year 1 which, together with their assessed rotation projects, provide for an MRes exit route should this be required.

The overarching aims of the Training Programme are:

- To focus on two areas of considerable local strength: AFS and WCUB, areas relevant to industry and society that cater to a diverse set of career aspirations and identified skills gaps.
- To provide a unique project-focused rotation model in year 1 that maximises training while encouraging student input and refinement to their research focus, thus maximising time available for their thesis research.
- To offer a challenging, stimulating and rewarding student cohort experience through a structured, yet flexible research and training programme developed by leading academics.
- To give a formalised student career development and placement experience, maximising their recruitment opportunities by enhancing their professional and entrepreneurial skills.
- To provide training in persuasive communication and interpersonal skills, leading to effective knowledge exchange and public engagement.
- To promote an understanding of the DTP's remit to the widest possible audience so that the true value of the investment in the centre is realised.
- To give access for students to a wide range of local facilities, resources and expertise, including the unique training resources available in the North Wyke Farm Platform, Rothamsted.

Challenges

Challenges that we previously faced:

- (i) 3 independent laboratory rotations in year 1 combined with a 3 month PIPS limited available time to complete an in-depth doctoral project within a 4-year studentship.
- (ii) adoption of common training units has previously not been possible due to the differing timetables and requirements for accreditation across different institutions; additionally, units need to be appropriate for both AFS and WCUB areas;
- (iii) cross-institutional projects can be complicated by pragmatic issues such as accommodation, travel and needs for a student home base;
- (iv) cohort-building activity across institutions has proven extremely valuable and can be enhanced through shared academic links.

To overcome these challenges:

- (i) students initially are recruited to broad, cross-disciplinary project areas and experience two rotations in distinctly different disciplinary areas but both relevant to their project. This allows students to incorporate the rotation projects within their thesis, hence circumventing the restriction of only three years to complete their thesis research which is typical of rotation-based programmes or programmes delivering a Masters qualification at the end of year 1.
- (ii) we have introduced common teaching units in the first year, to be taught as a single cohort on one site. This has been made possible through the GW4 partnership which is establishing procedures for common recognition of taught units across the partner institutions.
- (iii) we have facilitated cross-institutional projects by coordinating planning at the outset followed by case-by-case analysis and management
- (iv) by introducing cross-institutional 'thematic' student groups with academic Theme Champions. This will introduce theme specific workshops and seminars to the cohort.

Cambridge-led DTP

Lead contact: Prof Alison Smith (PI, Chair of Management Committee) [as25@cam.ac.uk; 01223 333952]

Operational contact: Dr Lesley MacVinish (Programme Director, Chair of Executive Committee) [ljm1000@cam.ac.uk; 01223 334034]

Website & Social Media: <http://bbsrcdtp.lifesci.cam.ac.uk>

Partner organisations (for DTPs):

School of the Biological Sciences:

- Department of Biochemistry
- Department of Genetics
- Department of Pathology
- Department of Pharmacology
- Department of Physiology, Development and Neuroscience (PDN)
- Department of Plant Sciences
- Department of Psychology
- Department of Veterinary Medicine
- Department of Zoology

School of the Physical Sciences:

- Department of Applied Mathematics and Theoretical Physics (DAMTP)
- Department of Chemistry
- Department of Pure Mathematics and Mathematical Statistics (DPMMS)

Other University Departments:

- Department of Chemical Engineering and Biotechnology (CEB) in the School of Technology
- Institute of Metabolic Science - Metabolic Research Laboratories (IMS) in the School of Clinical Medicine

Partner Institutes:

- Animal Health Trust (AHT)
- Babraham Institute
- European Molecular Biology Laboratory – European Bioinformatics Institute (EBI)
- National Institute of Agricultural Botany (NIAB)
- Wellcome Trust Sanger Institute (Sanger)

Summary

Key Features of Cambridge BBSRC DTP2 Training Programme

- Tailored Personal Development Strategy for each student;
- Individual mentoring throughout programme by Theme Leader, with close monitoring of progress in 1st year;
- Compulsory courses in Statistics for Biologists and SysMIC in first six months;
- 2 compulsory rotation projects in first six months;
- Progress to PhD registration requires attaining training targets;
- 20 credits/year of research-specific & generic professional skills training;
- PIPS

Overview

Students are admitted to a four-year PhD programme within one of the four BBSRC strategic priority areas. The majority are recruited centrally to each theme, and they then choose their

PhD project from one of the projects linked to their rotation projects. There are also a smaller number of Targeted studentships, which are awarded to a specific project and/or partner based on a set of criteria, including matched funding. Each priority area is overseen by a Theme Leader, who takes responsibility for recruitment into the theme, and for oversight of the training of students. This is particularly in their first year whilst they are doing rotation projects and mathematical (New Ways of Working) courses, but mentoring will continue for the full 4 years, including advice on the PIPS, to ensure completion within 48 months of embarking on the DTP programme.

For the first 6 months of the course, students carry out two rotation projects, for which they prepare short reports. These are assessed by two people independent of the supervisor, and students must also demonstrate satisfactory completion of the Statistics for Biologists course, and Module 1 of SysMIC. Their progress is monitored by the Theme Leader, who reports directly to the Executive Committee if any student is failing to achieve at least a Satisfactory grade on any aspect. This information is also passed to the Degree Committee. As well as these formal requirements, each student has a Personal Development Strategy (PDS), established at the beginning of their first year in consultation with their Theme Leader, and supervisor(s). We use our established Log Book system for personal progress monitoring to record the transferable and research-specific skills training undertaken by each student, and the Executive Committee will monitor the PDS annually.

Students embark on their PhD project in April of their first year, and submit a more substantive formal First Year Report after 8-10 months, incorporating a literature review, all the relevant research work, evidence of completing their first year training targets and a timetable for completion of their PhD, including an estimate of when they will take their PIPS. Progress will be monitored by the Graduate Education Committee of the respective Department or Partner Institution. Students will need to continue to accumulate credits in skills training, and to carry out the PIPS, most likely in the second or third year. The Theme Leader will draw up brief annual reports on their students for the Executive Committee, which will be made available to the PhD supervisor and the appropriate Degree Committee. This monitoring will ensure that we are responsive to the needs of each student cohort.

Case Study

Student: Greg Mellers (entry in October 2012)

PIPS Placement Company: Oxford Scientific Film

Project: Carol Klein's Plant Odysseys

"The PIPS project was working as a researcher for a BBC2 programme, exploring the biological and botanical history of six iconic plants including the rose, the tulip and the water lily. I feel that the PIPS has helped me to manage my time more efficiently, which has been useful in my return to lab work. I also learnt the ability to rapidly find information from textbooks rather than papers, as are more often used as primary resources in my PhD. The conversations, by phone and email, with potential contributors and consultants were useful in honing my communication skills. I really enjoyed the placement overall. I got to step out of the science world for the first time since GCSE level education, and learn more about non-scientific topics. I enjoyed the research and writing aspects, which I have continued back in Cambridge with work on BlueSci magazine. The experience has shown me that I wish to move into some area of science communication or science journalism upon completion of my PhD."

Strategic Focus & Portfolio

The BBSRC – Cambridge Doctoral Training Partnership rests on the primary mission of all partners to contribute to society through the pursuit of learning and research at the highest levels of international excellence. The Partnership will take advantage of the Cambridge

Excellence in world-class bioscience with a focus on training in the three strategic priorities of the BBSRC namely Agriculture and Food Security; Industrial Biotechnology and Biotechnology and Bioscience for Health, and include a substantial element of New Ways of Working. We actively seek applications from students with non-biological backgrounds, who currently number about 15% of the cohort, and we encourage the students to interact with each other to provide peer-to-peer support in exchange of knowledge between disciplines.

The Cambridge partners are unanimously enthusiastic about the prospect of further developing our postgraduate student training through DTP2. We value in particular the opportunity to operate as a partnership. The great breadth and high quality in our research related to the BBSRC strategic priorities provides an excellent opportunity for us to train the next generation of scientists and, at the same time, to help the BBSRC deliver its strategic plan.

PIPS

We have established links with over 100 different employers covering a diverse range of organisations in the following sectors: charity, communication, consultancy, education, enterprise, investment/legal/intellectual property, multinational, museum, policy/governance, societies and technology. The list below is not exhaustive. Those who have already hosted a student for their PIPS are marked with an asterisk

Anthill Environmental Ltd

*Aquarius Equity

Babraham Biosciences Technology

Babraham Institute External Relations

BBC

BBSRC

Biodiversity Consultancy Ltd

BioFocus DPI

Cambridge University Museums Archaeology and Anthropology

Cambridge University Museums Earth Sciences

*DEFRA

GlaxoSmithKline (GSK)

Horizon Discovery Ltd

Illumina

Institute for Continuing Education

*Julian Huppert MP

Medimmune

National Trust

Nature Publishing Group

Oliver Wyman Management Consultants

*Oxford Scientific Films (BBC)

Parliamentary Office of Science and Technology

Pfizer Ltd (Pfizer Neusentis)

RCUK Strategy Unit

RSPB

Sanger Institute Science

Communications

*Science Magazine

Society for General Microbiology

Society of Biology

Syngenta UK Intellectual Property

Taylor Vinter (solicitors)

*The Costello Medical Consulting

The Natural History Museum

The Royal Society

The Science Museum

TReND Africa (Teaching and research in Neuroscience for Development in Africa)

Unilever Research & Development

Wildlife Trust

World Land Trust

Unique Selling Point

“Offers a world-class environment for research and scientific training, with tailored programme and support for each student”

The Cambridge DTP builds on the mission of the University of Cambridge, which is to contribute to society through the pursuit of education, learning, and research at the highest

international levels of excellence. Our Unique Selling Point is that as well as considerable strengths across the biosciences, the Cambridge DTP includes partners from the Physical Sciences and Engineering, Bioinformatics (EBI, Sanger Institute), and those with direct connections to stakeholders outside academia (NIAB, Animal Health Trust). These diverse but strategically-aligned partners are geographically close, providing students the opportunity of multidisciplinary training throughout their studies. Moreover, the learning environment values the individual, and provides tailored mentoring support over and above that of the project supervisor, in the form of Theme Leaders and the collegiate nature of the University.

Challenges

All partners in the DTP consider that it has provided considerable benefit to our postgraduate training programme, and indeed has galvanised partners to interact more with one another in other areas too. Nonetheless, we have had to deal with a number of challenges:

- Large number of PI's and departments to the number of students, particularly for the first DTP. Managing expectations of partner needs both in terms of reduced number of studentships overall, and in ensuring projects were within the BBSRC remit.
- PIPS funding – possibly not enough for quality placements/opportunities for broad and diverse PIPS in the variety of geographical locations offered.
- Need to categorise projects and students into strategic priority areas, when in reality there is considerable cross over
- 4 year submission including PIPS is a challenge. The students in reality have 33 months in which to complete their PhD project (48 months minus 6 months rotations and training minus 3 months PIPS). Data obtained from School of biology Office indicates that only 6.5% of current “standard” PhD students have submitted within 36 months. We have no data for 33 month submission. Students and supervisors are concerned about ability to complete a body of work suitable for PhD examination within this time.

EASTBIO DTP

Lead contact: Dr Irina Stancheva [istancheva@ed.ac.uk]

Operational contact: Francesca Filiachi

Website & Social Media: www.eastscotbiodtp.ac.uk  @EastbioDTP

Partner organisations (for DTPs): University of Edinburgh (lead), University of Dundee, University of Aberdeen, University of St Andrews

Summary

The **EASTBIO DTP** is a doctoral training partnership delivering innovative interdisciplinary training to postgraduate students from the four East of Scotland Universities (Edinburgh, Dundee, Aberdeen and St Andrews) and students undertaking collaborative research projects at EASTBIO-associated non-academic partner institutions: The James Hutton Institute and the Scotland's Rural College (SRUC). The EASTBIO DTP is supported by and draws on the experience of the Scottish Universities Life Science Alliance (SULSA), an organisation facilitating strategic pooling of resources in research, teaching and commercialisation between universities across Scotland. The EASTBIO DTP is overseen by a management committee, which consists of the Directors of the Graduate Schools from each of the partner universities, the Executive Director of SULSA and the Professional Internships for PhD Students (PIPS) coordinator. This overarching management structure enables sharing of best practice and of strategic decision-making on how to best integrate the structure and the training goals of the programme with the strengths of each individual institution in research and postgraduate training.

The EASTBIO partner universities have excellent research infrastructure and state-of-the art facilities, which enable the DTP to deliver a unique interdisciplinary training programme that exploits new ways of working and spans all four BBSRC priority areas: Food Security, Industrial Biotechnology and Bioenergy, Bioscience for Health and cutting-edge fundamental hypothesis-driven research. The EASTBIO DTP currently trains 109 students working on challenging research projects across the spectrum of biosciences: from molecules and cells to organisms and ecosystems.

The EASTBIO DTP strongly benefits from the expertise of its associate partner institutions in plant and animal bioscience and the support from SULSA. The interactions with industry facilitated by SULSA have enriched the broad range of internships, which the DTP offers to its PhD students in order to develop their professional skills and widen their future career choices.

Case Studies

Although the EASTBIO DTP is in its third year of existence, there are excellent examples of achievements by our students both in research and in professional training. We would like to highlight two examples:

Research: Hospital-acquired (nosocomial) infections are widespread in patients in intensive care units and pose major problem throughout the world. This is further complicated by the emergence of antibiotic-resistant pathogenic bacteria. In the UK, one in ten patients acquire a nosocomial infection, and treatment of these acquired infections costs the NHS > £1 billion per year. Because infection-causing bacteria attach to the surface of medical devices and grow to form antibiotic-resistant biofilm, there is a need to design new surface coating for medical devices so that they no longer bind bacteria. **Seshasailam Venkateswaran**, a third-

year EASTBIO DTP student working with a team of scientists from the Schools of Chemistry and Biological Sciences (University of Edinburgh), set out to tackle this problem by performing a large-scale, high-throughput search for materials that repel the attachment of pathogenic bacteria. The study identified several polymers that resist the adhesion of a broad range of microbes and have the potential to be used for non-toxic, antibiotic-free, bacteria-repellent coatings for medical devices. The use and implementation of such devices in hospitals will have a major economic impact and will save human lives. The original study was published in the *Journal of Materials Chemistry B* and highlighted by the BBC and the University of Edinburgh web sites.

PIPS: **Magali Pitt**, a third-year EASTBIO student working at the University of St Andrews, carried out her professional internship at the Society for Applied Studies, Centre for Health Research and Development, New Delhi, India. Magali was involved in a clinical trial on the effects of feeding regimes in promoting recovery in children with uncomplicated severe acute malnutrition. When reflecting on her internship at the end of the trip, Magali felt that it provided her with life-changing experience, determination and confidence in taking decisions on the direction of her future career.

Strategic Focus & Portfolio

The strategic focus of EASTBIO DTP is to deliver a postgraduate programme that:

- (i) provides exceptional interdisciplinary training and research experience to its PhD students;
- (ii) equips its doctoral graduates with the skills, experience and vision required to address the global challenges facing society in the 21 century;
- (iii) fosters independence, leadership and entrepreneurship

Associate Partners

- Scottish Universities Life Science Alliance (SULSA) – SULSA is a research pooling partnership between the Universities of Aberdeen, Dundee, Edinburgh, Glasgow, St Andrews and Strathclyde that is supported by the Scottish Funding Council. SULSA ensures that the Scottish bio research is globally competitive by pooling resources from the leading universities in the Life Sciences.
- Scotland's Rural College (SRUC) - SRUC is an independent institution delivering education and research in many areas of rural, environmental and land-based sciences including animal and veterinary research and crop, soil and farming systems.
- The James Hutton Institute (JHI) - The JHI is an international research centre operating from two main sites in Scotland at Dundee and Aberdeen. Researchers are engaged in work that is at the top of the global agenda and involves tackling some of the world's most challenging problems including the impact of climate change and threats to food and water security.

PIPS host organisations

The aspirations of EASTBIO PhD students are the main driver behind their choice of professional internship. We provide our students with excellent support in putting into practice their PIPS plans. In the past three years, EASTBIO has established relationships and developed internships with a variety of diverse host organisations including:

SMEs: I2eye Diagnostics; Novabiotics Ltd; Bioascent Ltd; UCB Pharma Celltech; Bio-Product 3DM (Holland); Harrison Goddard Foote LLP; NCIMB Ltd; Axis-Shield Diagnostic Ltd; Bigdna Ltd; UK Phenotypic Screening Centre (SULSA); European Screening Centre (Biocity); Thermo Fischer Scientific; Ockham Europe Ltd; Reinnervate Ltd; Fios Genomics.

Charities: Worldwide Cancer Research (AICR); The Brain Tumour Charity; International Potato Centre (Malawi); Global Vision International

Organisations involved in science education, policy and publishing: Scottish Government; Scottish Parliament; Scottish Universities Life Science Alliance (SULSA); BBSRC; The

Wildlife Information Centre; Society for Applied Studies; Centre for Research and Development (India); St Andrews University Print and Design Centre; Edinburgh University Ashworth Outreach Project; Eurostem Outreach Project; Cults Academy; National Museums Scotland; Edinburgh University Biomedical Teaching Organisation; University of Manchester Fly Facility Outreach Project; Development and Alumni Organisation (UoE); Broughton High School; EMBO Press; Royal Society Edinburgh; British Council; Elsevier Publishing

Unique Selling Point

“EASTBIO: an interdisciplinary bioscience graduate school”

EASTBIO represents a strong interdisciplinary partnership bringing together the top four Universities in Scotland for Life Sciences as reflected in the recent REF assessment, with Dundee and Edinburgh ranked as the top two university Biology departments in the UK, Aberdeen ranked top in Agriculture, Veterinary and Food Science and St. Andrews ranked second in the UK for impact of research in Biological Sciences. The DTP draws on the unique expertise of all partner institutions and delivers cutting edge training in world-class environments to the next generation of scientists. The programme has several unique key aspects:

- While providing strong foundation training in core quantitative and analytical bioscience skills, the programme also fosters students' creativity and independence by providing them with opportunities to have an input into the content of training through themed cohort meetings and taking responsibility for the organisation of the EASTBIO Annual Symposia. These events foster exchange of information and ideas across the EASTBIO community.
- The DTP promotes interdisciplinary research by organising training events that cover the entire breadth of BBSRC's priority areas and thus promotes the exposure of PhD students, postdoctoral researchers and senior scientists to disciplines as diverse as Chemical Biology, Biophysics, Molecular Biology, Behavioural Biology, Neuroscience, Structural Biology, Mathematical Modelling and Computational Biology.
- The DTP enables interactions and shared experience throughout the PhD between students from four universities undertaking research at more than fifteen departments and institutes.
- The DTP stimulates development of new collaborations in interdisciplinary research and training between the partner institutions by joint training events and strong encouragement of collaborative PhD project between different partner institutions.

A common training programme consisting of four separate, but integrated, training strands (Research skills, Core bioscience skills, Generic transferable skills and Professional skills) is delivered to all EASTBIO students equipping graduates with the necessary skills for the workplace.

Challenges

Facing (and partly overcome):

- Geographical spread: training of EASTBIO student cohorts generates substantial additional costs, which cannot be completely met by the available budget.
- Achieving unanimous support for training activities from PhD supervisors.

Overcome:

- Geographical spread: close interaction of the members of the management committee and administrative assistants ensured full commitment of all partners to the programme including provision of additional personnel and financial support.
- Unified recruitment process for EASTBIO students: we introduced themed interview panels involving representatives from all institutions. This ensures that the allocation

of studentships is based exclusively on the academic excellence of applicants and their matching to their preferred research project.

- Delivery of training through Blackboard collaborate: neither the students nor academics delivering thematic training sessions liked the eLearning platform as it did not stimulate interactive discussions. We are now delivering training through regular face-to-face meetings of student cohorts.
- Full integration of supervisors into the training programme: this was achieved successfully by introducing face-to-face thematic group meetings that include supervisors and students from different institutions. The integration of supervisors into the training programme shapes the identity of EASTBIO DTP and promotes collaborative research.

WestBio (Glasgow-led) DTP

Lead contact: Prof Jeremy Mottram

Operational contact: Prof Gwyn Gould

Website & Social Media:

<http://www.gla.ac.uk/colleges/mvls/graduateschool/bbsrcwestbiodtp/>

Partner organisations (for DTPs): University of Strathclyde

Summary

WestBio is the West of Scotland Bioscience Doctoral Training Partnership (DTP). WestBio formed its partnership in the West of Scotland, a key region for life sciences in the UK for academic excellence and industrial support and investment. WestBio's primary aim is to deliver high quality, collaborative training for our PhD students in the strategically significant areas required to feed and grow UK bioscience. This partnership is viewed as a way to establish enhanced training opportunities for our students, whilst building collaboration and research capacity in key domains across the universities of the West of Scotland.

WestBio is a partnership between the University of Glasgow and the University of Strathclyde, with links to the Pirbright Institute and the Moredun Research Institute.

Students carry out two Mini-Projects (lab/rotations) over the first six months and attend Skills Training throughout their studentship. The mini-projects are chosen from a menu of projects in the themed areas (Agriculture and Food Security; Industrial Biotechnology and Bioenergy; Bioscience for Health; and World Class Underpinning Bioscience) and form part of the early stages of specialised skills training for the cohort.

WestBio also has a bespoke research skills programme which encapsulates subject-specific skills training which is tailored to enhance the student's knowledge-base in a given theme (e.g. Agriculture and Food Security) and the second is to provide formal, structured training in areas specific to the student. This involves monthly tutorial/seminar sessions which are held in themed areas. *All students*, regardless of year, in the four themes have to attend monthly activities which aim to both increase awareness of the general subject area and to foster interactions amongst the students in each theme. These activities vary, but are for example, a seminar, a paper-analysis session, analysis of a grant proposal etc. The areas and content has been devised by dedicated theme leaders.

Examples of the structured training that we have in place are imaging courses, introduction to Omics, MATLAB sessions. Cohort days throughout the year have also been implemented by where all students from all themes come together to engage with one another. Internal and external guest speakers are involved in these events.

WestBio student, Graeme Sneddon demonstrated the importance of growing communications skills through his PIPS placement at Rothamsted Research. Below is his PIPS case study.

Case study

When it came to finding a PIPS placement **Graeme Sneddon** knew exactly where he would like to work and that was at Rothamsted Research, a world renowned agricultural research institute based in Harpenden, Hertfordshire. He had worked there before as a summer research student and wished to build on this valuable experience.

To fit in with aims of the PIPS placement scheme, Graeme joined the Communications Group under the supervision of Adelia De Paula, the Science Communicator. Here he was given the task of developing resources for public engagement for, both, the 200th Anniversary of the birth of Sir John Bennet Lawes and current research being undertaken at Rothamsted. The results are impressive.

To bring the legacy of Lawes into a format which appealed to modern audiences, Graeme developed an interactive timeline celebrating Lawes' life using the open-source tool 'Timeline JS'. The end product is very user-friendly and includes photographs, YouTube videos and Tweets.

To showcase some of the research being undertaken at Rothamsted Research, Graeme researched modern methods of public engagement which encouraged two-way interactive participation between researchers and members of the public and involved the public in issues surrounding the societal impact of scientific research. He was particularly inspired by the DEMOCS (**DE**liberative Meeting **O**f **C**itizen**S**) format which is a 'conversation card' activity developed to promote discussion of controversial topics in science. Each DEMOCS kit is written on a specific topic and, since there are no right or wrong answers, players are free to discuss the issues and express their own opinions without having any prior knowledge of the topic. Through this Graeme brought his research to life by facilitating games on Bioenergy at the John Innes Centre and the Big-Bang Fair 2014 where he also publicised the game through social media, particularly Twitter.

The next step was for Graeme to develop his own DEMOCS game. He chose the theme of 'waste' which incorporated four key policies – Reducing Waste/Optimising Resource Use, Reusing Waste, Recycling Waste and Reinventing Human Lifestyle. The game was trialled with the Eco-Schools Club at a local school with 30 children in Years 8-12 taking part. The format proved popular with the pupils and now Rothamsted intend to use the resource as part of their programme of activities.

The time spend at Rothamsted has given Graeme an important understanding of the various methods and current trends in science communication as well as developing his communication and public engagement skills, which will be of value during his PhD and in the future. His internship supervisor, Adelia commented that *"he brought enthusiasm and valuable experience in the use of social media and other digital tools. Our team has benefited as a result"*.

Strategic Focus & Portfolio

The great strength of WestBio is that it brings together biologists, veterinary scientists, medical scientists, engineers, mathematicians, chemists, computing scientists and bioinformaticians to address complex and strategically important biological problems. In new ways of working students are able to utilise the combined excellence in image analysis with engineering; bio-nanoscience, a grouping of engineers and cell biologists seeking novel means to engineer and grow stem cells; strong bioinformatic and computational approaches to analysing large datasets in areas such as modelling the dynamics of antigenic variation and mutation using genetic sequence data, and in examining population dynamics in an aquaculture context; and hierarchical modelling of levels of organization from individual genotype to ecosystem.

Notable changes recently include further strengthening of our links with the Pirbright Institute and the Moredun Research Institute, with the specific intention of enhancing our research base and increasing our skills training in the area of Agriculture and Food Security. WestBio has been further strengthened by significant recent investment and planned future activities by each of the partners. For example, at the University of Glasgow, the investment of £40m

into the Centre for Virus Research, £4m into SCENE providing fresh water aquaria and laboratories at Loch Lomond, £4m into Glasgow Polyomics and a further £15m into a Stratified Medicine Innovation Centre that will underpin new ways of working (analysis of large data). A £10m investment lead by the University of Strathclyde will develop an Industrial Biotechnology Innovation Centre focussing on biocatalysis, biotransformations and cell factory construction. A £250m investment at the Pirbright Institute includes the provision of unique high containment laboratories and animal facilities for work on exotic and zoonotic viruses. The Moredun Research Institute's animal facilities offer unique provision for the study of endemic and zoonotic infectious diseases, encompassing a range of containment facilities for livestock.

Examples of PIPS host organisations include:

Glasgow Science Centre, UK
 Pasteur Institute, France
 Powerhouse Museum, Australia
 Rothamsted Research, UK

Unique Selling Point

“To produce postgraduates confident in their research ability, secure in their knowledge base, clear about the ethical and integrity issues surrounding their work, equipped with an array of transferable skills, and a willingness to embrace new skills and function outside their comfort zone.”

Challenges

The key challenge faced for WestBio results from the failure to secure funding from BBSRC for the DTP in 2015-2020. The last intake of WestBio students enrolled in October 2014 and the current students will miss out on the interactions with future cohorts of BBSRC-funded students. The key challenge is maintaining a productive WestBio partnership going forward.

Imperial-led DTP

Lead contacts: Martin Buck [m.buck@imperial.ac.uk]; Kleoniki Gounaris [k.gounaris@imperial.ac.uk]; Vincent Jansen [vincent.jansen@rhul.ac.uk]

Operational contact: James Ferguson [james.ferguson@imperial.ac.uk]

Website & Social Media: <http://www3.imperial.ac.uk/bbsrcdoctoraltrainingpartnership>

Partner organisations (for DTPs): Royal Holloway University of London

Summary

Our Doctoral Training Programme is a cross Imperial College (ICL) activity and, with partners at Royal Holloway University of London (RHUL) we seek to train students in new ways of working as defined by the BBSRC intent in this area. Both institutions are research intensive universities. ICL is ranked very highly (see 2014 REF outcome) and our partner department at RHUL, the School of Biological Sciences, is similarly well ranked.

The mission statement for our Doctoral Training Partnership mirrors those of the constituent colleges in aspiring to conduct research, education and scholarship at the highest international level in an intellectually challenging and inspiring environment, and to further scientific understanding and knowledge to the benefit of society by maximising its impact. The key strengths of our partnership lie in the breadth of our expertise and inter-disciplinarity. The intensity of research at RHUL on food security and aspects of biotechnology complements activities at ICL, and further allows students to be co-supervised across both institutions to tackle, for example, problems in animal and plant health and welfare which relate to biosecurity, or those which need biotechnological innovation in relation to bioenergy and synthetic biology, or a structural biology input into a key area of a plant pathogen's physiology.

We offer an intensive training programme. We recruit top undergraduate students into a 4-year programme in which they benefit from a relevant Masters year prior to a specific 3-year PhD project. During the MRes year, students will be trained in both distinct specific research skills via rotation projects, and generic professional skills provided by the Graduate School, the latter developed in response to feedback from students and staff and taking into account the changing needs of employers. Although intensive in terms of time and effort, this year is essential in order to fully prepare students for their 3-year PhD programme. During this 3-year period research students work in a PhD project area to which two supervisors with distinct skills sets contribute. In so doing, the students experience 'two ways of thinking' as well as 'two sets of skills in one' working on the project. We anticipate that students so trained will be much better placed in both industry and academia to see novel ways through research problems, by not being restricted to a single discipline in either their own research working, or in being unable to establish fruitful wider collaborations with scientists in other areas. Single skill sets are currently most usually held by one PI, and can often limit the rate at which a problem can be progressed and the depth at which it can be addressed. Increasingly, an applied knowledge and awareness of maths, statistics, biophysical processes and techniques is needed by life scientists in order to make appropriate step changes in the knowledge of how a system functions at any level. Gaining mechanistic insights into how systems behave at all levels is important in obtaining outcomes of both short term and long term practical value. Seen against a background of obtaining quantitative skills, we regard our Doctoral Training Programme as being fit for strengthening young scientists in being able to work in areas in which predictive outcomes help to frame experiments, and so meaningfully tackle the inferences that arise.

Case study - Mr Robert Glyde, a Biology graduate now taking a Biophysical route.
Project Title: Molecular mechanism of transcription regulation via AAA ATPase.
Area of alignment: World Class Underpinning Biosciences
Supervisor 1: Xiaodong Zhang, Section of Structural Biology, Department of Medicine, ICL.
Supervisor 1 skills set: Physical techniques including X-ray crystallography, electron microscopy, small angle X-ray scattering
Supervisor 2: Martin Buck, Department of Life Sciences ICL..
Supervisor 2 skills set: Bacterial Physiology, Molecular microbiology, Biochemistry of protein-nucleic acid interactions.
Project summary: Multisubunit RNA polymerases (RNAP) are the central enzymes for accessing genetic information. They are structurally and functionally conserved between Bacteria, Archaea and Eucarya. The student will build upon these promising preliminary results and provide entirely new high resolution structural information. Importantly, the student will perform biochemical and functional assays in vitro and in vivo, critical to testing mechanistic insights derived from structural information.

Achievement

The student took the MRes in Structural Biology taking rotations with Xiaodong Zhang (EM and Crystallography) and Robert Wienzierl (molecular dynamics simulations of RNAP structural dynamics) [10/2013-9/2014], and continued to work on the Xtal structure of the RNA polymerase for his PhD project [10/2014-10./2017].
 The enzyme structure is a “first” and at 3.8Å greatly illuminates a gene regulation mechanism. A manuscript is being prepared for submission to Science. Robert is finalising some biochemical data sets to support the novelty of the structure, so linking his work as a structural biologist to the biochemical activity of the molecule.

Strategic Focus & Portfolio

Examples of Industrial CASE partners:

Imperial has Industrial CASE awards with Biopharma Technology Ltd, Procter & Gamble, Fujifilm Diosynth Biotechnologies, Nestec York Ltd, Pfiser, TMO Renewables Ltd, AstraZeneca, Novartis, Perkin Elmer, Illumina Cambridge Ltd and Eli Lilly. RHUL has Industrial CASE awards with GSK, Syngenta, Boehringer, RHS Wisley, Symbio Ltd, Protexin Ltd, BerryGardens Growers Ltd, East Malling Research and Winchester Growers Ltd. In addition, RHUL received one of the first-round of Agri-Tech Catalyst awards with Germaines Seeds Ltd, who are interested in engaging on future projects. Other current industrial partners of RHUL who would be interested in supporting studentships include the England and Wales Cricket Board, Transport Research Laboratories, Nestle Health Science, Green Fuels Ltd and the Neutral Group.

Examples of PIPS host organisations (current and proposed):

Asthma UK, Chromatrap (part of Porvair), editorial offices of learned societies (Royal Society, Society of Immunology, Biochemical Society), BerryGardens, CABI, Rothamsted Research, Joint Nature Conservation Committee (JNCC), Cox Green School (Maidenhead), Aqua Enviro, VLA, Public Health England, Bumblebee Conservation Trust, Syngenta, Jacobs Ltd, Holloway Immunology, Wellcome Trust offices, SporeGen, Novozymes (Denmark).

Unique Selling Point

“Cross disciplinary working in the life sciences to tackle global challenges.”

We select PhD projects able to clearly offer major scope for the student to experience two differing skills sets (see an exemplar CASE above), and we carefully ensure the two

supervisors offer distinctive contributions to the development of the project. We draw across expertise from across all of ICL and, with RHUL, have a very strong core Life Sciences grouping working outside the remits of the MRC and medical charities to help deliver to the BBSRC the portfolio's mix of training in strategic science. Our established prior BBSRC support in Centres for Structural Biology and Systems Biology and recently Synthetic Biology greatly facilitates our modern working practices, having established in the life sciences community at ICL and RHUL much infrastructure, appointments and depths of expertise in the quantitative life sciences.

Challenges

Our major challenge is to align our studentship PhD project portfolio to the strategic intent of the BBSRC, and to ensure projects truly engage the student with at least two distinctive skill sets that reflect most often two disciplines.

Five examples of such projects are given below to illustrate the intent of training the student across disciplines and or with exposure to complementary and distinctive skills sets. These examples also illustrate that our program is cross institutional

Example 1

Project Title: Structural Basis of Calvin Cycle Regulation

Area of alignment: Bioenergy and Industrial Biotechnology

Supervisor 1: Dr. James W. Murray, Department of Life Sciences, ICL

Skills set: Photosynthesis, Structural Biology, Molecular Biology, Biochemistry

Supervisor 2: Dr. Ian Gould, Department of Chemistry, ICL

Skills set: Physical Chemistry, Molecular Dynamics, Force Field Development

Project summary: The Calvin cycle is the metabolic pathway for carbon fixation in plants, algae and cyanobacteria. A key mechanism of Calvin cycle regulation is via the redox state. In the light, photosystem I produces reduced ferredoxin. In the dark, the cytoplasm becomes oxidising in potential. The intrinsically disordered protein CP12 has two conserved disulfide residues. On oxidation, these form disulfide bonds, which increases the order of the protein. CP12 is then competent to form a complex with two Calvin cycle enzymes, glyceraldehyde phosphate dehydrogenase (GAPDH) and phosphoribulokinase (PRK). In GAPDH:CP12:PRK complex the two enzymes are inactive, which inhibits flux through the Calvin cycle. On reduction, either by chemical reductants in vitro, or the effect of light in vivo, the complex dissociates, and releases active GAPDH and PRK. The GAPDH:CP12:PRK complex is a key regulatory mechanism of the Calvin cycle, present in almost all known oxygenic phototrophs. The student will solve the structure of the cyanobacterial GAPDH:CP12:PRK complex by X-ray crystallography and/or electron microscopy. The student will use molecular dynamics simulation to model the formation of the complex and conformational flexibility of CP12. With these techniques, a mechanistic picture of CP12 and its partners will be produced.

Example 2

Project Title: Biophysical genetics of worm social behaviour

Area of alignment: World Class Underpinning Biosciences

Supervisor 1: Dr. André Brown, MRC Clinical Sciences Centre, ICL

Skills set: High-throughput imaging, behavioural genetics

Supervisor 2: Dr. Robert Endres, Department of Life Sciences, ICL

Skills set: Statistical physics, decision making and information processing

Project summary: This interdisciplinary project combines high-throughput imaging of hundreds of genetic worm strains with behavioural analysis of aggregation. The student will learn skills in producing and handling large data sets, as well as their computational analysis and modelling. Many behavioural traits are heritable, but identifying the associated genes remains challenging. With the rapid development of genome sequencing technology, the bottleneck is no longer knowledge of gene variants, but an insufficient description of their

impact on phenotype. Social aggregation behaviour in the nematode worm *C. elegans* has led to significant insights into conserved molecular mechanisms regulating complex behaviour including the roles of neuropeptides¹, pheromones², and oxygen sensation³. However, there is no understanding of the dynamics of aggregation nor sophisticated quantitative measures of the behaviour. We therefore propose to:

- 1) Track aggregating worms to understand their dynamics and develop physics-inspired models of the underlying behavioural mechanisms.
- 2) Use high-throughput imaging of hundreds of worm strains to determine precisely how genome variation affects the quantitative phenotype derived in 1).

This will enable a finer mapping between genes and behaviour than has been possible in any other system and lead to a better understanding of the dynamics and genetics of a model social behaviour. The recombinant inbred worm lines have recently become available and the high-throughput imaging system will be in place by the end of 2013, making this project both timely and feasible in three years.

Example 3

Project Title: Modelling energy homeostasis to treat obesity

Area of alignment: Basic BioScience Underpinning Health

Supervisor 1: Nick Jones, Department of Mathematics, ICL

Skills set: Multivariate time series analysis, mathematical models, inference, and topics in bioenergetics and mitochondrial function.

Supervisor 2: Kevin Murphy, Department of Medicine, ICL

Skills set: In vivo skills, use of the CLAMS, expertise in appetite regulation and obesity.

Project summary: Obesity is a major public health issue. Energy homeostasis is, however, a complex process that can only be studied *in vivo*. This project aims to model mathematically rodent energy homeostasis. Not only will this have bearing on basic physiological understanding but this will help identify effective anti-obesity drugs, is part of a programme to reduce use of lab animals and is rich data that can allow the development of refined models. The project will use the Comprehensive Laboratory Animals Monitoring System (CLAMS) to generate multichannel physiological data. The student will administer appetite regulating agents to rats and will then use the CLAMS to monitor parameters *simultaneously* including food intake, oxygen consumption, behaviour, blood pressure and body temperature: having such high frequency simultaneously recorded data on systems that can be perturbed is very rare and allows heavily data-driven model development. As well as considering conventional ODE/SDE models the student will begin by using linear and nonlinear latent variable regression methods: these will help detect statistical associations taking time-dependent modulations of parameters into account. Such multivariate models allow for simultaneous detection of patterns of co-regulated elements while simultaneously controlling false positive rates to ensure robust predictions. Further in vivo studies will be used to test the model once it is established.

Example 4

Project Title: Structure/function studies of bacterial type III secretion system translocon

Area of alignment: Food Security

Supervisor 1: Prof. Gad Frankel, Department of Life Sciences, ICL

Skills set: Uses molecular and cell biology of infection, protein interaction, bacterial secretion system and animal models to study pathogen host interaction

Supervisor 2: Prof. Xiaodong Zhang, Department of Medicine, ICL

Skills set: Utilizes a combination of electron microscopy and x-ray crystallography techniques to study macromolecular assemblies

Project summary: Enterohemorrhagic *E. coli* (EHEC) and *Salmonella enterica* are important zoonotic pathogens that cause significant morbidity. Cattle are the main reservoir of EHEC, the elimination of which from the food chain is a long-standing aim of the BBSRC. Although employing diverse infection strategies, these pathogens use a type III secretion system

(T3SS) to inject bacterial proteins, known as effectors, into mammalian cells where they subvert cell-signaling pathways for their own benefit. As the T3SS is conserved amongst many Gram-negative pathogens it is an attractive target for development of novel anti-infectious compounds. The translocon, which enables the effectors to cross the plasma membrane of the host cell, is a key component of the T3SS. However, although discovered almost 30 years ago, the translocon has not yet been visualized (and for that reason analyzed). Recently, we obtained preliminary images of the elusive translocon, the characterization of which is the focus of this PhD studentship. We will combine molecular biology (generating bacterial mutants and site directed mutations in the translocon genes), cell biology (to follow protein translocation), biochemistry (to study protein:protein interaction), animal models (to study the function of the translocon in vivo) and structural biology (crystallography and tomography) to comprehensively study this essential virulence factor.

Example 5

Project Title: Urban bees: why are cities good for our most important pollinator?

Area of alignment: Food Security

Supervisor 1: Elli Leadbeater (RHUL)

Skills set: social insect foraging behaviour; honeybee communication. Decoding honeybee dance language.

Supervisor 2: Richard Gill (ICL)

Skills set: *Environmental factors affecting the ecology of bees* and its application to conservation

Project summary: Bee pollination is enormously important to worldwide food production, and widely-reported threats to bee welfare have attracted global concern. Yet, reports suggest that bees are faring surprisingly well in an environment that would seem barren: the urban sprawl. Urban beekeeping is on the rise, and there is growing evidence that floral oases in cities can support astounding pollinator diversity. But although this might provide insight into conservation strategies, we currently understand little about why urban populations appear to thrive while their rural counterparts decline. Threats to UK bees are threefold: a lack of diverse forage, widespread pesticide use, and declining colony health. These stressors most likely differ substantially between urban and rural environments, creating a natural experiment to assess their importance for colony fitness. We will directly compare colonies placed in multiple urban and rural habitats, to assay (a) foraging distances, by interpreting the unique waggle dance by which honeybees recruit nestmates to food (b) forage diversity and pesticide exposure, by examining the pollen collected by foragers (c) parasite loads. By relating our findings to quantitative differences in colony growth and survival, our results will inform management strategies that aim to reverse the decline of our most economically valuable pollinators.

Norwich Biosciences (JIC-led) DTP

Lead contact: Prof Mike Merrick (Director of the Norwich Biosciences Doctoral Training Partnership) [01603 450749; mike.merrick@jic.ac.uk]

Operational contact: Dr Kate Conway (Manager of the Norwich Biosciences Doctoral Training Partnership) [01603 450769; kate.conway@nbi.ac.uk; graduates.nrp@nbi.ac.uk]

Website & Social Media: <http://biodtp.norwichresearchpark.ac.uk>

Partner organisations (for DTPs): <http://biodtp.norwichresearchpark.ac.uk/the-partners>

The John Innes Centre
The University of East Anglia
The Institute of Food Research
The Sainsbury Laboratory
The Genome Analysis Centre

Summary

Consortium

The BBSRC Norwich Biosciences DTP on the Norwich Research Park (NRP) brings together the resources of five world-class research institutions on a single site. As a consequence, DTP students have the opportunity, within a single-site programme, to pursue multidisciplinary research from atomic level structural studies, molecular and cell biology, *in vivo* research, computational and systems biology, to large scale crop field trials. Our DTP partners are the John Innes Centre (JIC), the University of East Anglia (UEA), The Sainsbury Laboratory (TSL), The Institute of Food Research (IFR) and The Genome Analysis Centre (TGAC). Our Associate Partners are: Plant Biotech Ltd (PBL), The Science, Art and Writing (SAW) Trust and the Norfolk and Norwich University Hospital (NNUH). This partnership allows us to offer a breadth and concentration of biosciences research training that addresses all four BBSRC priority research areas.

Organisation background

JIC and TSL are world leaders in Plant and Microbial Science and plant-microbe interactions, respectively. In REF 2014 UEA as a whole was ranked 10th in the UK for the quality of its research output and 21st overall amongst all mainstream British institutions. IFR has a specific focus on the fundamental science of food and health and its leading position will be consolidated with the establishment of the new Centre for Food and Health. This Centre (opening in 2017) is a collaboration between BBSRC, IFR, UEA and the NNUH. TGAC is a growing hub for innovative bioinformatics and the application of state-of-the-art genomics and bioinformatics to advance plant, animal and microbial research.

Strategic and operational aspects of training programme

The breadth and depth of the research within our partnership provides a critical mass of active biosciences researchers to deliver excellent training in all four of the BBSRC priority areas as well as in key niche skills and vulnerable areas. Our PhD students progress to a diverse range of careers and the Norwich Biosciences DTP training programme is tailored to equip students for careers requiring high-level skills both within and beyond academia. We offer a balance of mandatory core modules and optional courses from which students develop their individual training pathway, incorporating transferable and advanced research skills. A key part of the training programme is that it continues across the full 4 years of the PhD. This allows for responsive training throughout the PhD according to need.

Summary of training programme and delivery:

We provide our DTP students with an integrated programme that delivers training in *Professional and Transferable Skills* and *Discipline-specific and Advanced Research Skills*. This is delivered throughout the 4 years as follows:

- *Research Environment*: PhD supervisory teams and research colleagues provide a major input into the Research, Professional and Advanced Skills training of DTP students. The supervisor and supervisory team are responsible for oversight and delivery of the extensive training that takes place within the research environment. Transferable skills and discipline-specific advanced research skills are delivered and refined in this environment. A key output of the PhD for the student is publication and dissemination of their research.
- *Professional and Transferable Skills Training*: is delivered by dedicated Training teams across the NRP. This Personal and Professional Development (PPD) programme allows students to tailor their training in both Transferable and Advanced Research Skills. PPD comprises: (i) mandatory modules that offer a strong temporal framework for progression over years 1-4 and covers core skills essential for developing effective researchers and for supporting students in the timely completion of their PhD; (ii) optional modules from a tailored portfolio, supporting the Researcher Development Framework.
- *Advanced Skills and Cohort Training*: is delivered by NRP faculty, Training Managers, Associate Partners and external trainers. In parallel with the Professional and Transferable skills above, Discipline-specific and Advanced Research Skills training is provided to develop DTP researchers. The DTP cohort are trained in: computational and systems biology, statistics, bioinformatics and programming, IP and commercialisation, and public engagement. Additional training is also available in: bioimaging, high performance computing, mass spectrometry, biophysical techniques. Cohort meetings and conferences also focus on BBSRC strategic research priorities and enable DTP cohort students to engage with a wider research context.
- *PIPS training, monitoring and support, and a PIPS Employer Forum*: is provided by a NRP team comprising staff from UEA's Research and Enterprise Team and a dedicated PIPS Coordinator. Training and development support includes: workshops on the development of skill based CVs and effective networking, access to mentors and one to one careers guidance.

Student case studies

The strong Cohort identity facilitated by the single site allows for strong research and training synergies.

Case study, Cohort networking: two of our DTP students discovered research synergies in their work through the cohort research meeting. The projects, involving plant-pollinator interactions and genetic approaches to analysis of spatial ecology, both use bees as model systems. These networking discussions between the DTP cohort students and their supervisors then initiated new, synergistic research plans, culminating in a joint field trip to Spain.

Case study PIPS: one of our students who attained a BBSRC-sponsored internship at Parliamentary Office for Science and Technology (POST) conducted their PIPS at Westminster in 2014. In this they contributed significantly to the publication of a POST note on GM crops:

"My internship has been challenging and exciting, giving me insight into science policy. The experience has broadened my career horizons and developed my networking skills."

Strategic Focus & Portfolio

The NRP offers a breadth and concentration of internationally-recognised biosciences

research, representing excellence all on one site across all four of the BBSRC priority areas: Agriculture and Food Security, Industrial Biotechnology and Bioenergy, Bioscience for Health and World Class Underpinning Bioscience. This research training excellence is supported by the strategic focus of the industrial and associate partners (APs), as outlined below. Our strong portfolio of PIPs opportunities underpins our training across all aspects of *RCUK Statement of Expectations for Doctoral Training*, 2013 and the *Researcher Development Framework*.

Strategic focus of industrial (including CASE) partners relevant to the training programme:

Since 2014, BBSRC iCASE students have been formally incorporated into the DTP cohort. Prior to this, these students joined the cohort for many aspects of training. Our portfolio of CASE partners is broad, the CASE partners have strengths in all our strategic research areas, but currently particularly so for Agriculture and Food Security (e.g. Bayer CropScience NV; Plant Bioscience Ltd, EcoSpray) and Bioscience for Health (e.g. Eagle Genomics Ltd, Mologic Ltd, Biodeb UK Ltd, iQur Ltd, Kuecept Ltd). These partnerships offer specific strengths in training our students in Knowledge Exchange and Commercialisation, IP and ethics.

Strategic focus of Associate Partners relevant to training programme:

Our DTP includes three Associate Partners, who each provide a distinctive role in supporting key strategic areas of training:

1. *Plant Bioscience Ltd* (PBL) (www.pbltechnology.com), whose shareholders include the Gatsby Foundation, the JIC and BBSRC, contribute professional training to the DTP cohort in IP and commercialisation. They also offer PIPS to students. This develops our Doctoral researchers' understanding of the commercial exploitation of research.
2. *The Norfolk and Norwich University Hospital (NNUH)* (<http://www.nnuh.nhs.uk/>) is part of the NRP and has close links with many aspects of biosciences research conducted by the DTP institutions. NNUH contribute professional training to DTP students in a range of critical methodologies (including randomised control trials, cohort / case control studies, ethnography, ethics for clinical trials). NNUH staff are actively involved in DTP research projects and also provide samples for fundamental research studies in the area of human health. This Associate Partnership underpins key elements of our Bioscience for Health priority.
3. *The Science, Art and Writing (SAW) Trust* (www.sawtrust.org) was founded with development funding from the John Innes Foundation, BBSRC and UEA, and specialises in bringing together scientists, artists and writers to collaborate on science-themed projects delivered in schools. The Trust leads DTP cohort training in a variety of outreach activities and public engagement. The SAW Trust also offers PIPS opportunities. The relationship with the SAW Trust supports our outreach activity across the whole of our training priorities.

PIPS host organisations

The PIPS programme is overseen by the Joint Head of Careers Service at UEA, supported by an Internship and Mentoring Officer. The DTP also funds a dedicated PIPS Coordinator. The PIPS team support includes liaison with hosts, processing of applications to hosts, financial information and guidance on BBSRC internship regulations.

The PIPS Scheme on the NRP has > 70 supporting organisations, including our Associate Partners. Hosts range from large companies (such as AstraZeneca and Santander) to learned societies (such as the Royal Society of Chemistry and the Society for General Microbiology), from charities (such as the National Trust and RSPB) to public bodies (such as Norfolk Constabulary and Norfolk Record Office) and SMEs (such as Intelligent Fingerprinting

Ltd. and Procarta Biosystems Ltd.).

Supporting niche skills and vulnerable areas

BBSRC research and training priorities in main and vulnerable skills areas are also supported by the recent awards of 4 out of the 13 BBSRC Networks in Industrial Biotechnology and Bioenergy in which Norwich scientists are Co-directors. We successfully recruit students into vulnerable areas, including plant pathology, plant breeding, bioinformatics and computational biology. Research training in synthetic biology is also supported by the award of £12 million funding for a new UK synthetic biology programme (OpenPlant) to plant scientists at Norwich and Cambridge.

Unique Selling Point



“The Norwich Biosciences Doctoral Training Partnership: Excellence all on one site”

- Location of all partners on a single site
- Excellent track record in international, interdisciplinary, competitive science in all BBSRC priority areas
- Dynamic, growing and multi-national research environment
- Excellent researcher training programme
- A bespoke PIPs scheme
- Well-established and harmonized administration

The Norwich Research Park offers a breadth and concentration of internationally-recognised biosciences research. With the five established research centres and a vibrant, rapidly expanding commercial sector, the NRP offers a leading environment for training doctoral researchers. A key strength is the co-location of all five partners on a single research park. This facilitates meaningful synergies for integrated, cohort-based training and empowers research and training opportunities for students across research boundaries. DTP cohort students work closely together throughout all four years of their PhD in order to establish strong cross-institutional links and lasting professional contacts. Our single location also offers economy of scale whilst ensuring that we can deliver a single professional training programme to all students and set uniformly high standards of research across the Partnership. All DTP students engage in a single bespoke PIPS programme with PIPS training delivered to the whole cohort.

Overarching aims: ***To deliver world-class training to the bioscientists of the future.***

Norwich is uniquely positioned to provide a DTP that can deliver world-class bioscience research training in all aspects of BBSRC’s science remit.

We aim to deliver world class, responsive and student-centered PhD training to develop highly employable, internationally-competitive researchers equipped to undertake a diverse set of careers.

Challenges***The Norwich Biosciences DTP training programme benefits from recent advances in:***

- Integration of Personal and Professional Development training programmes across the DTP.
- Harmonisation of research facilities across the NRP through a Virtual Technology Centre.
- Harmonisation of Doctoral administration in advertising, recruitment and admissions.
- Integration of procedures across the DTP for monitoring student progression.
- Development of bespoke PIPS training programme.

Key challenges:

- Ensuring sufficient resourcing for PIPS to maintain high quality PIPS placements that deliver meaningful training opportunities.
- Ensuring the maintenance of an inclusive, supportive and meaningful DTP cohort identity under growing Doctoral student numbers.
- Monitoring and capturing relevant impacts of the DTP training programme, including PIPS

White Rose (Leeds-led) DTP

Lead contact: Prof Michelle Peckham [0113 343 4348; m.peckham@leeds.ac.uk]

Operational contact s: Dr Clare Green [c.j.green@leeds.ac.uk] & Samantha Aspinall [0113 343 3013; s.l.aspinall@leeds.ac.uk]

Website & Social Media: <http://www.whiterose-mechanisticbiology-dtp.ac.uk>

 @WhiteRoseUC

Partner organisations (for DTPs):

University of Sheffield

University of York

The Food and Environment Research Agency (Fera)

Research Complex at Harwell (RCaH)



Summary

The White Rose BBSRC DTP consortium is made up of the Universities of Leeds, York and Sheffield. These three Universities have had a long-standing network of interaction, under the umbrella of the 'White Rose University Consortium (WRUC)', which has supported active bioscience collaboration across the White Rose Universities, securing £130M since 1997, through a number of strategic initiatives. Our DTP focuses on 'mechanistic biology and its strategic application' with studentships in three main areas: World Class Underpinning Bioscience, Agriculture and Food Security, and Industrial Biotechnology and Bioenergy. Our goal is to train the bioscience researchers of the future, fully equipped to address and solve fundamental and strategic biological questions of national and global importance. We are achieving this goal by offering research projects that encompass a wide range of model organisms and biological systems, physical methods, mathematical models and computational techniques applied to some of the most compelling biological questions. All of our students benefit from the support of two supervisors to ensure excellent supervision and a cross-disciplinary approach to their research project.

To ensure that all students acquire the generic skills for future careers, independent of sector we provide an integrated training matrix (ITM) centered on the four domains of the Vitae Researcher Development Statement (RDF) and including a wide range of opportunities so each student can develop a custom programme to meet their needs. Training in all domains is provided and underpinned by the supervisor-student relationship in the context of executing world-class research supported by regular training needs analyses. Our ITM is subject to regular review in response to feedback from all stakeholders, including the White Rose Management Board, and our external advisory board, which has representatives from Industry, RCaH and an external University.

The White Rose BBSRC DTP features compulsory cohort-wide training modules in core skills that provide excellent opportunities for cross-institutional cohort building. Examples include: "Experimental Techniques", a technology focused day held in York during November of the first year; "Mathematical Modelling and Data Analysis", which includes an introduction to SysMIC, is held in Leeds just before Christmas in Year 1 and is followed by a festive social event in the evening and "Translation: Molecules to Market", which takes place in Sheffield in May and is followed up by a Dragon's Den competitions that brings the students together again in the Autumn of their second year. Other bespoke training courses, including 'confocal and super-resolution imaging' and Bio-informatics and Industrial

Biotechnology training, in collaboration with two BBSRC NIBBs held by York and Sheffield are planned. PhD students are also expected to engage in modules to develop their generic professional and scientific skills such as “Good Scientific Practice”, “Research Ethics”, “Public Understanding of Science” and “Translational of Research ideas”. Students will have ample opportunity to develop their Personal effectiveness as they manage their PhD project and prepare reports and presentations for their supervisory teams and postgraduate training coordinators. Student engagement in White Rose BBSRC DTP research symposia and annual induction days allows development of their communication and networking skills. Supervisory teams further support students in reflecting on their progress and identifying their individual training needs. During our regular meetings, the White Rose BBSRC DTP Management Board monitors training processes and consider feedback in order to ensure our training provision is effective, current and relevant to the strategic plans of BBSRC.

Highlights from our PIPS placements include: two students have had their contracts extended beyond the life of the pilot PIPS; one now has a job in Science communication for a leading charity and a second has secured a job in an IP firm. A further graduate is working at a government research centre and one is working as a postdoctoral research fellow at King’s College London. . In a recent PIP at Yorkshire Cancer Research, the student rewrote the website, wrote for the blog, helped select referees for project grants, helped write about YCR’s research for the lay audience, applied for funding from other trusts, helped out with fundraising events (e.g. on the Tour de France) and was took responsibility for accounts reporting.

Strategic Focus & Portfolio

Strategic focus

Our DTP focuses on ‘mechanistic biology and its strategic application’ with studentships in three main areas: World Class Underpinning Bioscience, Agriculture and Food Security, and Industrial Biotechnology and Bioenergy. Collaboration with Fera and RCaH provides access to world-class specialist technologies and an appreciation of the role of research in informing policy-making. We aim to equip graduates with the core skills and expertise to be internationally competitive and contribute to the development of interdisciplinary approaches, thereby embedding the concept of ‘new ways of working’ in bioscience and other sectors. Our current DTP has capitalised on the success of the WRUC by exploiting this partnership to promote collaboration and knowledge transfer across the three Universities to ensure first class training for PhD students. Operating our DTP within the broader WRUC framework over the past 2.5 years has helped us to shape and align institutional strategic priorities to develop a coherent training programme for existing and future DTP students. Key to this is the support by WRUC for the management of our current DTP as well as financial support for both single-institution and cross-institution studentships.

Associate Partners

Our two main partners are the Food and Environment Research Agency (Fera), in particular for areas of research in Agriculture and Food Security, and Industrial Biotechnology and Bioenergy and the Research Complex at Harwell. Both partner institutions are involved in enabling opportunities for training. For example, Fera holds cohort-building events and contributes to the day’s activities, co-supervision of studentships and hosting a range of PIPS. We run a residential event at RCaH, to introduce them to the complexity and scale of techniques and approaches available to them, and this event also provides them with an opportunity to mix with students from the Oxford DTP. Collaboration with Fera and RCaH provides access to world-class specialist technologies and an appreciation of the role of research in informing policy-making.

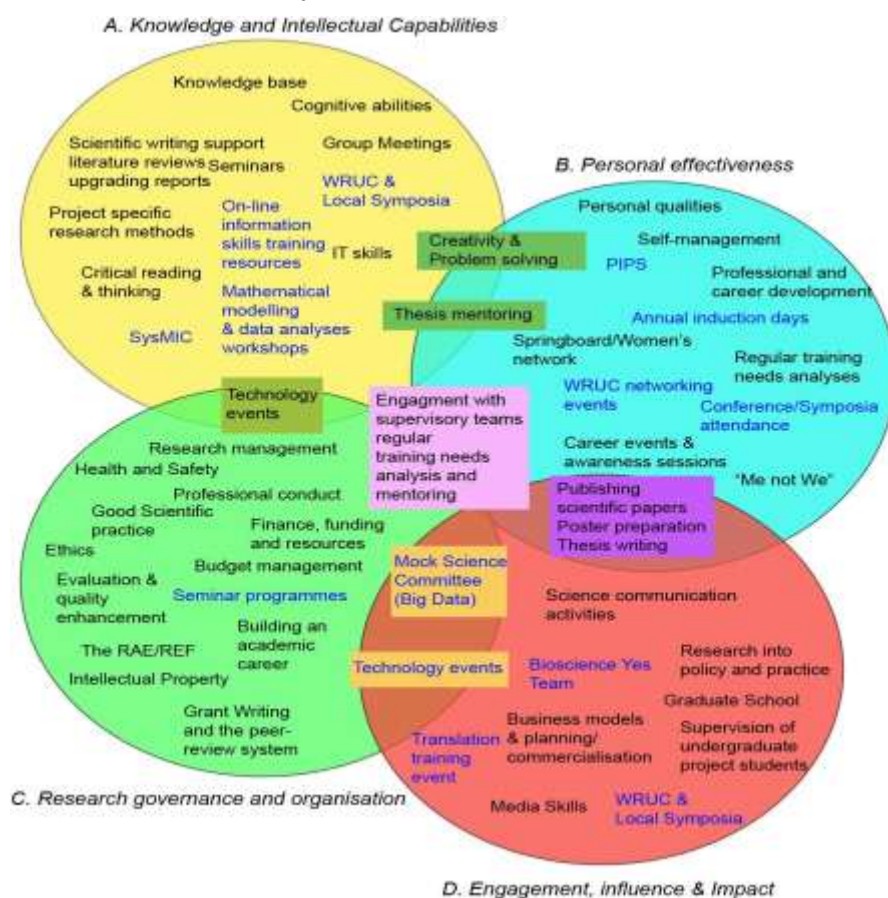
Examples of PIPS Host Organisations

Our PIPS programme has been really well received by students and supervisors are seeing the benefit of participants bringing new skills back to their research and approach to work. We have had students at a number of hosts. The success of our partnership with Yorkshire Cancer Research means that they regularly take students from our universities and have even planned to create a more permanent role to assist with translational science. We have an extensive range of organisations who host PIPS. Some examples include Great Ormond Street Hospital, Research Complex at Harwell, Fera, AS&K Visual, YCR, York District Hospital, Art in the Park and Avacta.

Unique Selling Point

A hallmark of the current and future research training provided by our DTP is collaboration between researchers from a wide range of fields. Not only does our DTP reflect the very best molecular and cellular bioscience research across the WRUC, but it also brings together researchers from different disciplines, by including supervisors who are chemists, physicists, engineers and mathematicians. We are exploiting recent developments in bioimaging, next generation sequencing, 'omics' technology and synthetic biology in our current research portfolio, through our established multi-disciplinary centres such as the Astbury Centre for Structural Molecular Biology (www.astbury.leeds.ac.uk), the Krebs Institute and the York Centre for Complex Systems Analysis (www.york.ac.uk/res/yccsa/), as well as individual departments. Across WRUC, our research infrastructure is commensurate with the best world-wide, with internationally recognized academic and support staff enabling us to provide an outstanding range of PhD training opportunities across a wide variety of experimental and theoretical methods, spanning Chemistry, Physics and the Biological Sciences.

We continue to develop a combined training programme that is robust in the developing world of scientific discovery and diverse to enable our graduates to explore a broad range of opportunities. The White Rose BBSRC DTP offers courses and workshops across all four of the Researcher Development Framework (RDF) domains. We ask that students meet regularly, all new starters meet all existing students at induction and they have three training days in the first year which we feel really begins to build up the cohort. In addition we hold a residential for all students at Harwell. It is not straightforward to bring



students together a build the sense of a group but with time and regular interventions we can see this approach working.

We also like to constantly evolve our programme to include new courses that reflect the needs of researchers. For example last year we ran a mock Scientific Select Committee with Stephen McGinness from the Parliamentary Science Select Committee. The subject was Big Data and researchers were given the opportunity to see how research could help inform policy through parliament. We also invited Dr Martin Penny, Head of Unit (acting): Physical Sciences & Engineering European Research Council to run an activity called Negotiating a European Treaty where participants see how policies based on research are made at a European level. These types of activities really illustrate how research influences many facets outside academia.

Challenges

Building a stable, enduring network of Universities for the White Rose DTP partnership

We have successfully built a durable partnership, facilitated by the long-developed working partnership of York, Leeds and Sheffield, under the auspices of the White Rose University Consortium (WRUC). We have a well-established management board, which takes oversight of all the activities, and which has representation from our associate partner organisations.

Building the BBSRC Student Cohort across Institutions

A challenge of the DTP is to build the student cohort across Institutions, and provide the students with their own unique identity. We have achieved this by running joint events in each year of study, including supervisors where possible. We will be building on this in DTP2 by providing more events such as joint symposia/conferences and training events.

Identifying vulnerable areas and developing them

We identified 4 key vulnerable areas that we plan to provide additional training in across the Universities, and will use the management board and our external advisors to enable us to continue to identify such areas.

Efficient management and administrative support for the DTP

Our management board is now well established, but we identified the need for a dedicated administrator to co-ordinate and manage our activities. The Universities have provided funding for this role, and a new DTP manager will be in place from February 2015

Capturing Outcomes

As DTP1 is entering its fourth year, our first students will start to graduate and move on to their next steps. We need to develop appropriate tools to capture their successes, and future careers. Appointing a new DTP administrator will enable us to start to implement strategies to do this.


Manchester DTP

Lead contact: Prof Ray Boot-Handford (DTP Director) [0161 275 5097; ray.boot-handford@manchester.ac.uk]

Operational contacts: Dr Anna Lawless (DTP Manager) [0161 275 5444; anna.lawless@manchester.ac.uk]

PIPS contact: Ms Vanessa Haves [0161 275 6770; vanessa.haves@manchester.ac.uk]

Website & Social Media: <http://www.dtpstudentships.manchester.ac.uk>

 @uom_bbsrc_dtp

Manchester BBSRC DTP Facebook account (for current students, closed access but we send to new offer holders) <https://www.facebook.com/groups/374907015860665/?fref=ts>

University of Manchester Doctoral Training College
<http://www.manchester.ac.uk/study/postgraduate-research>

Partner organisations (for DTPs): n/a

Summary

The University of Manchester is one of the largest and most successful centres for biological and biotechnological focused research and training in Europe and is one of the major centres for BBSRC investment in the UK. The Manchester BBSRC DTP is a single institutional programme encompassing researchers from Engineering and Physical Sciences, Life Sciences and Medical and Human Sciences. Our DTP programme interfaces research and training in the core biosciences with physics, chemistry, mathematics, computer sciences, engineering, material sciences, pharmacy, psychological sciences, dentistry and medicine. The Manchester DTP has particular strengths in providing specialist training in the BBSRC priority themes of bioenergy and industrial biotechnology, world class biosciences, and soil systems within food security. An interdisciplinary supervised research project addressing a timely, significant and complex bioscience question is at the heart of the Manchester DTP training programme. The first 9 months focuses on skills and knowledge tailored to the needs of the individual student, plus broader training as a cohort. Such training includes compulsory maths alongside project-specific courses, for instance in computer programming, experimental design and statistics and courses addressing specialised bioscience topics. Interdisciplinary training is provided through rotation projects in different laboratories and through attendance at workshops provided by our extensive suite of core facilities. The PIPs is usually undertaken at the start of the second year. Generic training in transferable skills is provided to the DTP cohort throughout their training and includes careers and employability. The student cohort organises the annual DTP symposium at which students either present short talks or posters. The DTP students also participate in the annual Manchester Life Sciences PhD conference and all students present their research regularly within their research grouping and at national and international meetings. The DTP embraces Manchester University's agenda on promoting Social Responsibility and many of our DTP students are involved in public engagement explaining their research to the local community and interest groups.

Case study - Kevin Rich

Kevin's project supervised by Dr Mark Travis and Dr Pawel Paszek uses a multi-disciplinary approach to study pathways and mechanisms by which cells of the immune system communicate to promote health and combines expertise in molecular and cellular

immunology (Travis) with skills in systems biology (Paszek) to address how, when and where important integrin pathways are regulated to promote a healthy immune system. Kevin's self-arranged PIPS at the University of California, San Francisco and San Francisco General Hospital looked at the clinical applications of spirometry (a test used to measure lung function). It presented the opportunity to work with clinicians in a hospital setting, whilst interacting with patients and having an indirect influence on patient care. Kevin used R-software from scratch to build algorithms which identify patterns in data that can be applied in the clinic directly. The data have since been used in an application for a potential start-up company. Kevin will remain a member of the team and is delighted that his PIPS provided him with an opportunity to do something different. When asked whether he would recommend this placement, he said "Yes, of course. This project was one of the best experiences of my life and taught me skills I now use routinely in my PhD. I highly recommend thinking outside the box in terms of arranging your own project". Kevin is active in public engagement, getting involved in the 'Body Experience' at Manchester Museum during National Science week, and was shortlisted for a prize with the Guardian for a 2 minute science video entitled "The Hero of our Time: Vaccination" which culminated in a very lavish awards ceremony in London. In his spare time Kevin is learning to speak Japanese!

Case study - Natalie Cureton

Natalie's project supervised by Prof John Aplin (placental biology), Dr Lynda Harris (Pharmacology) and Prof Nicola Tirelli (Material Sciences) uses a multidisciplinary approach to the development of novel lipid-based nanocarriers for targeted drug delivery to the placenta. Natalie's flair for entrepreneurship saw her on the winning team of the University's 'Venture Further' competition in 2013, and a cheque for £10,000. With Lynda Harris, she entered the Oxbridge 'OneStart' Competition in 2014 pitching 'LipoPep', a targeted drug delivery system which allows existing therapeutics to be actively and selectively delivered to the placenta, providing a potential treatment for pregnancy complications. The judges were so impressed that a special runner's up prize was awarded and the team was invited to sit on the judging panel next year <http://www.oxbridgebiotech.com/review/onestart/onestart-winner-announced/>. Natalie's PIPS in the University of Manchester's Intellectual Property team involved managing a portfolio of technical transfer assessments. She said, "My PIPS provided me with invaluable knowledge of technology transfer, something that will certainly prove useful in my future career". In March 2014 her abstract was one of 25 selected from over 800 to win a prize at the Society of Reproductive Investigation in Florence. Natalie is currently a committee member of the Society of Chemical Industries and sits on the DTP Symposium organising committee, with responsibility for securing sponsorship of the event; notably Natalie won the best oral presentation at the inaugural event in 2013. In her spare time she ice-skates and bakes, with a dream of entering and winning the Great British Bake-Off!

Strategic Focus & Portfolio

The major strategic focus of the Manchester BBSRC DTP is on providing training in the areas of Bioenergy and Industrial Biotechnology, World Class underpinning Biosciences, and Soil Systems.

We have major strengths in a broad range of world class underpinning biosciences. This includes significant multidisciplinary strength and BBSRC investment in structural and chemical biology, RNA regulation, cellular dynamics, developmental regulation, and biological timing; and, accordingly, these are the areas that our DTP strategically focuses much of its support.

The bulk of our industrially-focussed research falls under the umbrella of Industrial Biotechnology and we have particular strengths in bioprocessing, biocatalysis, natural

product discovery / bioengineering and glycosciences. Supervisory staff in the Manchester DTP lead the four BBSRC-funded NIBBS in these areas. The DTP is actively engaged with the organisers of these NIBBS to ensure that our DTP cohort of industrial biotechnology focused students is included in these additional training and networking opportunities. Our commitment to this important aspect of PhD training is ongoing. Thus, for example, we are developing an industrial biotechnology focused career workshop for all DTP students. Providers of the training will be invited to be associate members of the DTP. In addition, we are planning a cross-DTP session focusing on industrial biotechnology at the annual, student led, Manchester Life Sciences PhD conference which attracts around 300 participants from across the UK and Europe.

NIBBS directed by academics associated with the Manchester BBRC DTP:

- Biocatnet: Network in Biocatalyst Discovery, Development and Scale-Up (Nick Turner)
- NPRONET: Natural Products Discovery and Bioengineering Network (Jason Micklefield / Roy Goodacre)
- BioProNET: Bioprocessing Network (Alan Dickson)
- IBCarb: Glycoscience Tools for Biotechnology and Bioenergy (Sabine Flitsch)

PIPS

We have enlisted the help of range of host sectors and organisations to offer a variety of interesting and challenging placements. To date, around 35 students have completed their PIPS.

Examples of PIPS hosts:

Guru Magazine – [Reference/webpage no longer available – February 2019]

Institute of Science in Society - <http://www.i-sis.org.uk/index.php>

NHS England - <http://www.england.nhs.uk/>

Blueprint Partnership- <http://www.blueprintpartnership.com/>

British Heart Foundation - <https://www.bhf.org.uk/>

Agilent Technologies UK - <http://www.agilent.com/home>

IBM - <http://www.ibm.com/uk/en/>

Arthritis Research UK - <http://www.arthritisresearchuk.org>

Harrison Goddard Foote - <http://www.hgf.com/>

The Co-op - <http://www.co-operative.coop/>

Blackpool Zoo - <http://www.blackpoolzoo.org.uk/>

Unique Selling Point

The Manchester BBSRC DTP aims “to support researchers to become leaders who, in all walks of life, will question, inspire and motivate”

- Interdisciplinary training in world class environments for Industrial Biotechnology, underpinning Biosciences and Soil Systems.
- Training in and access to a world class set of core bioscience research technologies
- Emphasis on student-led activities such as the annual DTP symposium and PIPS Network Event
- Encouragement of, and training in, Social Responsibility
- Structured and web-based process for recording and monitoring progression through the training programme

The interdisciplinary nature of the Manchester DTP enables us to recruit strong students from a variety of biological and non-biological disciplines. All DTP projects are designed to provide multidisciplinary challenges for students with backgrounds including bioscience, biomedical, mathematical and physical sciences. The focus on 'Interdisciplinary Training' and 'Enabling New Ways of Working' prepares students to draw on a range of technologies and explore biological questions using innovative and creative approaches to their research.

We equip our students with the necessary skills to tackle the challenges presented by different disciplines and new ways of working. This is achieved through a series of lab rotations which provide technical skills and an understanding of the broader context of the research. By providing access to core research facilities and technical seminars, students gain valuable training in research methods, experimental design, sample preparation and data analysis. By interacting as a cohort, essential communication, team building and organisational skills are developed and a cross-DTP peer support system helps to promote confidence and motivation. Networking opportunities permeate within priority themes through industry days, seminars and conferences and specialist background knowledge is developed through lectures, workshops and on-line teaching materials.

DTP cohort training is supported at every level through a tailored programme of generic and professional skills mapped to the RCUK Research Development Framework; professional networking events; a 3 month PIPS either in the UK or abroad, exposure to business development and entrepreneurship skills; participation in public engagement and social responsibility activities and unlimited access to Manchester's award winning careers and employability services.

Challenges

Engagement with SysMIC

For some students, the time required for successful completion of assignments is at least 5 hours per week and detracts from other training opportunities they wish to undertake.

We have developed peer-assisted study groups to help weaker students complete the course.

How to keep cohorts together in years 2 – 4?

Social activities, outside of core cohort training, have not been particularly successful in engaging the whole cohort. We have developed the student-led annual DTP symposium that all DTP students attend either to present a poster or a talk. Students also gain experience at chairing sessions.

We are considering the introduction of a 2 day off-campus residential training school for 2nd and 3rd year students to maintain and strengthen the cohort identity once students are engaged with their full-time research projects.

How to engage with industry and develop DTP project collaborations?

ICPs provide studentships to supervisors independently of DTPs and individual CASE awards are made to the academic / CASE partner directly with no necessity to engage with the DTP.

Suggestion: DTPs could incorporate a limited number of CASE awards within their structure. Would allow much more timely decisions (as was the case in the previous DTAs). Currently CASE awards must be submitted at least 15 months before a project can start – a timeframe that many industrial partners cannot work within. Allowing DTPs a quota of CASE would mean that a pool of CASE studentships would be available for projects to start relatively rapidly (3-6 month time frame) and the training of these students could also be within the DTP themes.

Newcastle-led DTP

DTP Partner organisations:

Newcastle University; University of Liverpool; Durham University

Overall lead contacts:

Prof John Kirby, Dean of Postgraduate Studies, Newcastle University

Prof Rob Beynon, Head of Biochemistry, Institute of Integrative Biology, University of Liverpool [r.beynon@liverpool.ac.uk]

Prof Keith Lindsey, Head of School of Biological & Biomedical Sciences, Durham University [keith.lindsey@durham.ac.uk]

Organisational lead contacts:

Dr Tim Cheek, Deputy Director of Institute, Institute for Cell & Molecular Biosciences, Newcastle University [tim.cheek@ncl.ac.uk]

Dr Mal Horsburgh, Institute of Integrative Biology, University of Liverpool [m.j.horsburgh@liverpool.ac.uk]

Prof Keith Lindsey, Head of School of Biological & Biomedical Sciences, Durham University

Operational contact:

Ms Barbara Sumner, Graduate School Administrator, Faculty of Medical Sciences, Newcastle University

Website & Social Media: <http://www.ncl.ac.uk/fms/dtp/>

<https://www.linkedin.com/groups/BBSRC-Newcastle-Liverpool-Durham-DTP-4618449>

Summary

The Newcastle-Liverpool-Durham BBSRC DTP consortium is a strategic partnership in Biosciences research and training between Newcastle, Liverpool and Durham Universities. The partners see the DTP as adding value to their own research strategies to support research and training in the areas of Agriculture and Food Security, Bioscience for Health and more widely in supporting World Class Underpinning Bioscience. The Partnership agreed to match BBSRC funds to double the size of the cohorts that we are training through the DTP. Thus through DTP1 we were awarded the equivalent of 15 4-year studentships per annum, for three cohorts, a total of 45 students. The Partnership has recruited, through a leverage mechanism, a total of 90 students to DTP1. The universities continue to further invest in these studentships as evidenced by the extensive list of potential supervisors (over 200), research grant incomes, in particular from BBSRC, and cutting-edge scientific facilities to support their research in Biosciences. All partners have experience of cross-institution PhD student training partnerships, which include Newcastle and Durham universities coming together to form the ESRC-funded North East Doctoral Training Centre and Liverpool and Newcastle universities in the Liverpool-led MRC-Arthritis Research UK Centre for Integrated Research into Musculoskeletal Ageing (CIMA) [CIMA also includes Sheffield University].

The core of our research training strategy is a 4 year PhD programme in which year 1 is a training year to equip students with generic, transferable and specific skills that underpin modern bioscience research. In DTP1 this was delivered through a '1+3' training model whereby students undertook an MRes in year 1. MRes study comprised generic, transferable and subject-specific skills in addition to a substantial research project in the laboratory of the PhD supervisor. This training model was already very well embedded within partners (MRes in Biomedical Sciences in year 1 at Liverpool University; MRes in Biosciences in year 1 at Newcastle University). Durham University already made a

substantial contribution to the Newcastle MRes programme and Newcastle students routinely undertake MRes research projects at Durham. However, as our Partnership has evolved during DTP1, we are modifying delivery of year 1 training for DTP2. For DTP2 we will not require registration for an MRes degree but will introduce a more flexible training year which delivers through 'Master class' sessions, active learning workshops, online activities, cohort development and laboratory rotations (see Challenges).

In years 2-4, students will continue to develop their skills and understanding through a bespoke structured programme that emphasises individual training and cohort-based training, in addition to project-specific skills.

Case studies

PH was recruited to the Partnership in 2012, based in Newcastle. She won a prize for her MRes research project in 2013 and organised her own PIPS with Pfizer in Boston, USA. This was partially funded by Pfizer. PH speaks to successive student cohorts about her PIPS experience where she emphasises that organising an internship herself, and one that was abroad, helped her to improve significantly her confidence, ability and skills set, and that this has had a very positive impact on her personal development and on her PhD studies.

KE was recruited to the Partnership in 2012, based in Liverpool. In 2013 she completed her PIPS with the NNEdPro (Need for Nutrition Education / Innovation Programme) at Cambridge, which delivers and evaluates innovative training in Nutrition Education and Clinical Leadership to health professionals. She targeted the host organisation because the internship aligned with her research but offered the opportunity to develop her skills outside of the academic research environment. She was involved in a range of different aspects of the organisation, including assisting analysts to develop a new education project, assisting with aspects of a clinical trial, and attending senior advisory panel meetings. KE returned to NNEdPro, at their invitation, a few months later to help write-up a paper as an outcome of her PIPS (<http://downloads.hindawi.com/journals/jbe/aa/172020.pdf>)

KO'M was recruited to the Partnership in 2012, based in Durham. In addition to her academic studies (she has presented data at one international and one national meeting) and her PIPS (at Procter & Gamble, Egham) she has also developed outreach activities with the British Science Association British Science Festival. At the Festival in Newcastle in 2013 she was involved in the 'Energy Dragons Den', which was an event that taught children about the energy crisis and the necessity of sustainable fuels. KO'M found the event really rewarding, adding, "It was good to promote science to school children and also raise their awareness of the economic and environmental issues concerning fuel in the UK".

Strategic Focus & Portfolio

The overall strategy of the Newcastle/Liverpool/Durham DTP is to deliver world class doctoral training in BBSRC's remit and priority research areas where the Partnership demonstrates excellence in research and a depth and breadth of supervisory capacity. By placing students in these targeted areas, the Partnership ensures students are trained in areas of cutting-edge science to help meet and sustain the training needs required for BBSRC's long-term strategic aims.

Our DTP1 Portfolio focused on delivering training in Agriculture and Food Security (35%), Bioscience for Health (20%) and World Class Underpinning Bioscience (45%). For DTP2 we maintain a similar alignment but increase our delivery against Bioscience for Health, reflecting a widening remit based on our combined strength in this area, which is no longer focused just on Ageing. Our DTP2 alignment is Agriculture and Food Security (35%), Bioscience for Health (30%) and World Class Underpinning Bioscience (35%).

The Partnership is fully committed to adding value to doctoral student training by providing the generic and interdisciplinary skills required to foster a multidisciplinary approach to problem solving. A key component of this is professional training in employment sectors including industry, business, media, governmental and voluntary organisations, and education, through PIPS and CASE awards. Our links with these sectors is informed by a DTP Advisory Panel (Procter & Gamble, Unilever, KWS, GSK). Examples of PIPS hosts for DTP1 students include international internships at Pfizer (Boston, USA), GlycoSyn (Lower Hutt, New Zealand), the IGOE Institute for Groundwater Ecology (Munich, Germany) and at the Karauskakio Foundation (Nicosia, Cyprus). National PIPS hosts include the Diamond Light Source (Harwell), Croda (Widnes), SCM Pharma (Prudhoe), Tozer seeds (Cobham) [a separate DTP1 studentship was converted to a CASE award with Tozer seeds], NNetPro (Cambridge), the Pirbright Institute (Pirbright) and Procter & Gamble (Egham) [a Master Collaboration Agreement with P&G has established Durham University as a core strategic research partner to this multinational corporation].

Unique Selling Point

“Our training programme has been developed to promote an ethos of lifelong learning and continual personal development in the next generation of UK bioscientists.”

The core of our DTP1 training programme was a 4-year PhD delivered in a 1+3, MRes+PhD, format. This enabled students to gain key bioscience skills including quantitative and computational skills, research governance, ethics, data handling and bioinformatics, in addition to those directly relevant to their PhD studies, during the initial MRes year. This training model, based on the original Liverpool University pilot of the Wellcome Trust 4-year PhD programme, has additionally been delivered by Newcastle University for more than 10 years, and in collaboration with Durham University for 8 years. Students trained alongside others on 1+3 programmes supported by MRC, Wellcome Trust, EPSRC and various charities at each of the partners. This ensured that students benefitted from engagement with a wider community of research students throughout the first year. In subsequent years students continue to develop their skills through a structured programme that includes both individual (e.g. conference presentation, PIPS) and cohort-based advanced training (e.g. Biotechnology YES), in addition to their project-specific experience.

Challenges

As our Partnership evolved, two key challenges became apparent. Firstly, our year 1 training proved insufficiently flexible (e.g. increasingly students already have a Masters degree when they apply for the DTP). Secondly, the quality of interaction between partner institutions, although high in ‘hot-spots’, was uneven. To address these challenges we are modifying the programme with particular emphasis on year 1 in DTP2 to increase flexibility and to increase cross-institutional and cross-disciplinary training. We will not require registration for an MRes degree, but will embed generic training through ‘Master class’ sessions, active learning workshops, online activities, cohort development and laboratory rotations. Students will be jointly supervised by academics from more than one partner institution and laboratory rotations will take place in the co-supervisor’s laboratory in the partner institution.

This prescribed flexibility will enable us to introduce two further enhancements that will benefit the training experience as a whole. Firstly, it will allow the PIPS training to be carried out in year 1, where this is appropriate. Secondly, it will allow us to maximise provision of local support to enable students to take full advantage of the BBSRC’s SysMIC programme.

We will introduce a bespoke training course for DTP students in year 1 semester 1 that will be co-ordinated with the local SysMIC support officers and directly feed into training for SysMIC module 1.

Nottingham-led DTP

Lead contact: Prof Jerry Roberts (Director) [jeremy.roberts@nottingham.ac.uk] & Dr Susan Anderson (Deputy Director) [susan.anderson@nottingham.ac.uk]

Operational contact: Rachel Van Krimpen (from March 2015)

Website & Social Media:

<http://www.nottingham.ac.uk/graduateschool/bbsrc-doctoral-training-programme-in-biosciences/index.aspx>

 @UoNgradschool

Facebook Cohort 2014: <https://www.facebook.com/groups/503920409737309/>

Facebook Cohort 2013: <https://www.facebook.com/groups/280788275384984/>

Facebook Cohort 2012: <https://www.facebook.com/groups/249770541804509/>

Partner organisations (for DTPs): Rothamsted Research (RRes); East Malling Research (EMR); Diamond Light Source (DLS); Harwell (H); Centre for Process Innovation (CPI); Crops for the Future Research Centre (CFFRC) in Malaysia

Summary

The Consortium

The Nottingham DTP provides an outstanding research environment designed to harness the significant recent investment by the University in equipment and infrastructure across its campuses with the aim of delivering world-class doctoral training in bioscience. The DTP is delivered by a consortium of institutions tailored to provide expertise and access to state of the art facilities to carry out research across BBSRC priority areas, as well as specific training opportunities in strategic competencies, vulnerable capabilities and other niche skills. Rothamsted Research (RRes) contributes valuable expertise, training and facilities in: bioinformatics; imaging; systems approaches to study biological problems; pathogen-host interactions, and entomology. East Malling Research (EMR) provides expertise to support research and training in: agronomy, plant physiology, plant breeding and soil science within the *Agriculture and Food Security* strategic priority. Diamond Light Source (DLS) and Harwell offer facilities, unique in Europe, to support cutting-edge research in a range of disciplines underpinning *World-Class Bioscience*, including structural biology, health and medicine, and spectroscopic/analytical methods. The Centre for Process Innovation's (CPI's) National Industrial Biotechnology Facility brings state-of-the-art facilities and expertise in bioprocessing relevant to the *Industrial Biotechnology and Bioenergy* strategic priority. Crops For the Future Research Centre (CFFRC), Malaysia, adds capacity for international collaboration and researcher mobility as well as expertise and facilities on tropical crops, in particular in the context of food security and bioenergy.

Strategic and Operational aspects of the Training Programme

The programme has evolved in response to student and external assessor feedback from the first DTP. It is framed by individual development needs analysis and includes: *Generic research skills development training* that is delivered in the two weeks following induction plus three annual Spring Schools; *Masters Level Modular Training* that provides access for DTP students, in a bespoke way, to a wide variety of Masters-level lecture courses (including those from the BBSRC AgriFood ATP), relevant to their background, research interests and development needs.

Laboratory rotations delivered in 3 X 8 week blocks that connects DTP students to a wide community of supervisors and early-career researchers in labs across the partnership consortium prior to embarking on their PhD programme. In each rotation students must review literature, generate hypotheses, design and carry out experiments, achieve competency in a range of relevant techniques, and analyse and interpret results. Each rotation is assessed in a different way via literature review, poster, laboratory report or presentation.

Experiential learning through public engagement and outreach activity during which DTP students are: introduced to the principles and techniques of science outreach; configured into teams; allocated an academic mentor experienced in science communication; and tasked with developing an activity for the University of Nottingham's showcase public engagement weekend – Mayfest.

Case study

"I took my placement with a pharmaceutical company at their research and development site in the USA. As a mathematician, this was a fantastic opportunity to see how the desk based work that I do feeds into the larger picture within industry. I was also able to observe and take part in many steps of the drug discovery process, from the initial discovery steps to production and testing.

Even though I'm still undecided about a career path, the placement has really opened my eyes to an area of work which I hadn't seriously considered. It enabled me to develop many skills, and the exposure to labs and experimental techniques was an experience that I wouldn't have otherwise had. I was also able to bring some of my analytical skills and put together a data analysis package. As I didn't take a break between finishing my degree and starting this programme, the chance to experience a different working environment, lifestyle and culture has been invaluable."

Strategic Focus & Portfolio

Integration of strategically important competencies and vulnerable capabilities into the DTP programme

The Training Programme gives all DTP students the opportunity to acquire skills in bioinformatics, computational and systems biology, and bioimaging. Cross-disciplinary working is prioritised and is characterised by a suite of workshops specifically "for biologists". This part of the programme introduces relevant elements of engineering, chemistry and physics to students with a background in the biological sciences with the aim of broadening their horizons and promoting cross-disciplinary working. Specialist training days, provided through consortium partners, focus on skills and techniques such as: protein crystallography, protein purification and biophysical characterisation, biophysical techniques (UoN, Harwell and DLS); as well as knowledge and understanding in pest and pathogen ecology, entomological techniques (EMR and RRes). CPI offers students and opportunity to get involved through use of facilities, training and placements with a range of current and future strategic competencies in industrial biotechnology, including up-scaling, biocatalysis, fermentation, smart chemistry, anaerobic digestion and biologics. CFFRC brings relevant expertise in its knowledge systems research priority, giving students the opportunity through placements to gain expertise in the use of digital information tools to manage large data sets related to underutilised crops and to develop and share integrated knowledge with end-user groups.

PIPS Programme Package

The University of Nottingham manages a European Regional Development Fund scheme which has placed over 300 postgraduate students in business-led placements in local SMEs. The structure of the PIPS programme has been built on the results of student/supervisor

consultation and evaluation of the Pilot PIPS programme, and framed by institutional best practice in work-based learning. The programme's strategic aim is to maximise outcomes for learning and knowledge exchange by supporting students to take the initiative in shaping and driving their own, individualised PIP: from making first contact with the host to networking after completion. The Partnership provides a package of support using classroom and online delivery comprising:

- A series of Workshops incorporating sessions on career-planning, CV review, "How to develop a placement", reflective practice in work-based learning, "Keeping contacts and networking", "Challenges and opportunities of international Placements";
- Online information in the form of a "PIPS Pack" (two complementary booklets setting out key information for students and placement hosts with regard to context, learning outcomes, milestones, contracts, example project briefs and case studies).

Students are expected to undertake an online development needs analysis and goal-setting exercise prior to beginning their placement and to complete a weekly reflective blog as part of their e-portfolio development. The blogs are shared with other students on placement and enrich the PIP learning outcomes by facilitating peer learning, peer support, and evaluation and monitoring. Students are required to undertake their PIP between 22-36 months after registration.

Hosts for PIPS have includes: *NHS; The National Childcare Trust; Arthritis Research UK; BBSRC, Innovis Ltd; Cancer Research UK; The West Bridgford School, Azotic Technologies Ltd; Zoetis Inc; Prosen Therapeutics; International Maize and Wheat Improvement Centre (CIMMYT); Nottingham Citizens; Aviagen Turkeys Ltd.*

Unique Selling Point

"Our students are engaged, skilled, and connected."

The Nottingham DTP provides an innovative, integrated, student-led programme targeted to train a generation of scientists to lead the next industrial revolution in the biosciences.

- Our students are **engaged** because they have considerable input into the programme. From day one when they chose their three **lab rotations** the student voice is strong in the DTP and we view our students as partners in the DTP. They help shape their training by **identifying their needs** and developing key skills initiatives alongside staff (e.g. Spring School). They are engaged in the wider University and with the public via their **outreach activities** during Mayfest (20 000 audience, all students take part). They are **represented** on Management Committee and regularly feedback their views on the DTP through online questionnaires and verbal contributions. Because they **'try before they buy'** with their final PhD project, they are fully engaged with the project.
- Our students develop excellent **skills** throughout the programme. Initially via a range of experiences and training in our lab rotations. Our programme of three lab rotations offers students the opportunity to try a project with a totally different focus and set of techniques, gaining a **better understanding** of all the BBSRC themes. As well as generic training we also offer **bespoke training** which responds to students self-identified needs in Spring School. We engage **students as leaders** for some of our training (e.g. PIP training at Spring School). Students also benefit from a wide variety of PIPs and **i(international)PIPs** providing a different training opportunity, this time workplace/industry based.

- Our students benefit from an **extensive network**. We produce a cohort of graduates that are better **connected** than many staff at the University. There is strong interaction and knowledge exchange between students in different cohorts and across the three DTP themes due to the lab rotation structure and the structure of research, technique and application dissemination at **Spring School**. As students move on into the workplace we hope this will foster a lifetime of interdisciplinary collaboration, fostered by the regular interaction between students in a research led forum in the DTP. They will also have established contacts at our partner organisations. The **strong cohort identity** of the DTP is also driving better supervisor engagement within the institution and between the institution and partners.

Challenges

Exploiting new ways of working in supervision

The Nottingham DTP has introduced a new way of working for supervisors. Instead of supervisors advertising for and recruiting their own students, they have had to pitch projects to excellent students, selected by the DTP recruitment panel, at a series of poster-based showcase events. In this way, the selection process is controlled by students and supervisors are challenged to deliver innovative, interesting, self-contained mini-projects, related to the PhD project and incorporating a range of techniques developing a range of skills. The studentship is therefore 'earned', as students only pick one of three laboratory rotations as their final project. There have been a number of unexpected and pleasing developments as a result of this model. For example:

- The presence of high quality, motivated students during laboratory rotations has generated pilot data for grant applications and conference abstracts or completed final experiments to contribute to publications even if the project is not finally selected as a PhD.
- Supervisors are highly motivated to appeal to students and have developed new collaborations and strengthened existing collaborations across disciplines as a result of taking part in the DTP events and talking to students about their other lab rotations.
- Over 40% of projects submitted to the DTP in 2013 were interdisciplinary across Schools. In addition, in 10-15% projects in each year, the student has led the development of a new collaboration by blending facets from 2 different rotations to shape their final PhD project.

This way of working has not appealed to every supervisor, but has been a resounding success with students. Supervisors' anxieties regarding their power to select students and uncertainties around the model of students selecting projects is regularly discussed and is being addressed during specific DTP training events and by using case studies in School newsletters to evidence benefits of working in this way.

Transitioning from the DTP into Schools

DTP students spend their first year as part of a distinct community that has its own assessment and progression rules. At the beginning of the second year, students transition into their host Schools which commonly have their own processes and procedures. The nature of cohort building means that students routinely share experiences, and in particular highlight contrasting administrative operations that are sometimes in apparent conflict. To resolve this issue the DTP has been mapping student progression across transitions with a view to harmonizing, where possible, School procedures.

Oxford-led DTP

Lead contact: Prof Mark Sansom [mark.sansom@bioch.ox.ac.uk] and Dr Gail Preston [gail.preston@plants.ox.ac.uk]

Operational contact: Mr James Wright

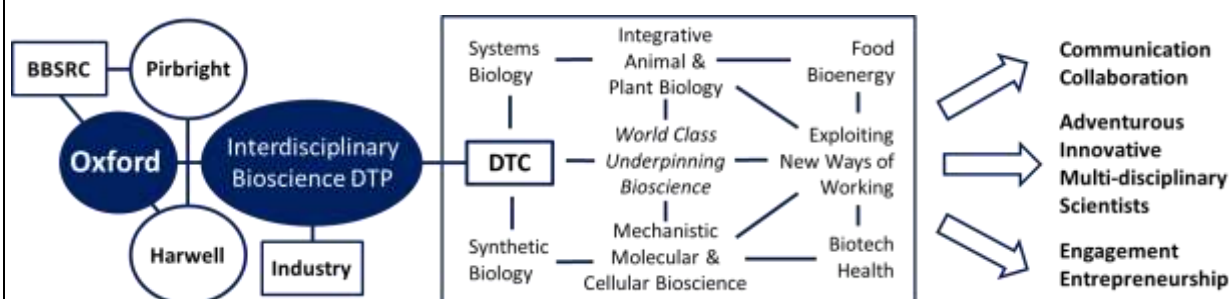
Website & Social Media: www.biodtp.ox.ac.uk

Partner organisations (for DTPs): The Pirbright Institute, Oxford Brookes University, Diamond Light Source, ISIS, The Research Complex at Harwell, STFC Central Laser Facility

Summary

The Oxford Interdisciplinary Bioscience Doctoral Training Partnership

The Oxford Interdisciplinary Bioscience Doctoral Training Partnership (DTP) draws together three centres of excellence: **Oxford (University of Oxford, Oxford Brookes University), The Pirbright Institute, and Harwell Oxford (Diamond Light Source, ISIS, The Research Complex at Harwell, STFC Central Laser Facility)**. Together, we aim to train a new generation of researchers who are equipped to drive forward the frontiers of bioscience and to translate this research into high impact applications. Modern bioscience is interdisciplinary, quantitative and fast-moving. Researchers must be able to work within and lead multi-disciplinary teams, to tackle new challenges and take full advantage of rapidly changing technologies. Our students undertake an individually-tailored training programme in an environment that supports exploration, excellence and engagement; and become fluent in the skills needed to make an impact through innovation and collaboration.



The Oxford Interdisciplinary Bioscience DTP programme is structured around four themes that align with the expertise of the partners and the aims of the BBSRC: Integrative Animal and Plant Biology (IAPB); Mechanistic Molecular & Cellular Biology (MMCB); Bioscience for Food, Industry and Energy (BFIE); and Exploiting New Ways of Working (ENWW). Our students benefit from direct access to facilities and expertise in centres that provide the UK's national capabilities for synchrotron and neutron science and research into viral diseases of farm animals, as well as world-class facilities for imaging, genomics, biochemistry, chemical biology and in vivo research. They are able to draw on expertise and resources available across the partnership to tackle important challenges such as the development of vaccines to control livestock diseases, new technologies for bioenergy production and the integrated use of biochemical, imaging and computational methods to investigate the structure and function of supramolecular assemblies.

Our training programme is based around four guiding principles: Foundation; Exploration; Excellence; and Engagement. Our students establish a strong sense of cohort identity, and a

solid foundation of scientific knowledge and interdisciplinary skills through a core training phase during which they are based in the University of Oxford's innovative, multi-disciplinary Doctoral Training Centre (DTC), which also houses five RCUK-funded training programmes focused on different aspects of research at the interface between the biological and physical sciences, including systems biology, synthetic biology, synthesis for biology and medicine, drug discovery and biomedical imaging. Our students subsequently undertake two exploratory projects with different supervisors before committing to their substantive research project, and continue to have access to advanced training offered within the DTC and across the partner organisations.

Academic, industrial and public sector scientists must be able to collaborate and communicate effectively at the interface between the physical and life sciences and at the academic/industrial interface, and be prepared to realise the potential of their discoveries through interactions with the public, policymakers, industry and entrepreneurship. Our students are supported in developing these abilities through a 4-year skills training programme specifically designed to develop interdisciplinary team-based problem solving, communication skills, commercial awareness, and an awareness of the interaction of science and society.

Case study

Nathalie Willems completed a BSc in Biochemistry at the University of Sussex before joining the Oxford Interdisciplinary Bioscience DTP in 2012. She describes her research below:

"In my first year, I took DTC courses in programming, biophysics and mathematical modelling. These shifted my interests to pursue a project grounded in computational modelling and biophysics. I use computational methods such as molecular dynamics simulations to investigate how enzymes interact with surfaces. Our aim is to provide comprehensive insight into how the nature of the surface (e.g 'soft' vs 'hard') affects the conformational dynamics of industrially-relevant lipase enzymes in the context of enzyme immobilisation. We have been able to use a multi-scale methodology to predict favourable interactions of lipase enzymes with charged lipid bilayers, which has led to a new collaboration with Novozymes, Copenhagen. Future directions will involve modelling how surfaces can affect industrially important lipases. We will establish an integrated methodology to predict optimal enzyme-surface interactions with a view towards enzyme immobilisation and industrial applications of lipases and related enzymes." Nathalie Willems

Strategic Focus & Portfolio

Doctoral research in the Interdisciplinary Bioscience DTP aligns closely with the strategic research interests of the BBSRC and the programme partners. Four themes define the scope and remit of the programme:

1. Integrative Animal and Plant Biology (IAPB). Research in the IAPB theme investigates how biological processes function in an integrated and dynamic fashion in tissues, organisms and populations. Such understanding has a vital role in underpinning improvements in human and animal health, and in supporting innovation in agriculture, crop science and biotechnology

2. Mechanistic Molecular and Cellular Bioscience (MMCB). Research in the MMCB theme uses the latest technologies to understand the fundamental principles by which microbial, plant and animal cells are built, maintained and function. MMCB research has wide-ranging impacts that range from targets and leads for drug development through to novel biomaterials and technologies.

3. Bioscience for Food, Industry & Energy (BFIE). Research in the BFIE theme develops and applies knowledge of biological systems to ensure the provision of sufficient, safe and sustainable food, with high standards of animal health and welfare; to underpin the long term security of energy supplies, and to develop innovative technologies based on biological processes and materials.

4. Exploiting New Ways of Working (ENWW). Research in the ENWW theme intersects with all of the themes outlined above, and includes the use of computational, statistical and modelling approaches and the latest bioanalytical and imaging technologies to generate insights into the structure, dynamics and evolution of biological systems, and to tackle challenges in emerging fields such as single cell and single molecule biology.

We have established a network of organisations that are helping to support the ongoing development of the Oxford DTP. These include organisations working across the breadth of our remit, including: animal health (**Aviagen, Zoetis**), crop science (**Syngenta, Manor Fresh, HDC**), vector control (**Oxitec**), nutrition (**TdeltaS**), biotechnology (**GreenBiologics, Oxford Expression Technologies**), and life science IT (**Tessella**). We are also able to build on strong links to the Defence Science and Technology Laboratory (**DSTL**) in areas ranging from vaccines and virology to the development of biomimetic unmanned air vehicles.

DTP students have undertaken internships in a wide range of sectors. PIPS host organisations include biotechnology and biopharmaceutical companies such as **Oxford Gene Technology, Oxitec** and **Chronos Therapeutics**, research organisations such as **DSTL**, science communication, policy and outreach-focused organisations such as **Oxford Botanic Garden**, and software and medical communication companies such as **Wazoku, AXON Communications** and **Remedica Medical Education and Publishing**.

Unique Selling Point

“The Oxford Interdisciplinary Bioscience DTP provides a supportive and truly interdisciplinary training environment in which students can develop the skills needed to make substantive and innovative contributions to important research questions and become part of a scientific network that will support their development as leaders and innovators throughout their careers.”

We would also like to present the answer to this question from the perspective of seven of our current students:

“I have really enjoyed working with the DTP and it’s great to have a supportive network. It is a fantastic opportunity to experience new areas of research and to learn more.” Lucy Taylor (2013)

“Rotation projects allowed me to experience different styles of supervision as well as different topics. It encourages students to be open-minded in choosing DPhils too.” Michael Barber (2012)

“Through exposure to new ideas and methods at the DTC, I acquired the skills and confidence to tackle an interdisciplinary research project of high complexity.” Charlotte Kirchhelle (2012)

“During my time at the DTP, I took courses in programming, statistical analysis and mathematics. The skills I obtained are essential in my current project, which utilises a multidisciplinary approach.” Isobel Watts (2012)

“Experiencing different types of research helped me to make an informed decision in selecting my DPhil project – I realised that I really like lab work!” Sophie Nixon (2012)

“I would have never thought of doing a computational project if not for the first term courses. And now I am enjoying it so much that I am trying to incorporate <computational skills> into my thesis.” Julia Binder (2013)

“DTP course training has helped me progress quickly and advance my understanding in a range of relevant skills. I also feel that the collaborative environment of the DTC has aided my progress and I have enjoyed sharing ideas and discussing research with other scientists from a

range of disciplines” Katerina Johnson (2014)

“Being in a cohort is a brilliant way to make new friends and settle into graduate life. It also means that you know people from different departments with very different expertise which is great for when you hit problems later in the main DPhil project.” Thomas Hughes (2012)

Challenges

The Oxford Interdisciplinary Bioscience DTP has developed a distinctive, flexible training programme that enables students to engage with the full range of world class research, training opportunities and facilities available within the University of Oxford and its partner organisations. We have been particularly successful in developing a training programme and environment in which students from diverse academic backgrounds are given the opportunity to develop quantitative and computational skills through supportive, intensive training courses.

One of the strengths of the Oxford Interdisciplinary Bioscience DTP is that students have the opportunity to undertake two 12-week rotation projects with different supervisors before selecting and commencing their substantive doctoral project, and are encouraged to use these projects to further develop their interdisciplinary skills. In our experience the opportunity to undertake rotation projects encourages an exploratory, interdisciplinary and adventurous approach to research, and helps to ensure that student, project and supervisory team are well-matched. Both students and supervisors benefit from the opportunity rotations provide for students to expand and develop their skills; to broaden their scientific network; to observe and develop best practice, and to strengthen collaborations between groups.

Challenges and opportunities for the future include

- maintaining our flexible, student-centred approach while expanding student numbers
- fully integrating the expertise of researchers within DTP partner organisations into the training programme
- supporting the development of collaborative links across the partnership
- strengthening and building on links with industry and non-academic organisations
- connecting and integrating doctoral training programmes both within the University and at different institutions to support interdisciplinary research, while maintaining the advantages of cohort-based training
- further developing our programme of professional skills training, particularly in relation to enterprise and entrepreneurship

The Food Security (Reading-led) DTP

Lead contact: Prof Richard Tiffin [j.r.tiffin@reading.ac.uk]

Operational contact: Prof Donal O'Sullivan [d.m.osullivan@reading.ac.uk]

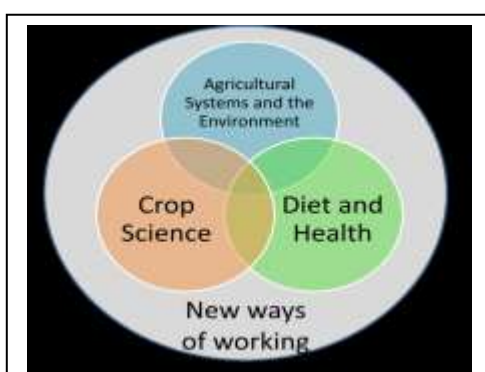
Website & Social Media: <http://www.dtpfs.org.uk/>

Partner organisations (for DTPs): University of Reading, University of Lancaster, Rothamsted Research, University of Southampton, University of Surrey

Summary

The sole focus of the Reading (Lancaster, Rothamsted, Southampton, Surrey) doctoral training partnership is Food Security as compatible with that of the BBSRC's definition of the Food Security Challenge, "...to produce and supply enough safe and nutritious food in a sustainable way for a growing global population". The Partnership is led by the University of Reading (UoR), whose cross-faculty Centre for Food Security was set up in 2009 to engender joined-up thinking and to give strategic focus to UoR's own investments in research underpinning Food Security. The structure and membership of the Food Security DTP is very closely tied to our mission statement, which is "to provide world-class training in biosciences underpinning food security, addressing sustainability in all parts of the food chain from production to human nutrition & which includes the environment in which the food is produced." The partner organisations have strong international reputations for training and research in agri-food science, with a critical mass of 600+ academic staff working in food security related disciplines.

The Food Security DTP is structured around three core themes with a cross cutting theme of exploiting new ways of working. The interrelationship and overlap between the themes is illustrated in the figure. All students are trained at the interface of at least two of the inner circles and incorporate aspects of the exploiting new ways of working underpinning theme. Thus the environment that we offer is marked by interdisciplinary working at the interfaces between the broad bioscience disciplines that contribute to food security. More details of the core themes can be found in the strategic focus section.



Training is designed around the 4 domains of the Researcher Development Framework (A: Knowledge and Intellectual Abilities; B: Personal Effectiveness; C: Research Governance and Organisation; D: Engagement, Influence and Impact) and is delivered through 3 modes: (i) Interaction with supervisors, and fellow researchers & technicians (Domain A); (ii) Bespoke training for the Food Security DTP (Domains A, B, D); (iii) Locally delivered generic researcher development training at each member organisation (made available to DTP students from

any partner; Domains A-D). The bespoke DTP training is delivered through residential schools. Training in this form brings DTP students together as a cohort across multiple intakes, building strong networks between students (which are subsequently sustained by a Yammer network). At these residential schools, students are exposed to food security issues outside of their research specialism and are provided the opportunity for peer-peer reflection on career-related skills and values and their relationship to career choice.

Student Case Study: Frances Cheesman (Rothamsted Research-University of Reading)

Frances' project 'The microbiology of lean and obese soil', http://www.dtpfs.org.uk/phd_project/2143/, has been a great success so far. The aims of the project were to determine the role of free living soil *Bradyrhizobium* isolated from a range of agronomic soils by exploring their metabolic and genetic potential. Soil metagenomic (sequencing complex microbial communities) data had previously indicated that bradyrhizobia constituted a high proportion of the soil microbial community. The corresponding number of nitrogen fixation genes normally associated with bradyrhizobia (fixes atmospheric Nitrogen in a range of legumes, important for agriculture) were however not present indicating a different role in the soil ecosystem.

The ability to isolate and culture free living bradyrhizobia was unknown prior to the start of the project. Frances has so far managed to isolate 40 different isolates. Metabolic profiling (96 substrates) has indicated that they can use a range of different carbon sources and that this may depend on the environment (woodland, grassland, arable, bare fallow) from which they were isolated.

DNA sequencing of the small ribosomal subunit (16S rRNA gene, used for phylogenetic classification of bacteria) confirmed that all isolates are from the genus *Bradyrhizobium*. Further analysis will be done using a range of core and accessory functional genes (particularly those involved in nitrogen cycling) to confirm their phylogenetic relationship and to determine how different land managements have influenced the diversity and function of this important group of bacteria. In addition Frances has generated two bacterial genomes, a bare-fallow isolate and a grassland isolate. Two high throughput sequencing methodologies were used: Ion torrent PGM shotgun sequencing, for generating the number of sequences required for good coverage and illumina HiSeq 6Kb Mate Pair sequencing, to bridge gaps and close the genome. This approach appears to be working successfully and will generate either a complete or very nearly complete genome very shortly. The genome size of both isolates appear to be around 7.5 Mb compared to Nitrogen-fixing symbiotic bradyrhizobia which are around 9 Mb.

Put together all the data that Frances is generating will give us insights into the role of this highly abundant environmental bacterium, its role in carbon and nitrogen cycling (denitrification, responsible for nitrous oxide emissions), how it is adapted to different environments and whether we can manage these environments to better reduce fertilizer losses and nitrous oxide emissions.

Outside of the immediate PhD research, Frances has just completed her PIP at the Royal Institution and also took place in the BBSRC's BiotechnologyYES competition this year; Frances's group won a prize for best plant/microbial/environmental business plan which was sponsored by Syngenta.

Strategic Focus & Portfolio

As mentioned above, the sole focus of the Reading (Lancaster, Rothamsted, Southampton, Surrey) doctoral training partnership is Food Security encompassing three core interactive themes (see Figure in Summary) with a cross cutting theme of exploiting new ways of working.

The *Agricultural Systems & Environment* theme recognises that crops are not grown in isolated ecosystems but also interact with the natural environment. Thus we analyse the ways in which natural biodiversity contributes to and is affected by agri-food productivity. Both above & below ground systems are included.

The *Crop Science* theme combines plant biotechnology for crop improvement with crop physiology & pathology. It includes interactions of crops with the environment eg responses to abiotic stress & modelling the impacts of climate change on production & quality

The *Diet & Health* theme focuses on the effects of food on human health, recognising that food security is ultimately about delivering a nutritious diet. We have expertise in the impact of food & dietary components on health, & in food processing to maintain nutritional quality. The fourth cross cutting theme, *Exploiting New Ways of Working*, ensures that mathematical & computational approaches, & the use of novel technologies, are incorporated into all research training in the partnership.

This strategy provides the framework for delivering the core bioscience skills in the context of research on food security. Students are exposed to the breadth of the food security agenda, thus developing an understanding of how a variety of disciplinary perspectives can complement each other in addressing the challenges which confront our society. The compulsory inclusion of new methods of working in the training programmes of all students (including the SysMIC Systems Biology online course) ensures they all have a strong understanding of the potential contributions of modelling, mathematics & data analysis to modern bioscience.

PIPs that have taken place/ are underway:

Student	PI Institution	Supervisor	Host	Placement date
Frances Cheeseman	Reading	P Hirsch	The Royal Institution (Ri)	29/09/2014
Skevoulla	Surrey	J Johnston	Biochemical Society	06/10/2014
Elaina Marie Maldonado	Surrey	J Moore	British Nutritional Foundation	15/10/2014
Nick Evens	Southampton	L Williams	Forestry Commission	05/01/2015
Frederick Steinmeyer	Reading	H Jones	Growing Underground	01/02/2015
Aislinn Pearson	Lancaster	K Wilson	CABI	19/01/2015

Unique Selling Point

“Strategic training of food security experts in an interdisciplinary context is our hallmark.”

The Reading (Lancaster, Rothamsted, Southampton, Surrey) doctoral training partnership is the **only** DTP focussed solely on Food Security, giving our students some of the best resources, experience and skills for flexible careers in the bioscience industry. Our mission is “to provide world-class training in biosciences underpinning food security, addressing sustainability in all parts of the food chain from production to human nutrition & which includes the environment in which the food is produced.”

Our Food Security focus together with our project selection and training model enable our partnership to support strategically important and vulnerable areas relevant to the Food Security challenge: e.g. crop science, horticulture, entomology, agronomy and soil science. Projects that span the interfaces of disciplinary boundaries (see Figure) are selected on the basis of their scientific excellence and their alignment to strategic and/or vulnerable areas. Excellent students are recruited to these projects and immediately (without ‘rotation’) start project research.

Challenges

Interdisciplinarity is at the heart of what we do and we genuinely function as a partnership

operating on multiple axes joining institutional partners. All projects have supervisors from two institutions and two different areas of science. However, after the first (2012 intake) round of projects were selected, the management board had a concern that not enough new supervisory teams were coming together to put forward project ideas and it was the initial aspiration that the DTP would catalyse new collaborations as well as strengthening existing ones. To address this concern, the DTP management board introduced an annual partnership facilitated workshop which brings together the supervisory pool and stakeholders from the partner institutions to brainstorm project ideas. This successful workshop not only generates PhD projects but also allows interactions which have led to other forms of funding application.

We have not been able to develop a formal training programme which meets the apparent requirements of the BBSRC. This is because of the small numbers of students that we have funding for and the diversity of science which is covered in food security and runs from sub-cellular to ecosystem science. Instead we believe that more localised training coupled with our insistence in inter-disciplinarity is an alternative route to providing the breadth of training that students require. This coupled with a summer school also delivers the cohort identity that is required.

London Interdisciplinary (UCL-led) DTP

Lead contacts:

Director; Prof Gabriel Waksman FRS, FMedSci
 Head of Department of Structural and Molecular Biology, UCL
 Head of Department of Biological Sciences, Birkbeck College
 [g.waksman@ucl.ac.uk]

Deputy Director; Prof Geraint Thomas
 Department of Cell & Molecular Biology, UCL
 [0203 549 5456; g.thomas@ucl.ac.uk]

Operational contact:

DTP Administrator: Mrs Nadine Mogford
 Division of Biosciences, UCL
 [0203 549 5458; n.mogford@ucl.ac.uk]

Website & Social Media: www.lido-dtp.ac.uk

LinkedIn Group: [BBSRC London Interdisciplinary DTP](https://www.linkedin.com/groups/BBSRC-London-Interdisciplinary-DTP/)

Facebook: <https://www.facebook.com/groups/BBSRC.LIDo/>

Partner organisations (for DTPs):

- Birkbeck College London
- Kings College London
- London School of Hygiene and Tropical Medicine
- Queen Mary University of London (from October 2015)
- Royal Veterinary College
- University College London

Summary

The London Interdisciplinary Doctoral (LIDo) Training Partnership is a first-class environment for outstanding training aligned with BBSRC's priorities for the "age of bioscience". Since 2012 LIDo has combined the research strengths of Birkbeck, King's College London, The London School of Hygiene and Tropical Medicine, The Royal Veterinary College and University College London. The core of KCL/UCL research intensity and excellence channels the focused quality of the centres specialising in structural biology, animal health and welfare, plant sciences and public and global health. Our rich landscape of interactions provides many new exciting opportunities for the brightest science graduates to develop as research professionals through the experience of discovery and innovation at both the frontiers and interfaces of disciplines.

At **UCL** the cross faculty structures and institutes support structural molecular biology (with Birkbeck), nanotechnology (with Imperial), both computational biology and computational medical sciences, the physics of living systems and also drug discovery. Joint appointments and expanded collaboration in BBSRC priority areas strengthens excellent links to the ZSL, The Natural History Museum and The Francis Crick Institute. In general LIDo research aligns with both of UCL's Global Health and Human Wellbeing Grand Challenges. **KCL's** long-standing interdisciplinary strengths are housed in the Randall Institute (structural/cell biology), the Institute for Mathematical & Molecular Biomedicine, a Centre of Human & Aerospace Physiological Sciences, The Dental Institute (biomaterials & bioengineering) and the Wolfson Centre for Age-Related Diseases. Also complex chemical systems and the bioscience interface underpin the re-launched Chemistry Department while centres for ultra-structural imaging and the JEOL/Nikon/Leica sponsored International Centre of Excellence

emphasise super resolution innovation. Routes to impact can be explored through the Innovate UK (TSB) Cell Therapy Catapult and the Institute of Pharmaceutical Science (IPS) which has been responsible for >£300M in spinouts. **Birkbeck** is essential to LIDo because of research focused in two departments: Biological Sciences delivers profound expertise and facilities for structural biology (with UCL) and molecular microbiology while Psychological Sciences emphasises developmental neuroscience (ageing) and cognition over the human life course. **LSHTM** combats human and animal pathogens including ebola, malaria, TB, leprosy, dengue, bacterial infections, virulence and the drug resistance/discovery interface using modern genomic approaches. Joint senior appointments with the Crick & Sanger Institutes and internationalization of fundamental and translational research through the LSHTM–UCL Bloomsbury Research Institute is reinforced with £148M funding including upgrades for specialist breeding and pathogen containment. Expansion of LIDo to include **QMUL** brings coverage of plant sciences especially the molecular machinery of photosynthesis, plant genetics/genomics, taxonomy and horticulture (with the RBG Kew). QMUL conducts BBSRC funded research in both the Faculties of Science & Engineering and Medicine & Dentistry. Recent appointments in behavioral genomics, bioinformatics and animal replacement science are augmented by a history of impact through London's largest bio-incubator and major spinouts valued at £290m. **RVC** is home of the London Bioscience Innovation Centre – the second of London's three bio-incubators – and delivers BBSRC-oriented excellence in integrative comparative locomotor systems, veterinary epidemiology & public health (especially in emerging livestock zoonoses and host-pathogen interactions) along with vaccinology for endemic protozoal and bacterial diseases. RVC is expanding work in pathogen evolution, and ecosystems health research and enjoys global reach with many headline overseas projects.

LIDo fosters research efficiencies by supporting the formation of cross-institutional project teams and inspires investigators to connect to research capabilities and networks not normally available. Only very high quality projects matching both BBSRC priority areas and our requirements for interdisciplinarity are accepted into the programme and we maintain a 6:1 excess of projects to students allowing considerable freedom of choice. LIDo management actively promotes adventurous and forward-looking projects proposed by co-supervisory teams where each partner is from a clearly distinguished research discipline. 49% of our students have 1st-class degrees, 49% Masters or MSci and 64% have relevant experience from industry. In 2015 applications are up by 270% with 10:1 over-subscription for places. This presumably reflects the growing standing of both the programme and students. Preservation of the mix of qualifications and experience means that we can aim to improve our intake further and accept only the top 10%.

Our ambitious skills training programme can deliver post-doctoral professionals to public and private sectors with the core skills necessary to exploit new ways of working (ENWW) and employment of new tools and advances in all areas of BBSRC priority. We place an emphasis on enhancing skills in mathematics and computing for effective bioscience research in an environment of ever expanding data richness. Our unique engagement with the SysMIC program established by **Birkbeck and UCL** and access to new post-graduate bio-business courses emphasizes commitment to ENWW and knowledge transfer at the earliest stages of research training.

Case study

A LIDO student case study: Christopher Penny. "My PhD project is a collaboration between two researchers with quite different areas of expertise. Prof. Patel (UCL) works on Ca²⁺ signalling and the putative function of the two-pore channels (TPC) within these pathways, whilst Prof. Wallace (Birkbeck) has uses structural and biophysical techniques to study related ion channels. I use their expertise to study the structure and function of the TPCs on both a molecular and cellular scale, using a wide array of interdisciplinary techniques. With a mathematician I have utilised the skills from SysMIC to publish a computational model of TPC activity in local and global Ca²⁺ signaling (recommended on F1000Prime) and two

further publications. The DTP's focus on interdisciplinary and cross-institutional research has allowed me to gain superb skills and generate novel, useful and interesting data, and will hopefully continue to do so!"

Strategic Focus & Portfolio

LIDo will undertake PhD training in a large proportion of the BBSRC's research priority areas using our interdisciplinary and inter-institutional approach. Uniting new strengths in plant biosciences with existing power in animal physiology from RVC means that we can contribute to the **Agriculture and Food Security** priority by delivering projects targeted at productive, sustainable agriculture, livestock health, biofuels and other bio-products. Interactions with LSHTM offer opportunities to investigate the pathogenesis of animal and human disease (including prevalent and exotic zoonoses), to address pathogen resistance and to couple virus research to traditional and novel vaccine development. The **Industrial Biotechnology and Bioenergy** priority is captured through the involvement of excellent engineering and chemistry departments with strong records of translational collaboration with industry. This creates opportunities in synthetic biology and systems approaches to the manufacture of useful bio-products as well as novel drug development and production. Our many interfaces within the outstanding biomedical research environments found in central London (which is especially concentrated in many of our partners) allows productive engagement with the **Bioscience for Health** strategic priority. This interaction also maintains exposure to current and emerging biomedical and health problems and opportunities for translation of fundamental science. LIDo reach extends to regenerative medicine and tissue engineering, quality of life issues in neuroscience, and the multi-scale biology of digital organisms and humans. Specifically LIDo has sponsored PhD projects in the following areas of BBSRC interest:

- Animal health
- Bioenergy - replacement, greener fuels
- Antimicrobial resistance
- Data-driven biology
- Food, nutrition and health
- Healthy ageing
- Strategic approaches to biotechnology
- 3Rs - replacement, refinement and reduction
- Synthetic biology
- Systems approaches
- Technology development for biosciences and health
- Welfare of managed animals

Between 2015 and 2023 we aim to engage with established and emerging industry sectors by placing new emphasis on knowledge exchange and transfer to business and industries ranging from SMEs to multinational, global bio-businesses. In addition we are well placed to accommodate projects that offer opportunities for entrepreneurial activities as LIDo partner institutions encompass over two thirds of the bio-incubator resource available in London.

PIPS Internship hosts include UK and foreign government departments, UK and global NGOs, global bioscience industry, policy units, science communications industries, international consultancy and business analytic groups and leading centres for the public understanding of science. For example, in alphabetical order:

- Axona
- Chronos
- Embassy of Nepal
- GSK and Takeda
- IHS (international analysis and consulting)

- IMC Healthcare Communication
- King's College London Institute of Cancer Policy
- L'Oreal
- Malawi-Liverpool-Wellcome Trust Clinical Research Programme
- Parliamentary Office of Science and Technology
- Portland Press - Biochemical Journal
- Royal Society of Chemistry
- "Science" magazine/AAAS Science International Inc
- Science Museum
- Synthetic Genomics Inc.
- TEVA
- The Royal Institution of Great Britain
- World Health Organization (WHO)

PIPS case study: Helina Marshall, Diagnostics laboratory auditor, Queen Elizabeth Central Hospital, Blantyre Malawi on behalf of the Malawi-Liverpool Wellcome Trust Clinical Research Programme (MLW). September – December 2014.

"My primary responsibility was to carry out internal audits of all MLW clinical diagnostics laboratories with the aim of progressing towards GCLP and ISO accreditation. These laboratories process almost all patient samples at the largest hospital in Malawi. In addition I delivered a large amount of the training on correct aseptic technique. This was motivated by a Typhoid outbreak in Blantyre city and the surrounding villages and also by the Ebola outbreak in West Africa, in readiness for Ebola reaching Malawi. This training is now crucial following the devastating flooding in this region of Malawi over Christmas, causing the number of cases of Typhoid, Malaria and many other communicable diseases to soar. Differences in culture and required skill sets made for a steep learning curve. However, I'd like to think that I stimulated some positive change. The main aim of my work was to highlight potential problems and to try to implement changes, where possible, that might improve these. I aimed to include the opinions of the Malawian staff and to put forward their suggestions on how to make their work more manageable and enjoyable. I also provided training on specific topics to further the continuing personal development of the technical staff. On the whole, although sometimes difficult, my time at the Queen Elizabeth Central Hospital was hugely enjoyable and rewarding."

Unique Selling Point

"LIDo: Training for the Interdisciplinary Future of 21st Century Bioscience"

The **vision** of LIDo is to create outstanding bioscience professionals capable of making profound contributions in science, business, commerce and policy over the next 40 to 50 years. There is no doubt that work in all of these arenas will change dramatically as new discoveries and technologies put increasingly ambitious objectives within reach. LIDo graduates will therefore combine the excellent specialist skills and bedrock knowledge invaluable at earlier career stages with enhanced capacity for collaboration between disciplines, interaction between public and private sectors and develop an openness and enthusiasm for change. They will be capable, confident individuals well equipped for a competitive future. Collectively we understand that ground breaking bioscience research requires analysis of complex molecular networks, signalling pathways, cells, tissues, organs, organisms and communities operating in isolation and in systems. These investigations increasingly benefit from the vertical transfer of knowledge between biological scales and this new scientific landscape necessitates a different approach to research training that crosses the boundaries that have historically isolated disciplines.

The **mission** of the LIDO programme is to produce world-class post-doctoral professionals who are able to rise to the challenge of generating and acquiring novel data and extract meaning from it by developing a sophisticated mathematical and computational literacy. This can be encapsulated by the strapline:

LIDo; Training for the Interdisciplinary Future of 21st Century Bioscience

The **unique selling point** of the London Interdisciplinary Doctoral Training Programme (LIDo) is that each cohort, comprised of young scientists with a diversity of subject-based experience, will graduate well prepared to tackle both “hard” aspects of biology and biotechnology research such as computational analysis and the “soft” biology of organisms, cells and tissues.

Key factors that contribute to achieving this aim are:

- Selection of high calibre students with background knowledge and experience in areas ranging from mathematics and engineering to molecular biology and biomedical sciences; About 40% of LIDo applicants have first degrees in established bioscience disciplines, 30% in medicine and subjects allied to medicine and the remaining 30% are from mathematics & physical sciences, engineering & computing, plant, agricultural and environmental disciplines and arts and humanities. Where applicants have refined their training through one or more post graduate degrees we find that most often they choose disciplines like biotechnology, biology, biochemistry, computer science, biological or medical computing, immunology, cancer biology, chemistry, drug development & pharmacology, mathematics & modelling, neuroscience, systems biology and a wide assortment of subject related to modern medical research like tissue engineering or regenerative medicine. This diversity amongst our students is a strength of LIDo as it mirrors the diversity in our project portfolio;
- Development of a portfolio of adventurous and forward-looking PhD projects in BBSRC priority areas, each with an associated 4 month rotation project, that are co-supervised by a team comprised of partner from clearly distinct disciplines;
- Our requirement for first year students to undertake two four month rotation projects based in two different partner institutions with selection of the thesis project finalised after eight months on the programme. This offers all students an authentic sample of the research cultures of different partner institutes, strengths of supervisory teams and available infrastructure and resources before they choose their final PhD projects;
- Mandatory participation in a fast-track version of SysMIC Modules 1 and 2 (**S**ystems **T**raining in **M**aths, **I**nformatics and **C**omputational Biology) which entrenches systems and interdisciplinary skills for bioscience research. SysMIC training offers high-powered mathematical, statistical and computational skills and experience in applying these to biological systems for all BBSRC sponsored researchers. The unique colocation of the SysMIC project team within the LIDo partnership offers an intensive training experience and additional benefits and opportunities before they are rolled out to the wider community;
- Participation in lecture-based training in *either* world-class bioscience that is delivered by researchers from across the LIDo consortium and beyond *or* bio-business and entrepreneurship. This ensures the proper orientation of the LIDo student cohorts towards bioscience relevant to and the BBSRC and the wider bioscience economy;
- Encouragement of cohort building and knowledge exchange throughout the programme, informally through social activities and social media and formally through participation in an annual student residential conference and attendance at first year student rotation

project symposia twice a year;

- Creation of an Internship and Industry Impact Committee to oversee developments in industry links and with potential internship partners and support the work of the UCL Careers Office team in organisation of PIPs for LIDo students;
- Sharing of resources and access rights between LIDo partners is also crucial. All LIDo students enrol initially through UCL but then remain associated through a “shadow enrolment” that guarantees access to library and computing as well as research infrastructure and expertise. In addition all existing LIDo partner institutions are members of the Bloomsbury Postgraduate Skills Network (<http://courses.grad.ucl.ac.uk/bloomsbury/>). This facilitates continued access to the hundreds of generic research skill and personal transferable skill courses aligned with the Vitae Researcher Development Framework and available in London.

Challenges

LIDo has been active since 2012 and the management team has overcome many of the challenges faced by a large, highly diverse multi-centre research partnership. There are many relationships to be managed – those between researchers, supervisors and students, local finance and administrative systems, university registry and student services (especially those surrounding academic regulations and admissions, monitoring, progression and examination). However institutional investment in dedicated administrative support and the maintenance of a core management structure and delivery team has ensured that most of these have been overcome or are being managed successfully. Looking forward we believe that the principal challenges will be:

- Expanding our highly professional administrative team and embedding effective communication across all partner institutions. This includes providing support for the students and academic supervisors involved in the programme and supporting and managing the PIPS programme;
- Ensuring an equitable distribution of students across the partnership whilst maintaining student choice as the primary driving factor in project selection (overcome in DTP 1; continuing challenge for DTP 2);
- Ensuring true interdisciplinary nature of the projects offered to each cohort of students;
- Ensuring equitable, transparent and well-documented recruitment as the DTP expands;
- Balancing the workloads of academics and support staff who contribute to LIDo management especially during periods of peak activity;
- Introducing business-oriented training in a structured way that is appealing to the majority of students taking the course so that the modules are well populated without the need to make the training compulsory (for DTP2);
- Maintaining a cohesive cohort of 30 to 40 students per year (DTP2) when the mechanisms designed to do this were produced for a cohort of 18 to 22 students (DTP1). This will require a considerable uplift in the profile of the programme, the creation of even more visible “points of contact”, record keeping, internal and external reporting procedures, workflows and annual timelines of activities and inter-institutional agreements. The maintenance of high-quality student input into key committees will be prioritised;
- Managing increasing demand and expectations of existing and prospective supervisors given a challenging funding environment.

Midlands Integrative Biosciences (Warwick-led) DTP

Lead contact: Dr Katherine Denby, University of Warwick [k.j.denby@warwick.ac.uk]

Operational contact: Dr Katherine Denby, University of Warwick

Website & Social Media: <http://warwick.ac.uk/mibtp>

Partner organisations (for DTPs): University of Birmingham, University of Leicester

Summary

The Midlands Integrative Bioscience Training Programme (MIBTP) is a partnership between the Universities of Warwick, Birmingham and Leicester designed to train students in interdisciplinary and quantitative bioscience. MIBTP is designed to deliver innovative, world-class research across the Life Sciences to boost the growing Bioeconomy in the Midlands and across the UK. Birmingham, Leicester and Warwick are research-intensive universities with clear goals to increase the volume and excellence of their research.

MIBTP includes 25 departments and several research centres, all with specialisations that align to BBSRC strategy priorities. MIBTP partners have overlapping and unique areas of research expertise creating an environment not possible with one institution alone. Warwick has a distinctive record for pioneering and fostering interdisciplinary research training and has been very successful at embedding state-of-the-art biology with physical and mathematical sciences to create novel synergies. All three Universities have outstanding research in world-class biosciences. In addition, Warwick has great strength in food security ranging from plant systems biology to agronomy, farm animal health and wellbeing. Two newly created centres, the Centre for Integrative Synthetic Biology and the Centre for Industrial Biotechnology and Bioenergy, provide facilities and world-class leadership in synthetic biology and industrial biotechnology with strong links to industry. Birmingham contributes strengths and depth in industrial biotechnology (focused on the Centre for Biochemical Engineering), and microbiology (Institute for Microbiology and Infection) as well as the application of data-rich methodologies such as metabolomics (NERC Centre for Metabolomics), proteomics, high throughput sequencing and quantitative imaging. Leicester has particular strengths in gene expression, structural biology, genome dynamics, cell signalling, neuroscience and hosts the MRC Toxicology Unit, the UK's foremost centre for research into the molecular basis of responses to external molecules. New investments such as the Centre for Genetic Architecture of Complex Traits (GATC) and the Centre for System Neuroscience highlight Leicester's commitment to new ways of working in the biosciences.

A key objective of MIBTP is to train researchers to routinely apply computational and mathematical techniques to high-quality quantitative biological data. During the first three months students take taught modules and masterclasses. The taught modules include Module 1 of the BBSRC-funded SysMIC course and a custom module taught by Warwick Systems Biology Centre on statistics and programming. Training in an extensive range of hands-on laboratory and theoretical skills is delivered via a set of technology-driven master classes. These are been extremely popular with the DTP students and provide them with confidence and experience in a wide range of techniques prior to their mini-projects. It is also an effective way to expose the students to the technologies used by researchers at each of the partner institutions and to the researchers themselves, helping facilitate choice of mini-project.

During the rest of Year 1, MIBTP students carry out two 3-month miniprojects and their professional internship. We are unusual in requiring the PIPS to be done during the first year

but have found that students benefit from exposure to broader science and impact early on in their training and they acquire useful skills and contacts outside academic research that they can bring back to enhance their PhD projects in the following years. We require students to do their miniprojects at two different partner universities and one project will be primarily in an experimental area, while the other will normally be much more theoretical, aimed at learning new data analysis techniques and/or computational/mathematical modelling. To support the start of research work we run a 3-day version of the Vitae induction course "Speed PhD". Students are introduced to all aspects of PhD research in this time, including reviewing the literature, project planning, risk analysis, safety assessment, ethics review, poster presentation, paper writing, applying for jobs, thesis writing and finally defending the thesis in a viva. This is an extremely valuable and enjoyable exercise, teaching skills in teamwork and working under pressure and also developing strength within the cohort and an awareness of what is involved in completing a successful PhD.

MIBTP students carry out their PhD research in years 2-4 whilst continuing training in transferable skills. Students are enrolled on Postgraduate Certificates in Transferable skills and within their cohort participate in a Teamwork Skills course in the Lake District, and organise the Annual MIBTP Conference. Additional modules are selected from a range available within MIBTP including Science communication, decision making, Introduction to Teaching, Envisioning and Enabling Innovation and Research Ethics and Practice. Chris Morgan from the 2012 cohort has become an excellent science communicator and MIBTP outreach expert. He won the 2014 University of Birmingham (UoB) Three Minute Thesis *competition* and was one of 17 finalists in the international competition (Universitas 21) out of more than 800 applicants. He won a UoB video competition 'Less Talk More Action', performed a routine at a research stand-up comedy night at Birmingham's REP Theatre and reached the Midlands final of the science public engagement competition, Fame-Lab. Chris also designed and implemented an event "Flower Power" at the ThinkTank Science museum which he also took to the UoB's city centre pop-up shop Think Corner.

Strategic Focus & Portfolio

MIBTP focuses on three Priority Research Themes; Agriculture and Food Security, Industrial Biotechnology and Molecular Systems Biology where there are particular strengths and research opportunities in well funded labs within the partnership. Throughout all themes there is an emphasis on multidisciplinary approaches. The majority of students are expected to employ quantitative analyses and/or new and emerging technologies in a significant part of their research building on the new skills acquired in the training year 1. MIBTP delivers a multidisciplinary research training programme, recruiting students with first degrees in either experimental sciences such as biology and chemistry or more theoretical sciences such as maths, physics or computer science based on their potential to become first rate scientists within the BBSRC remit. Initial cross-disciplinary training for all students in advanced experimental techniques and quantitative methodology builds a student cohort ready to embrace multidisciplinary approaches in subsequent research.

In the new MIBTP we are addressing three vulnerable areas: Plant and Agricultural Sciences, Whole Animal Physiology, and Industrial Biotechnologies, in addition to Quantitative Biology, an overarching capacity that needs continuing development. We have support from BASF and the British Society for Plant Pathology to run an annual Grand Challenges in Plant Pathology Study Group. This will involve PhD students in plant pathology from MIBTP and DTPs led by Oxford, Exeter, Nottingham, Reading, John Innes Centre and Imperial providing an excellent range and critical mass of Plant Pathology expertise. The study group will consist of advanced training and research seminars, but also a sandpit type activity in which attendees have to work together in groups to come up with innovative solutions to current challenges in plant pathology alongside industrial participants.

MIBTP will be part of a Horticulture Study Group that will bring together DTP students from MIBTP, Nottingham, Reading and others that work on topics relevant to horticulture. This group will meet annually for research talks and networking and will also have at least annual visits to horticulture relevant industry such as breeders, growers or supermarket centres. Similarly an Animal Physiology Study Group will be developed that will meet at the different partner Universities each year. This will involve animal physiologists that are MIBTP or other PhD students from the three partner Institutions. We will create a forum where innovation in technologies, scientific questions and 3Rs are discussed and shared among the students. The study group will consist of training and research seminars, but also of facilitated group activities to develop novel solutions to the challenges faced in this area. These activities, along with targeted recruitment in Industrial Biotechnology, will help build capacity in vulnerable research areas.

In addition to the industrial support for our Grand Challenges in Plant Pathology study group, we have two MIBTP students on projects with CASE partners, AstraZeneca and [P1vital](#).

Students are encouraged and helped to find supportive and informative PIPS internships.

Example organisations hosting MIBTP students are:

University Professional Offices:

- Enterprise & Business Development Offices (Warwick Ventures, Alta Innovations)
- Finance Office, University of Birmingham
- Biology Department, University of Hull
-

Outreach organisations: GENIE-CETL (Genetics Education Networking for Innovation & Excellence)

- The Birmingham Think Tank

Commercial organisations:

- GlaxoSmithKline Registrations (GSK)
- Leicester Education Business Company
- Waltham centre for pet nutrition
- BaCWAN, University of Warwick
- The Binding Site Group Ltd, Birmingham
- Fixed-Phage Ltd
- Micropathology Ltd @Warwick Science Park
- Begbrooke Science Park, Oxford

National and International organisations:

- Royal National College for the Blind
- The NFU
- AHDB (BPEX (R&D team), EBLEX, the Potato Council, and HGCA
- World Health Organisation, Geneva
- CABI, Plant Clinics, Kenya
- EPSO (European Plant Science Organisation)
- BBSRC Global Food Security
- BSPP (British Society for Plant Pathology)

Education:

- John Henry Newman Catholic College
- Bishop Ramsey CE School

Unique Selling Point.

“MIBTP: training the next generation of quantitative bioscientists - new technologies, new tools”

Interdisciplinary training is core to the ethos of the MIBTP. First year training is focused on quantitative skills and applying these to bioscience, with students undertaking taught modules, masterclasses and a miniproject in systems biology and computational/mathematical biology. PhD projects require two supervisors from different disciplines and represent “new ways of working”.

MIBTP ensures students experience the research environment at all three partner Institutions. This is achieved through masterclasses and miniprojects, and ensures students have a strong network of scientific support. Successful mini-projects also foster new collaborations between laboratories from different fields of study and different Universities.

Cohort development is another key focus of MIBTP. We work hard to ensure that students at all partner institutions have a sense of cohort and have seen that it is proving beneficial during their PhD research. All taught modules are at Warwick so students spend at least 2 days a week together during the first three months. During years 2-4, a variety of regular activities ensure all students continue to meet and cohort identity is developed further. These activities include skills training, annual conference, poster symposium, and careers events.

MIBTP has a strong programme of transferable skills training spearheaded by the Speed PhD course in year 1 but including training in skills such as science communication, research ethics and practice, decision making and leadership. Personal Development Planning is an integral part of the PhD programme and informs decisions such as masterclass, miniproject and PIPS selection in year 1 as well as further training in years 2-4.

MIBTP has a significant focus on food security research. 40% of our studentships (22 a year) will be in the area of food security. Research in this area involves development of research tools and understanding over different biological scales, from molecular systems biology through to population-led systems and epidemiological modelling. Our excellence in Food Security spans three Kingdoms (plants, animals and microbes) and MIBTP offers an outstanding breadth of training opportunities. In plant and crop science, MIBTP encompasses a broad spectrum of research from fundamental to applied, and is uniquely placed to combine genetic, genomic and systems approaches with crop species to find genes underlying agronomically important traits. We are launching a Grand Challenges in Plant Pathology Study Group, sponsored by BASF, to enhance the training offered to plant pathology students and attract top quality students to this crucial area.

Challenges

Key challenges that we have overcome in MIBTP are i) cohort development between geographically separated partner institutions, ii) building awareness amongst students and staff of the research portfolio at each institution to enhance research collaboration and training for the students through optimal miniproject selection, and iii) engaging a wide range of staff in the PhD programme and ensuring they offer suitable interdisciplinary projects.

We have managed to build a strong sense of cohort amongst the students by ensuring that much of their training is done together, that students move between partner institutions in the first year and that subsequent MIBTP- and cohort-wide events occur during the PhD years. These include annual conferences and symposium, transferable skills events and careers events.

MIBTP students are exposed to the research at all partner institutions by having to carry out miniprojects at two different institutes and taking masterclasses at the different universities. These provide them with contacts that they can maintain throughout the training programme. Furthermore, through annual conference and poster symposium events the students hear about the research of the whole cohort and learn what their fellow students are investigating. With respect to the staff, they are invited to the poster symposium where the range of MIBTP research is show-cased. They are also able to make new contacts and collaborations through the miniproject selections of their PhD students and via our website are proactive about finding potential collaborators.

To ensure we have a strong selection of high quality interdisciplinary PhD proposals, we have engaged a range of staff to help with the MIBTP training programme to ensure they understand the programme, the type of training students receive and how to recruit students to their groups. Staff from all three partner Universities are involved in the taught modules, masterclasses, and transferable skills events as well as short-listing and interviewing candidates. By requiring PhD proposals to have two supervisors from different disciplines, supervisors need to make research connections with other groups and have the framework to initiate new collaborations.

Challenges that we are facing include i) ensuring successful progression of students within the 4 years of funding, ii) improving recruitment of students from non-biological backgrounds and iii) enhancing collaboration with industry.

We are trying to ensure that students successfully complete their PhD within the 4 years of funding through an active monitoring scheme. During the first year, mentoring and support is provided by the DTP Director and Co-Directors, and, once on mini-projects, their mini-project supervisors. During their PhD each student will have two supervisors representing different disciplines and/or types of expertise. Students and supervisors meet formally each month and records of these meetings are uploaded to our online database system. Each student will have an Advisory Committee (minimum 2 members) that formally monitors progress and reviews research goals and thesis plans.

We have a small proportion of students from a non-biological background but would like to enhance this to increase the diversity of our cohorts. We have added a requirement for Maths A level or equivalent this year and will review the effect of this on our recruitment. We use FindaPhD, Twitter, the MIBTP website as well as subject-specific organisations and publications to advertise our programme and will review this and our use of keywords for future rounds.

We have an Advisory Board with industrial members and engage with a large number of industries for the Careers Symposium held annually in Leicester. Several students have carried out PIPS in commercial science organisations and some have maintained a professional relationship with these companies after their PIPS. However, we would like to enhance our engagement with industry further. We have obtained sponsorship from BASF for an annual Grand Challenges in Plant Pathology study group and this will be an excellent opportunity for students to network and for new research collaborations to arise. We are also looking to increase the number of studentships that are converted to CASE awards. The Synthetic biology centre at Warwick has a significant number of industrial partners and supporters and MIBTP can benefit from those interactions and projects.

AstraZeneca ICP



Lead contact: Graeme Smith [graeme.smith2@astrazeneca.com]

Operational contact: Graeme Smith

Summary

AstraZeneca is a global biopharmaceutical business whose focus is on the discovery, development and commercialisation of prescription medicines for six important areas of healthcare: cancer, cardiovascular and metabolic disease, respiratory, inflammation and autoimmunity, infection and neuroscience. AstraZeneca operates in over 100 countries and our innovative medicines are used by millions of patients worldwide. AstraZeneca is one of only a handful of companies to span the entire life-cycle of a medicine from discovery, early and late-stage development, to the global commercialisation of primary care, speciality care-led and specialty care medicines. Early R&D efforts are conducted by our small molecules (Innovative Medicines) biotech group, which is responsible for discovery and development of new medicines up to clinical proof of concept. Since 2009 we have been awarded 72 BBSRC ICP/iCASE studentships. Internally, the ICP/CASE studentship scheme has proven very popular due to the quality of applicants, the attractiveness of collaborating with academic labs, alignment of BBSRC and AZ strategic imperatives and the cost-effectiveness of the programme. When working at AstraZeneca students are placed either within the Alderley Park Research Site or at our interim Cambridge labs, and then from 2017 in the new “state of the art” purpose built Global R&D Centre located at the Cambridge Biomedical Campus. Students become members of a scientific team that is conducting leading edge research into the discovery of medicines to benefit the health of patients. The research departments at AstraZeneca encompass a vibrant research community that has both national and international links with academic scientists. For example our Discovery Sciences function is split between Alderley Park, Cambridge, the Mölndal site in Sweden and our Boston Campus, whilst our Oncology research group has labs in both Alderley Park and Boston. Many of our teams work globally and the students will be exposed to global ways of working in an international community. Typically, the student will participate in project and strategy discussions, scientific seminars and become integrated into AstraZeneca's research community. This community has grown over the last couple of years through an expansive “PostDoc” scheme where ~50 postdoctoral level scientists are working alongside the project based scientists (~500 at Alderley Park and Cambridge) on contracts akin to those in the academic setting. The nature of this post-doctoral research and its intimacy with the projects teams has further enhanced the research base within AZ and the vibrancy within the laboratory community.

Matthew Baron successfully used his BBSRC AstraZeneca CASE award (BB/H53903/1) to develop a novel idea of creating three dimensional fish liver cell cultures. Large numbers of fish are currently used in regulatory risk assessments of chemical toxicity, and we have a need to develop better alternatives. Matthew characterised this model and the publication was featured by BBSRC to show the step change delivered by this approach. The partnership between Plymouth University and AstraZeneca provided the unique combination of facilities required to develop this technology. This formed the basis of a successful BBSRC IPA award (BB/L01016X/1) of in excess of £500k that is co-funded by

BBSRC, NERC and AstraZeneca and is currently supporting two postdoctoral researchers. Without this initial studentship this area of research would not have developed; AstraZeneca and several other companies are continuing to collaborate on establishing these methods as alternatives for global testing regulations.

Industrial Sector & Portfolio

AstraZeneca's Innovative Medicines Discovery Organisation conducts multidisciplinary research in order to discover and develop new medicines. AstraZeneca's research is focussed in the following disease areas: cancer, cardiovascular and metabolic disease, respiratory, inflammation and autoimmunity, infection and neuroscience. Furthermore AZ invest heavily in the following cross research areas: drug metabolism and pharmacokinetics, drug safety, toxicogenomics, functional genomics, bioinformatics, metabonomics, structural biology, systems biology, bioprocesses, environmental science and in vivo and in vitro pharmacology. ICP studentships may be placed in any of these areas. The projects carried out within our "Discovery Sciences" organisation may include bioimaging, development and use of informatics tools for data analysis and mathematical modelling of biological systems. We do not operate strategic partnerships with any specific Universities and have a diverse set of partnerships across the UK as outlined below for our studentships that started in October 2011-2013, highlighting the diversity of studentships aligned to the BBSRC strategic areas.

2011	Predicting renal clearance	DMPK	University of Manchester
2011	Glucuronide metabolites in DDI	DMPK	University of Manchester
2011	Drug metabolites in biofluids	DMPK	Imperial College
2011	Grem1 in diabetic kidney disease	CVMD	Queen's University Belfast
2011	Neurotrophic factors in β -cell survival	CVMD	University of Exeter & Plymouth
2011	DGAT1 in skin lipid homeostasis	GSA	University of Manchester
2011	Gut microbial metabolites	GSA	University of Reading/Imperial College
2011	Scale up of human hepatocytes	DS	Manchester
2011	Systems biology: cancer metabolism	DS	University of Manchester
2011	Xenobiotic disposition in fish	Brixham	Kings College London
2011	Ecotoxicology in the benthic zone	Brixham	University of Exeter
2011	PET tracer: membrane transporters	DMPK	University of Aberdeen
2011	DGAT1 inhibitors on skin	GSA	University of Manchester
2012	Mitochondrial nucleoside transporter	GSA	University of Liverpool
2012	Cathepsin D and autophagy	GSA	New castle University
2012	PIP Kinase regulation	Onc	Babraham Institute
2012	Glial tumour metabolism	Onc	University of Birmingham
2012	Expressing soluble proteins	DS	University of Manchester
2012	Drug transporter-metabolism interplay	DMPK	University of Manchester
2012	Tumour dependent pharmacokinetics	DMPK	University of Surrey
2013	Adductomics screening approach	GSA	University of Leicester
2013	Underlying genotoxic thresholds	GSA	Sw ansea University
2013	Imaging during disease and treatment	DMPK	University of Glasgow
2013	Population PKPD of pre-clinical data	DMPK	University of Manchester
2013	Bio-isosteric similarity of 'fragments'	DS	University of Sheffield
2013	AMPK activation <i>in vitro</i>	DS	MRC Clinical Sciences Centre, London
2013	CSTC circuitry	Neuro	University of Strathclyde, Glasgow
2013	Tau transmission in AD	Neuro	King's College London
2013	IKK/NFkB & TGF β resistance	Onc	Babraham Institute
2013	HT 3D organotypic invasion assay	Onc	Queen Mary University, London
2013	NanoDrugs in aquatic organisms	Brixham	University of Exeter
2013	Effect concentrations of micropollutants	Brixham	University of Exeter

Unique Selling Point

“Research Training within an international science focused pharmaceutical company working in multidisciplinary teams addressing basic bioscience questions.”

During the time which students are based within AstraZeneca they receive training in the multifaceted approaches of drug discovery in one of only a few remaining international pharmaceutical companies committed to the research base in the UK. The students are exposed to different parts of the pharmaceutical business; in particular the phases of discovery and early development of new medicines as well as the environmental impact of pharmaceutical agents. The scheme provides students with the opportunity to work in a world class company amongst highly motivated individuals and teams in the pursuit of the discovery of new medicines. Students are expected to be committed team players and can expect coaching in all key skills, including project management from their immediate manager. Students have ample opportunity to develop communication skills, both oral and written, including report writing, publications, preparation of a thesis and presentations. Students will receive training in general IT skills, mainframe based databases and project planning systems along with electronic lab note book keeping. Students will receive theoretical and practical training for use of specialised equipment appropriate to the project that is not normally available in academic institutions. Students also have access to modern techniques in molecular and cell biology; genomics, proteomics and metabolomics supported by the application of bioinformatics; biochemistry; biomedical imaging and the use of robotics, including high throughput screening processes where appropriate. Students will receive training in the relevant practical skills required to carry out the specific project; for example studentships targeted at strategic areas of skills need, such as in vivo physiology/pharmacology and mathematical and computational skills aligned to questions surrounding pharmacological modeling will receive bespoke training. Specific training may be given to students if required in the areas of GLP, GMP and GSP (Good Statistical Practice).

Challenges


- i. Staff changes during restructuring of our organisation have caused issues with continuity of the project within our company. To help mitigate any future issues we now have two supervisors (primary and co-supervisor) aligned to any project. As the majority of our research efforts will be transitioning to our new campus in Cambridge, any new studentships are only being awarded to those who have committed to moving to Cambridge.
- ii. Having a joined up programme for all of the students has proven difficult in the past due to the breadth of research that is carried out within AstraZeneca. Most groups see the training that we give as more project, student and departmental specific. Whilst students have the ability to present their work in their departmental/project forum, they have not had the opportunity to do this across the wider research environment within AZ. As of summer 2014, we are bringing our students (and supervisors if available) together for a poster presentation day in an attempt to share the breadth of research with the students. More direct training on our industry is being considered to be brought into this forum.
- iii. Intellectual property has been one of the more tricky areas of negotiation when putting agreements in place. However, as we now have agreements in place with the major academic institutions in the UK we have a fairly slick process in dealing with agreements based on historical knowledge.

Bayer ICP

Lead contact: Isolde Haeuser-Hahn [isolde.haeuser-hahn@bayer.com]

Further contact: Pieter Ouwerkerk [pieter.ouwerkerk@bayer.com]

Website & Social Media: www.bayercropscience.com
<https://www.facebook.com/BayerCropScience>

 @Bayer4crops

Summary

Bayer CropScience provides students with an industrial perspective to complement their academic training they receive at the University or academic Research Institution. Each student will be assigned an industrial supervisor who will ensure that the cooperation runs efficiently and smoothly. The supervisor will stay associated with the student for the entire four year period of each cooperation.

An important part of the training and support delivered by Bayer will be the three to six month placement within one of our research facilities in Germany, Belgium or France. Whilst at Bayer CropScience, the student will work as part of a small team developing new crop protection agents and it is expected that students actively participate as members of this team. Their day-to-day work will be supervised by their industrial supervisor and students and supervisors will meet regularly to discuss progress and future directions of the project.

Students will have access to state of the art research facilities, for example automated synthesis robots or high throughput biological screening facilities. The students will have the opportunity to participate in discussions relating to the important scientific, environmental and economic criteria for industrial projects and will have access to an extensive virtual library.

Industrial Sector & Portfolio

Bayer CropScience (BCS) is an international research based enterprise working in the area of plant protection and seed production. The student will be able to receive insight in our chemical and biological research including crop breeding activities. These activities focus primarily on enabling sustainable agricultural practices through the discovery of new fungicides, insecticides and herbicides and seeds for a number of crops to enhance crop productivity and food production, in particular by offering integrated solutions to protect crops from biotic stress induced losses and on tackling losses caused by abiotic stress in key crops.

These are some topics of a possible training programme:

Practical and technical research training will be conducted on the job by experienced Bayer scientists, focusing on research in private industry

Specific training courses and seminars: research students will be invited to attend internal Bayer Colloquia and those held at nearby Universities (i.e. Frankfurt, Cologne, Gent or Lyon). In addition, we envisage running an introductory course covering the discovery, screening and development of new agrochemicals for visiting scholars.

Interdisciplinary research training: Interdisciplinary work is essential to address the complex problems tackled by researchers at Bayer. Visiting scholars will have the opportunity to visit other areas in addition to that in which their placement takes place (eg. chemists will visit biology and biochemistry). The introductory course referred to above will also be of an interdisciplinary nature.

Postgraduate research training environment: Bayer will liaise closely with the academic partner to ensure that the placement at Bayer fulfils the academic requirements for Ph.D. level research. All students will be asked to provide feedback during and at the end of their placement about their experiences at Bayer.

Computing: State of the art facilities are available to all research staff

Health and Safety: Bayer takes safety very seriously and we have an excellent laboratory safety record. Laboratory safety meetings are held each month to discuss important safety issues and in order to proactively prevent accidents from occurring.

Unique Selling Point

Bayer CropScience is an international research enterprise running worldwide research facilities. The student will be hosted either in Germany, Belgium or France. The student will have the chance to get to know more about different socio-cultural environment. Such an exchange is beneficial to both parties.

The student also has to deal with a different research environment. The person can compare and see advantages and disadvantages between an industrial lab versus an academic institution and can make up his mind. Training of social skills will be in focus besides gaining scientific know-how.

Challenges

Key challenges in industry are on IP protection, publication of the PhD thesis, availability of facilities and the focusing on relevant topics. Bayer CropScience continuously develops new IP and protects it accordingly, for which a dedicated department is in place. Participation in CASE projects and the visits of the PhD students means that dedicated Bayer personnel has to be made available during the students stay as well as an adequate working environment. Personnel might have to be shifted from one project to another and this has to be arranged well before in time.

A further challenge is that certain projects might no longer be in the main focus area, due to a shift in research and development approaches driven by market needs. Despite this fact personnel and facilities will be allocated as agreed at the start of the project.

GSK ICP

Lead contact: Hira Sudan [hira.l.sudan@gsk.com]

Operational contact: Hira Sudan

Website & Social Media: www.gsk.com

Summary

GSK is a global healthcare company that researches and develops a broad range of innovative products. We make innovative medicines, vaccines and consumer healthcare products that are used by millions of people around the world, allowing them to do more, feel better and live longer. The products we develop and manufacture and how we do this contributes directly to the health of patients and consumers, and indirectly to the wider well-being of the economy and society. Our products cover a wide range of healthcare areas: prescription medicines, vaccines, rare diseases, dermatology, and consumer healthcare. We also have dedicated research programmes for diseases that affect the developing world. We are one of the few healthcare companies researching both new vaccines and new medicines for all three of the World Health Organization's priority diseases: HIV/AIDS, malaria and tuberculosis.

GSK is a UK-based, science-led, global healthcare company and has over 3,400 R&D employees in the UK, and spent £1.8 billion on R&D in the UK in 2010; over 40% of our global R&D spend. GSK (and its heritage companies) has a long history of supporting PhD level students, and currently support in excess of 240 PhD students, with on average 70 new studentships being initiated each year. These are funded either through the Research Councils' CASE scheme, co-funded with Universities or, occasionally, fully funded by GSK. The pharmaceutical industry in the UK is undergoing significant change and re-prioritisation, but GSK has maintained, and intends to maintain or indeed grow, its current level of interaction with academia, and we strongly believe in the value of the CASE scheme and the relationships formed as a result of the scheme. GSK's research, whilst spanning the remit of several research councils, has significant focus on areas which are directly relevant to BBSRC's mission and strategic priorities, and as such the synergy is clear. The allocation of CASE awards to GSK allows us to continue, foster and develop relationships with key academic partners in the UK, supporting projects which are essential to the UK, and helps to train the next generation of UK scientists. Moreover, GSK is an active contributor to research in, and funding of, scientific excellence in academic research in the UK science base.

Recently, GSK has been expanding its cohort of PhD students, and this is reflected by the Industrial PhD studentship scheme we have introduced. Under the scheme, students spend the majority of their PhD project on site at GSK, with placements back to the host University. The scheme has seen GSK gain accreditation from the University of Kent as an official supplier of higher education. The process, which commenced in 2005 and took 2 years to complete, resulted in accreditation for our in-house training; a training programme that was recently reviewed by the University of Kent and accreditation extended for an additional 6 years. The scheme delivers a work-based learning package to facilitate learning, and exemplifies GSK's commitment to training the UK science base.

Industrial Sector & Portfolio

Industrial Sector: Pharmaceuticals

GSK is a global healthcare company that researches and develops a broad range of innovative products. GSK employs over 97,000 people in over 100 countries. We have a significant global manufacturing and R&D presence with a network of 74 manufacturing sites and large R&D centres in the UK, USA, Spain, Belgium and China. In 2011, our global community investment was £204 million. GSK is one of the most generous contributors of the FTSE-100, supporting health and education programmes in almost 100 countries. We are also taking a lead with our approach to enable and facilitate access to medicines for the developing world. We have over 3,400 R&D employees in the UK, and are the largest private sector funder of R&D in the UK. GSK is also the top private funder of the academic research base in the UK and is involved in more academic collaborations than any other company. In 2011, we worked with over 50 academic institutions and supported over 240 PhD studentships. GSK is now entering many consortia to co-develop advances in technology and train the next generation of scientists. In addition, GSK has multiple partnerships with the UK Research Councils in UK Universities.

Our portfolio of Academic partners is large, with studentships placed at over 30 UK Universities. We have over 10 studentships placed within each of the following universities: Imperial, Oxford, Cambridge, UCL, Manchester, Nottingham, Newcastle, Bristol, Leeds and Southampton.

GSK's research, whilst spanning the remit of several research councils, has significant focus on areas which are directly relevant to BBSRC's mission and strategic priorities. Specifically, GSK focuses a great deal of resources investigating basic biological mechanisms, systems and processes, and how these underpin health and may impact normal physiological function. Indeed, many therapeutic groups within GSK now focus on individual biological mechanisms, rather than specific diseases, and the understanding of how these mechanisms may contribute to the promotion of health (and conversely dysfunction in disease).

Unique Selling Point

“GSK: Training the next generation of UK scientists, to enable people to do more, feel better and live longer.”

GSK's research environment is dynamic, diverse and collaborative. Most GSK R&D sites house a number of different business units and research areas and employees have come from a wide range of research backgrounds and skills. Interactions between researchers both within and outside the company are encouraged in order to promote innovation and foster alliances to keep GSK competitive. In addition, many GSK sites now co-locate different disciplines working on projects, so that (for example) biologists will be co-located with chemists, computational experts, project managers and clinicians, vastly increasing the interactions and experience to which the students will be exposed.

Typically a number of cross-functional, multidisciplinary projects are run within a research team through collaborations across different departments and also externally. The student's involvement in these projects will depend on their individual research project, however GSK do realise the importance in providing the student with multidisciplinary training and will incorporate this into the student's training plan. This may include the student spending time in another GSK department with the appropriate facilities to perform complementary work elements. The CASE project itself is a collaboration between GSK and academia, and the

student will therefore gain an early understanding of the drivers and advantages that collaborations with external organisations bring. This will be further reinforced at team meetings, where collaborative projects will be reviewed and discussed. GSK's R&D laboratories have state-of-the-art facilities and specialist expertise. The specific requirements for each student will depend on the nature of the project and host department, but generally the equipment will be modern, start-of-the-art and in many cases bespoke. GSK always receives positive feedback from our students on the level and range of available equipment within the company.

Students are expected to spend at least 3 months at one of GSK's R&D sites during their studentship, through one or a number of separate placements. However, above this the duration of any placement(s) at GSK would be discussed and agreed between the Industrial and Academic Supervisors and the student. When students first come to site their industrial supervisor will ensure that they are introduced to the research team they will be working with, and any other students within the department at that time. Research teams typically comprise researchers at different levels of hierarchy, including other students, post-doctoral researchers, managers and directors. Interactions within the team will be encouraged, and students will have the opportunity to do this in the laboratory, the office and at group/departmental meetings. Most site offices within GSK are open-plan, facilitating communication between team members. The student will also have opportunities to interact with researchers outside their research team through site-based seminars, lectures, instructor-led training courses and cross-functional projects.

GSK operates a central system for ensuring all new starters are enrolled and complete compulsory generic training courses, after which training provision is managed at the individual and/or departmental level, to reflect the individual training needs of each student for each project. Industrial supervisors are typically experienced managers, who are practised in developing and managing an appropriate training plan for the student which will incorporate generic and business related training.

The introduction of GSK's Industrial PhD scheme has seen an increase in the number of PhD students on site at any one time. Moreover, these students are fully integrated within University initiatives and participate in problem solving sessions, research meetings and symposia, and a number of these initiatives have been replicated within GSK which benefits the entire student cohort. An obvious benefit from this scheme is that GSK is considered as providing excellent training for young researchers, and regularly hosts a range of seminars and invited lecturers to present on a wide variety of topics. GSK realises the importance in providing the student with interdisciplinary training. The collaborative nature of the CASE studentships mean that the research programme will typically encompass cross-functional elements that can be appropriately divided between the host University and GSK, according to their complementary facilities. GSK recognises the importance of providing the student with training in both generic skills as well as more business-related transferable skills. Training will be given in both these areas as described below.

Challenges

GSK's over-arching objective is to help train the next generation of UK scientists. There are a number of scientific areas (for example statistics, computing and particularly computational biology) where it becoming increasingly difficult to identify high-quality students who are eligible for funding by the UK RC's. The nationality and residency requirements of UKRC's are therefore impacting student recruitment into a number of these areas, and therefore also impacting availability of the next generation of scientists. Where possible, GSK does seek alternative funding mechanisms to aid student recruitment, and the setting up of the Industrial PhD scheme, which is wholly funded by GSK and receive no funding from UKRC's, certainly helps in this area. Moving forward, we would welcome any moves by UKRC to relax

residency requirements in these key STEM subjects.

The ever-changing research environment in Pharma can also potentially impact studentships which are already on-going. For example, sites can close or research areas are changed. This can sometimes impact the level of supervision that the company may offer studentship training. For each individual project, the industrial and academic supervisor will monitor the progress of the project, and agree on the optimum timing and duration of the industrial placement(s). GSK are acutely aware of the importance of the placement to the training of the student, and do everything possible to ensure this occurs. There are, occasionally, exceptional circumstances which make placements at the intended GSK host department difficult or (very occasionally) impossible. This has occurred previously, for example, at the time of a site closure. In such cases, these circumstances are communicated in a timely manner to academic partners, and alternative arrangements made. Previously, we have worked within the company to place students within alternative host departments where this is viable, and we have also worked with other Pharma companies to place students in alternative facilities where this is also a viable option. For example, GSK took on the responsibility for supervision of several students previously supported by Pfizer, prior to their site closure in Sandwich. In all cases, GSK ensures that its financial commitments are met in full, and indeed where such circumstances result in additional costs being incurred GSK ensures that we meet those additional costs in full, even when these costs are in excess of those budgeted for studentships.

KTN ICP



Lead contact: Dr Huw Jones [huw.jones@ktn-uk.org] / Chris Warkup

Operational contact: Dr Huw Jones

Website & Social Media: www.ktn-uk.org

Summary

Consortium Details

The KTNL exists to accelerate UK economic growth by stimulating and supporting innovation of relevance to UK businesses by facilitating the conversion of the UK's innovative capability and knowledge into innovative agricultural, food and industrial bioscience products and processes. In the context of the ICP award, the main focus is on working with four main sectors which represent a large proportion of the BBSRC remit, namely: Plant and Animal Research, Agri-Food and Industrial Biotechnology. We operate a network of over 600 participating businesses and research providers (and over 60,000 individuals) with an interest in these sectors.

The ICP awards to KTNL are further allocated by competition to pairings of academic and industrial partners members of the network. For each competition the applications were assessed cross-across sectors by a panel that includes academic and industrial representatives from each of the four KTN advisory groups that represent the relevant sector in addition to senior KTN staff. This promotes sharing of research and knowledge across sectors and ensures that projects are business relevant. In addition, company experiences are included as an integral part of the assessment of the proposed placement and training. In the first 2014 competition, a total of 54 applications were received for the 10 studentships available, with a total of 29 people involved in the evaluation process.

Most awards go to pairings where the academic partner is already in receipt of a BBSRC Doctoral Training Partnership grant and we expect the research training provided to meet the same or better standards than for the DTP. Academic applicants not participating in a BBSRC DTP award are asked to provide additional detail on the quality of their training and support and are be required to complete a Performance Indicator Form detailing achievement of the minimum submission rates.

Organisational Background

The Knowledge Transfer Network Limited (KTNL) was instituted in April 2014. With BBSRC's approval, the ICP CASE PhD Studentships that were previously awarded to The Biosciences Knowledge Transfer Network (BKTN) were included in this transfer to KTNL. As part of the transition, the sectors covered through the programme have been retained. The newly constituted KTNL has a wider overall remit into areas including Chemistry, Health, Physics, Material Sciences, Electronics, Energy, ICT, Environmental Services and Space. While this will not impact upon the remit of in the programme, it does provide the students with opportunities to be part of the wider network as outlined above with concomitant exposure to a wider innovation community.

Training and Industrial Placement

Applicants are required to provide details of the specific training provided by the project and also the Academic departments training policy. The quality of the training to be provided is a critical assessment criteria in the allocation of awards. The research skills and techniques (wet and dry) that the student will learn to apply and also broader skills such as developing an understanding of the research environment and research project management will be assessed. Students will also be expected to benefit from attending and presenting at regular lab meetings, presenting their work orally and using posters within their CASE partners and participating in journal clubs. In most cases students will also have access to at least one (and some case several different) regular seminar series provided by their academic partners. We also consider the Industrial training and placement to be a very important part of the ICP experience for the student. The quality of the industrial placement being offered and the nature of the training is a critical assessment criteria.

In addition to training provided through the academic and Industrial partners in the project, the students are able to take advantage of an annual, two day training workshop on business relevant skills that is run by the KTN which provides an opportunity for all the students to come together in a stimulating environment which is different but complementary to their study programme. The business relevant training is focussed on a relatively small number of areas that are covered over the four year period of the PhD, which are: Intellectual Property Rights; Supply Chains; Knowledge Transfer; Benchmarking; Business Models; Technology Impact; Technology Planning and Acquisition; Maths for Biologists; Social Science for Biologists; Negotiation Skills; Group Dynamics and Influencing without Authority; Communicating Science to a General Audience, and Ethics for Biologists.

Given the four-sector remit of the programme the experiential sharing aspect is wider and potentially more valuable than would be experienced in other circumstances. In addition the students are a part of a large network that includes a number of companies both within and outside of their sector or discipline. KTNL also undertake a regular "horizon scanning" of relevant training courses and conferences and seminars (including BBSRC ATP training courses and workshops), and details these in an events calendar on our website.

Over the last three years we have been involved in organising an annual Early Career researchers' event for the Food sector that provides an opportunity for PhD students and early career Postdoctoral researchers to present their work in form of industry representatives. Prizes also given for the best presentations and posters, with the main prizes on offer being largely focused on high quality industry placements or business relevant training. In 2014 we also organised an early careers event focused on Agricultural sector (Plants and animals), which was attended by over 40 PhD students and early careers. The two successful students were – presentation: Emma Monaghan; poster Andrew Beacham (poster), and both were awarded a personal visit/tour of Fera to hear more about the research and industrial collaborations that were being undertaken.

In 2015 we also plan to include student profiles within the KTN newsletters (initially for the Plant and animal sectors), with the aim of highlighting the value that the student has gained from the industrial placement in particular.

Student successes

Student awarded highly prestigious award by Genetic Society

Laura Corbin undertook her PhD through an academic collaboration between the Roslin Institute and the Animal Health Trust with the British Equestrian Federation (BEF) at the industrial partner. The focus of her project was 'The application of genomic technologies to the horse'. Following the PhD Laura was nominated and successful in receiving the highly prestigious Sir Kenneth Mather memorial Prize by the Genetics Society for 2012/13.

Following the success of her PhD, Laura was also subsequently invited by the industrial partner to lead a scoping project (funded by the BEF) to investigate the need for the UK equine industry to establish an equine bio-bank.

Industrial Sector & Portfolio

The programme that is led by the KTNL covers four sectors which represent a large proportion of the BBSRC remit, namely: Plant and Animal Research, Agri-Food and Industrial Biotechnology. In 2014, KTNL took over the responsibility for ICP CASE studentships that had previously been allocated the Bioscience KTN (BKTN). As part of the transition, the sectors covered through the programme have been retained. The newly constituted KTNL has a wider overall remit into areas including Chemistry, Health, Physics, Material Sciences, Electronics, Energy, ICT, Environmental Services and Space. While this will not impact upon the remit of in the programme, it does provide the students with opportunities to be part of the wider network as outlined above with concomitant exposure to a wider innovation community.

The Biosciences KTN (BKTN, formerly the Farm Animal Genetics and Genomics Faraday Partnership Limited – Genesis Faraday) had received an annual ICP allocation of BBSRC CASE studentships per year since 2003, initially of five studentships, but more recently the number was increased to 10. The allocation was initially for studentships in the scope of 'Genetics and genomics as applicable to domestic animal breeding and animal health', but following the transition to BKTN and with BBSRC's agreement, the remit was broadened to encompass the four sectors now represented and the number of studentship available was also increased.

Unusually compared to many other ICP allocation, in each year the allocation was not for use by BKTN as the industrial partner, but was for further allocation, by competition, to pairings of industrial and academic members of the network. For each competition the applications were assessed by a panel that includes academic and industrial representatives from each of the four KTN advisory groups that represent the relevant sector in addition to senior KTN staff. In the first 2014 competition, a total of 54 applications were received for the 10 studentships available, with a total of 29 people involved in the evaluation process.

To date BKTN has allocated 84 CASE awards. The quality of applications has been very high. Across all years less than 50% of awards were selected for funding and in most years proposals of very high quality could not be funded. On several occasions these were forwarded to BBSRC and unused stand-alone CASE funds were used to allow more than our standard allocation to be funded. The completion rate for awards that should have finished to date was 97%.

Of those students that have completed their ICP PhD and where we are aware of their next destination, about 38% have gone onto postdoctoral research positions, a similar proportion took up jobs in industry and the remainder went to posts that will utilise their training – such as in a University TTO or scientific writing.

Unique Selling Point

The primary objective and strapline for any ICP CASE Studentships provided to KTNL is:

“to provide high quality graduates with a first-rate, challenging, research-training experience leading to a PhD.”

The KTN ICP students additionally will be supported as a cohort provided with more industry-relevant training, opportunities to network with their peers and with industry at all levels. The academic, societal and economic impacts of an ICP allocation to KTNL can be expected to arise in at least three ways.

- Primarily impact will be through the training of highly skilled individuals with deep expertise in cutting-edge biological science and with broader skills that industry would value and an awareness of other areas gleaned from the wider KTNL network. Some of these individuals will go on to make significant career contributions in research, innovation, commerce, regulation and policy.
- The second area of impact will be the new knowledge generated. We can expect this to be high quality science published in high-impact journals that should contribute directly to BBSRC Strategic Objectives and wider societal needs such as food security and an environmentally sustainable economy.
- The final area of impact is the establishment and nurturing of the relationship between the academic group and the industrial sponsor. This relationship should have impact that is wider in scope and longer in duration than the single studentship. Important outcomes from CASE students will be publicised via the KTN _connect website, newsletters, and excellent partnerships will be written up in our Case Study format.

This new knowledge will be of value to the partners, the wider research base and industry more broadly, and may be of direct or indirect commercial use – most likely following some form of translational activity (that KTNL can help facilitate). It is our experience that the value of the PhD research training to potential end-users is enhanced by the CASE process for three reasons; i) access to real-world data, biological materials, experimental conditions or analytical resources; ii) the interaction with industry can result in the formulation of better hypotheses and the design of more relevant experiments, and iii) the results of experiments are interpreted into an industrial context as part of the research-training experience.

In addition to training provided through the academic and Industrial partners in the project, the students are able to take advantage of an annual, two day training workshop on business relevant skills that is run by the KTN which provides an opportunity for all the students to come together in a stimulating environment which is different but complementary to their study programme. The Business relevant training is focussed on a relatively small number of areas that are covered over the four year period of the PhD, which are: Intellectual Property Rights; Supply Chains; Knowledge Transfer; Benchmarking; Business Models; Technology Impact; Technology Planning and Acquisition; Maths for Biologists; Social Science for Biologists; Negotiation Skills; Group Dynamics and Influencing without Authority; Communicating Science to a General Audience, and Ethics for Biologists.

Given the four-sector remit of the programme the experiential sharing aspect is wider and potentially more valuable than would be experienced in other circumstances. In addition the students are a part of a large network that includes a number of companies both within and outside of their sector or discipline. KTNL also undertake a regular "horizon scanning" of relevant training courses and conferences and seminars (including BBSRC ATP training courses and workshops), and details these in an events calendar on our website.

Over the last three years we have been involved in organising an annual Early Career researchers' event for the Food sector that provides an opportunity for PhD students and early career Postdoctoral researchers to present their work in form of industry representatives. Prizes also given for the best presentations and posters, with the main prizes on offer being largely focused on high quality industry placements or business

relevant training. In 2014 we also organised an early careers event focused on Agricultural sector (Plants and animals), which was attended by over 40 PhD students and early careers. The two successful students were – presentation: Emma Monaghan; poster Andrew Beacham (poster), and both were awarded a personal visit/tour of Fera to hear more about the research and industrial collaborations that were being undertaken.

Challenges

Challenge 1 – Industrial Partners, Relevance and Training.

As any ICP award to KTNL will be further allocated by competition to pairings of academic and industrial partners, the research training and support provided by the company will vary.

In line with the conclusions of the CASE review, we consider the quality of the industrial placement to be very important as this is a distinguishing feature of CASE awards and adds significant value. In our current ICP allocation we already place significant emphasis on the nature of the placement and expect it to be an integral part of the research project the student will undertake. This may take a variety of forms, such as data collection, use of analytical resources or some form of field validation of results. This does not exclude training in other skills within the company, such as an awareness of operations or marketing, but we consider there must be a significant research element to the placement. On occasions where it was merited, and with BBSRC's agreement in each case, we have allowed tripartite arrangements where there are two industrial sponsors engaged in the CASE studentship, one that provides the cash contribution and one industrial supervisor (they may also contribute part of the placement and some access to resources such as data), and a second that provides the location and facilities for the research element of the placement. We also expect this second organisation to provide an industrial supervisor. We have found these arrangements to be benefit the studentship, by broadening the students industrial exposure, and access to resources relevant to the project. Unless advised otherwise, we would expect to continue with similar arrangements in the future where justified and each time agreed with BBSRC.

As mentioned previously, a number of industry representatives are involved in the assessment process for the applications that are received. We believed that helps not only assess the industry relevance and likely impact of the scientific work being proposed, but allows a more accurate assessment of the quality of the proposed industry placement.

Challenge 2 – The Heterogeneous Nature of Partnerships

Company partners within KTNL ICP CASE awards will vary from SMEs with limited in-house R&D capacity through to research based companies or multinational companies with significant in-house resources – sometimes these include laboratory resources (such as for high-throughput screening) that are not available within the academic partner. In addition to the use of laboratory resources, other research resources may be made available via the company partner and we will continue to encourage this. We aim to ensure that the nature of the placement and the training environment remains a major factor in the evaluation of applications for the allocation of ICP awards via KTNL. We have also increased our monitoring efforts to ensure that placements happen in accordance with the plan (or as reasonably modified in the light of circumstances).

In order to deliver a fair assessment of the applications received across the focus sector we have developed an across sector evaluation process. For each competition the applications were assessed by a panel that includes academic and industrial representatives from each of the four KTN advisory groups that represent the relevant sector in addition to senior KTN staff. In the first 2014 competition, a total of 54 applications were received for the 10 studentships available, with a total of 29 people involved in the evaluation process.

Challenge 3 – Maintaining Contact and Networking Students

KTNL maintains in contact with all ICP CASE students, provides them with access to the network and brings all students together as a cohort at least once per year for additional business relevant training. Through these events students can benefit from sharing experiences with a wider pool of students working in the field of biosciences than they may otherwise meet. Through the wider KTN network the students can also access expertise and advice from a much wider range of academics and industrialists than the immediate partners in the project. This improves their commercial understanding, broadens and enhances their career options, and helps them develop a broad personal network of contacts to enhance their future careers. KTNL also works closely with the Agriculture and Horticulture Development Board (AHDB) in its funding of PhD studentships – we promote their competition, in some cases are involved in application assessment and participate in their annual meetings of PhD students. We will investigate the feasibility of joint cohort activity with AHDB students and incorporate linkages where appropriate e.g. by species for plant or animal related CASE awards. Links with Learned Societies and related organisations (e.g. Royal Society of Chemistry, Institute of Biology, Society of Chemical Industry) are in place to increase networking opportunities.

MedImmune ICP



Lead contact: John G. Elvin D.Phil. FSB (Scientific External Liaison UK) [01223 898186; elvinj@medimmune.com]

Operational contact: John Elvin and Jacqui Hall [01223 471471 (main); halljr@medimmune.com]

Website & Social Media: www.medimmune.com

Summary

MedImmune is the global biologics research and development arm of the biopharmaceutical company AstraZeneca. MedImmune discovers and develops biologic medicines, including antibodies, therapeutic proteins, vaccines, and peptides. Our marketed products include Synagis® (palivizumab), an antibody for prophylactic use against Respiratory Syncytial Virus infections in new-born children at high risk of the disease, and FluMist (Fluenz in the EU), a vaccine for the prevention of infections with live attenuated influenza virus.

Our global areas of therapeutic focus are: infectious diseases, inflammation, cancer, autoimmune, and respiratory diseases, and in particular in Cambridge we are building on our expertise in neuroscience, cardiovascular and metabolic diseases.

The Cambridge UK research centre of MedImmune is based in Granta Park (formerly Cambridge Antibody Technology) and is focused on developing monoclonal antibody and protein therapeutics via its proprietary Phage Display and Ribosome Display technologies. MedImmune contributes to 50% of AstraZeneca's pipeline and currently has approximately 120 biologics in the R&D pipeline, with 31 clinical programs utilizing 26 different candidate drugs.

MedImmune was awarded our first ICP in 30 October 2013 and consequently it is too early in our programme to point to a case study of a student on the ICP.

MedImmune's Training Approach

All ICP students at MedImmune receive access to the same training opportunities as our full-time employees. We have a well-developed and well-resourced approach to training, with a dedicated in-house training team, supported by multiple partnerships with external, high quality, training providers. We partner with over 25 global training providers to deliver a range of courses, tailored for MedImmune.

Our approach to training starts when a new employee or student joins the company. They receive a package of basic training as standard, which includes health and safety, compliance requirements, familiarisation with any IT tools or systems and functional (on-the-job) specific training. However, every employee/ student is also encouraged to have a discussion with their line manager/ supervisor about their additional training needs and to capture this in a Personal Development Plan which is reviewed and updated on a regular basis.

Employees / students at MedImmune have access to a wide range of courses, delivered as classroom, e-learning or video training. These courses may be scientific or process-related (for example, we run a course in conjunction with Macmillan publishing on 'How to Publish in High Impact Journals' as well as various project management courses). They may also be related to regulatory compliance (such as GCP or GLP training) or to communication skills, team skills or management/ leadership.

As well as internal courses, all functional groups in MedImmune have a budget to support any external training that may be required and cannot be delivered in-house. We also have an extensive program of scientific seminars and symposia which run throughout the year both on-site, and in conjunction with some of our academic partners. Students have full access to these resources.

Our electronic learning is delivered through a central electronic learning management system. We have also developed our own in-house video site, where students have access to a wide range of video learning. In time, it is anticipated that this will operate as our own internal 'You Tube', where employees can directly upload their own videos to share.

Industrial Sector & Portfolio

MedImmune is in the Biotechnology/ Pharmaceutical industrial sector.

Our current Portfolio List of Academic CASE Partners

ICP	Partner	Institution
1.	Prof Mark Lindsay	University of Bath
2.	Dr Maddy Parsons	Kings College London
3.	Dr Bart Hoogenboom	University College London
4.	Dr Ben Challis	University of Cambridge
5.	Dr Heidi Welch	Babraham Institute
6.	Prof Steve McMahon	Kings College London
7.	Prof Jim Scrivens	University of Warwick
8.	Dr Robert Falconer	University of Sheffield
9.	TBC	TBC
10.	TBC	TBC
11.	TBC	TBC
12.	TBC	TBC

Four ICP have yet to be confirmed.

Unique Selling Point

The USP of MedImmune's Training Programme is that any training which is available to full time employees is also available to industrial CASE students. ***"If we run it – you can go on it"***

Practical and technical training is provided through two major routes. Primarily, MedImmune 'expert users' (e.g. of particular instrumentation) will mentor placement students through 1:1 training programmes, monitored at appropriate intervals by senior staff.

Secondly, MedImmune R&D is supported by the Learning, Standards and Insights (LSI) team, which is responsible for supporting all Training and Standards requirements for R&D. They provide a combination of computer based training and classroom based training to train all staff working on site and these courses are available to students on placement (and

some are mandatory).

Students will be working alongside full time staff and will be able to experience industrial scientific working environment. During placement, students will be able to take advantage of our proximity to the University of Cambridge and attend the large number of seminars that are available. We think this combination of industrial setting and proximity to academic excellence is an attractive proposition for students.

Challenges

One of the problems we face is that sometimes the science we are doing is extremely novel, and it is delivered by 1:1 expert tuition from MedImmune staff – during the placement. Thus it is challenging to document this more esoteric training.

To overcome this challenge we have to develop a customised training programme, case by case for each situation as it arises.

Nestlé ICP



Lead contact: Dr Simon Livings [simon.livings@rdyo.nestle.com]

Operational contact: Dr Ramana Sundara [ramana.sundara@rdyo.nestle.com]

Summary

Nestlé has the largest R&D network of any food company in the world, with 34 R&D facilities (3 Science & Research centres; and 31 R&D centres including Product Technology Centres (PTCs) worldwide), and over 5,000 people involved in R&D. PTC York is specialised in confectionery research and has two roles; the first is to develop innovative technologies and manufacturing processes which are the basis of new product development. New textures and flavours are created as well as improved nutritional profiles. The second is to implement these technologies for the company's operations, to be used in Nestlé's factories around the world, ensuring products are produced in the safest and most effective way, while meeting the constantly changing needs of the consumer.

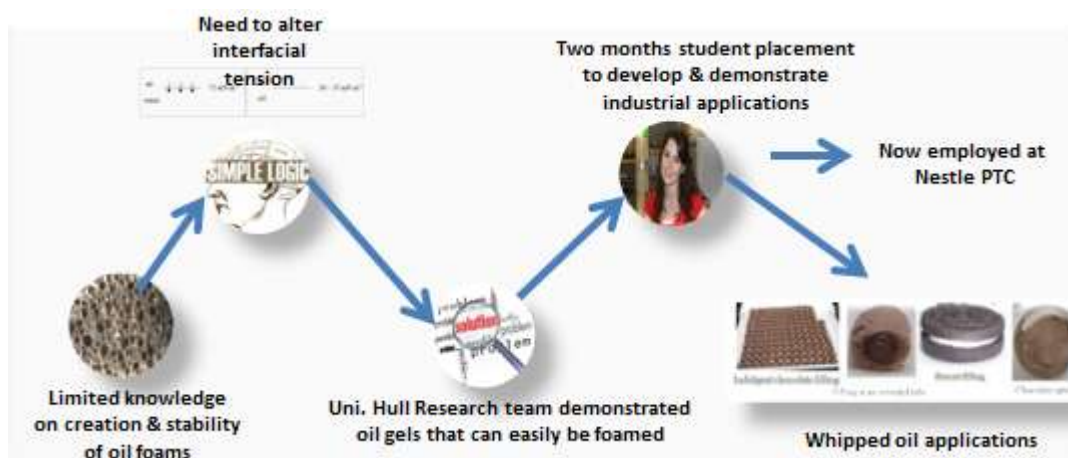
All PhD student programmes including BBSRC Industrial CASE partnerships at Nestlé PTC York provide support for post-graduate training and research which is supervised jointly by academic and industrial supervisors. The proposed studies are expected to provide PhD students with scientific excellence and challenging research training experience that is relevant to the food industry with an economic and social impact. Presently, we have 19 on-going PhD students from various universities, of which 11 are being supported by BBSRC ICP funding. Nestlé PTC York has demonstrated a strong track record with BBSRC with previous ICP competitions. After successful completion, several students were recruited and now work at different Nestlé PTCs. These partnerships have fostered strong links between industry, academic partners and BBSRC.

The industrial training provided at Nestlé PTC is often complementary to that of Academia including the development of technical and practical skills, commercial and entrepreneurial awareness (for example: Finance courses) and generic professional skills (Communications driving internal presentations). Industrial placements are an important mechanism for delivering the "added value" in accelerating project studies. Although the majority consisted of multiple, periodic placements, there has been one single continuous placement. The industrial supervisors have a wealth of technical knowledge in their subject areas. Students have been encouraged to publish or present their original research article as a result of their studentship. Based on their published work, the overall performance of the student research projects has been good.

Case Study: Development of low-calorie confectionery through foaming of oils.

Emma Garvey*, Bernard Binks* and Joselio Vieira**

*University of Hull; ** Nestlé PTC York



Industrial Sector & Portfolio

For the food industry as well as Nestlé, everything we do should make sense in terms of value creation. Innovation is one of our value drivers. Innovation is the economic application of ideas, technology and/or processes in a new ways to gain a competitive advantage. Each day we strive to make our products tastier and healthier to help consumers care for themselves and their families. This would not be possible without our unmatched R&D capability and external research collaborations. Academic collaborations must start with co-innovation already in mind, suggesting that partnerships are paramount for cross-fertilization and synergy. Development of researchers' in-line with our technology strategy is very important to Nestlé PTC to: (a) accelerate our projects and innovation process; (b) efficiently source of young talents from academia. Thanks to BBSRC, which is uniquely positioned at the interface of bioscience academia and industry ensuring information and people move more freely between the sectors through ICP grants, we have been able to provide (a) Training with industry: Our industrial placements at Nestlé PTC York have been providing extensive exposure to concept refinement, pilot plant trials and quality procedures within the industry. This enables researchers to translate their scientific skills into product development. These trainings are normally not available either online or through university systems; (b) Training about industry: Our cohort events (e.g. Finance matters for non-specialists – Value Creation) have been intended to train our researchers in transferable skills that are uniquely or significantly required by industry. Further, industrial placements also assist in learning project management, team-working, entrepreneurship and communications skills.

Unique Selling Point

“Getting talents on-board before they enter the job market”

Nestlé PTC York fully acknowledges both personal and university trainings that each researcher undertakes during his/her PhD programme. Our implementation of the training programme sets forth a three-pronged strategy to reach the goal. The first prong of the strategy is an industrial placement programme. This allows researchers to develop skills in applying theory to practical work situations. The second prong targets training in transferable skills that are uniquely required by Nestlé (for example we organised

commercial awareness training in January, 2013). This provides an insight into R & D as one of the value drivers. The final prong is cohort events such as our biennial PhD students' symposium. Through this event we identify and track talented young researchers for hiring.

Over the years, ICPs have been instrumental in:

- a) Training and introducing young researchers to industry culture;
- b) Delivering high quality research aligned to Nestlé PTC's business strategy;
- c) Becoming an integral part of the recruitment policy; and
- d) Enriching supervisory skills and compliments academic supervision

Challenges

Supervisory resources: Most experienced industrial supervisors have often been busy with project management and manufacturing support. Sometimes, it requires hours of supervisor's time in training young researchers in health & safety; food hygiene and quality aspects of food manufacturing. We have developed a dedicated induction programme to overcome this challenge and accelerate the researcher's project work.

Lean thinking: Most industries aim to deliver more and more with less and less human effort, less equipment, less time and less space while coming closer and closer to providing consumers with exactly what they want. Young researchers coming from academic institutions often need additional help in understanding industry way of working.

Oxitec ICP



Lead contact: Dr Simon Warner (Chief Scientific Officer)

Operational contact: Dr Neil Morrison [neil.morrison@oxitec.com]

Website & Social Media: <http://www.oxitec.com/>
<https://www.facebook.com/oxitec>

 @Oxitec

Summary

Founded as a spin-off from Oxford University, Oxitec Ltd is an Oxfordshire-based biotechnology SME that specialises in application of transgenic technology to control insect pests important for human health and agriculture. The company's core technology comprises repressible, self-limiting traits in pest insects. The engineered male insects are released into the field to mate with their wild pest counterparts, and progeny from these males is not able to survive. This mating-based approach offers a highly species-specific effect, with consequent minimal ecological impacts.

Oxitec's lead product is a strain of the dengue vector mosquito, *Aedes aegypti*. The product has undergone successful field trials in the Caribbean, Panama, Malaysia and Brazil; has received commercial approval in Brazil, and is the subject of the company's first commercial trial, involving release of these male mosquitoes in a town of 50,000 people in north-eastern Brazil. In agriculture, Oxitec are working to develop several products against major pest species, and three Oxitec product strains are due to be tested in field trials in 2015.

Within the company there is an unrivalled expertise in insect transformation together with a broad range of experience in the basic disciplines of molecular biology, cell biology, genetics, biochemistry and ecology. Students are expected to attend weekly laboratory meetings in the company and discuss their research progress, as well as attending appropriate academic meetings, seminars and conferences. We also expect the students to present their work at a minimum of one international meeting. We encourage the students to use relevant external courses, including the BBSRC media training course: environmental use of recombinant DNA technology is an area of considerable public interest and some controversy and we encourage our students to be well-equipped to discuss the issues with the public as well as with scientific peers.

Oxitec has close collaborative links with researchers in several UK and international universities, companies and government departments, and – in addition to working in supervisors' laboratories – students communicate with and spend time in some of these laboratories as appropriate to the specific project, gaining general experience in research aligned with the objectives of the company.

In addition, the students gain valuable experience of life in a growing, dynamic biotech firm. The students receive training and experience in a range of industry-related skills, including approaches to prioritising research alternatives, the role of research in business development, identifying patentable findings, patent application procedures, project management, time management, good laboratory procedures and communication skills. Given the small size of Oxitec, the students benefit from working closely with all members of the enterprise in both the research and management arms, thereby providing a rounded

appreciation of all working aspects of the company. Moreover, students are encouraged to consider taking up a 3-month professional internship to supplement diversity of experience. Career advice on opportunities of future employment within the industrial sector, and beyond, is provided.

Case study

Tim Harvey-Samuel, former BBSRC iCASE graduate student, Oxitec & Department of Zoology, University of Oxford

Tim started his project by developing new transgenic strains of the diamondback moth, a major pest of brassica crops. One of these strains showed Tim's designed female-specific transgene expression for male-only production ('genetic sexing'). In laboratory experiments, Tim investigated the strain's potential for future field application, studying life history characteristics and ability to compete for mates with non-transgenic counterparts. To investigate the effect of introducing males from the transgenic strain into target moth populations, Tim undertook glasshouse cage experiments at the Rothamsted Experimental Station. Following demonstration of the strain's pest population-suppressing effect, Tim sought to empirically test an additional modelled insecticide resistance management benefit in Cornell University, USA. By conducting releases of the GM strain over transgenic and conventional crops in caged glasshouse trials, he demonstrated that GM insects can have a synergistic effect with other pest management tools. This GM strain is now set to undergo field trials in the USA later this year. In addition to his excellent research record during his BBSRC iCASE studentship, Tim has also authored peer-reviewed publications and presented at several conferences, winning the award for best student presentation at the 2013 Royal Entomological Society annual meeting.

Industrial Sector & Portfolio

Oxitec specialises in insect biotechnology, in the Research and Development sector with applications in Agriculture and Public Health. Oxitec R&D places emphasis upon translation of proven technology to commercialisation; in other words taking candidate products through the R&D process, including proof-of-concept testing, regulatory trials, industrial production and commercial registration. In addition, Oxitec conducts extensive early-stage research to support a pipeline of new technologies and products, identifying and testing new genetic systems and approaches; which is where most of our industrial PhD research is conducted.

Current ICP partners

University of Liverpool, Dr Alistair Darby & Dr Ilik Saccheri (2014)

John Innes Centre, Prof Saskia Hogenhout (for 2015)

Existing BBSRC iCASE partners:

University of Oxford, Dr Seb Shimeld & Prof Michael Bonsall

University of Liverpool, Dr Alistair Darby & Prof Neil Hall

Cardiff University, Prof Helen White-Cooper

University of East Anglia, Prof Tracey Chapman

Unique Selling Point

"Insects controlling insects"

Oxitec is a biotechnology innovator, bringing new genetic pest management approaches to the market to improve peoples' health and food production, worldwide. Oxitec are unique in commercial application of genetically modified insects for field use in public health and agriculture, Oxitec's insects are the first transgenic arthropods to be released into the environment. As Oxitec is a small company (~40 employees), ICP students will have the

opportunity to routinely interact with all staff members working in a broad range of fields – technical, communications, intellectual property law, general management, and regulatory - with consequently full exposure to life in industrial biotechnology.

Challenges

Maintaining a balance between research and product development is key to balancing Oxitec's strategic commercial priorities. For graduate students in their industrial placement, however, we seek to maintain their focus on the research side of R&D. Typically this involves early-stage research into new technologies or methods, which generally has a moderate-to-low risk of success, with regards future real-world application. In such instances, we strive to ensure that the student is able to complete investigations to generate a thesis-worthy body of work, partly by offering 'lower-risk' sub-projects – often largely observational research – to maximise potential for publishable experimental results.

In addition, data generated in these new areas of investigation is frequently the subject of intellectual property protection. We recognise that peer-reviewed publications are an important outcome of PhD studentships, so we work hard to strike a pragmatic balance between intellectual property protection and releasing data for publication, to protect the research interests of students.

With our academic partners, we have been successful in overcoming these challenges. These sorts of tensions and activities also offer students valuable insight into commercial R&D that they would not experience in straight academic research.

Syngenta ICP



Lead contact: Stuart John Dunbar [stuart.dunbar@syngenta.com]

Operational contact: Stuart John Dunbar

Summary

Syngenta is the world's largest agriscience company with sales of \$13.4bn in 2012. The company is number one in agrochemicals including fungicides, herbicides and insecticides. It is the world's third largest seed company. We operate in all the world's major crops; in the UK the focus is on cereals, fruit and vegetables. Syngenta is also the world's largest supplier of flowers to the horticulture market. Jealott's Hill is the largest research site in Syngenta with ca. 1000 scientists focusing on chemical invention, herbicide research, product safety and formulation science.

ICP CASE studentships are central to our research. Dr Mike Bushell, Principal Scientific Advisor at Syngenta said *"The CASE scheme is highly valued in Syngenta. It links our scientists to leading academics and provides PhD students with an opportunity to do research in our laboratories, investigating new solutions to the challenges we face in feeding the world. It is also a successful route for future employment in Syngenta."*

All students undertake a placement at a Syngenta site in collaboration with the academic and Syngenta supervisors. Placements are a minimum of 3 months and more often than not in the range 3-6 months. All CASE students have had a placement over the past 10 years. During the placement, students are given training in a range of technical and personal areas covering all 4 of the Vitae training domains, Domain A knowledge and intellectual abilities, personal effectiveness, research governance and organisation, and engagement, influence and impact. Training includes working in an industrial laboratory environment and training on key pieces of equipment that may not be available in the academic institution but are important to the delivery of the final project, addressing their skills gaps. They are also given training on how to use computing tools such as XL and in data visualisation and interpretation if they are in a laboratory. Statistical tools and training are provided, via a dedicated Biometrics team who are expert in designing biochemical experiments and understanding the statistical significance of data.

All students have a whole day's health and safety training and undertake a course 'Understanding Agriculture' before starting work. In addition, they are trained on radiochemical and genetic manipulation regulations, if these are appropriate to their studies. We train students to understand risk assessments of the work they are undertaking and how to write a risk assessment of their work.

Students have daily contact with their supervisor and local technical experts whilst on their placement. This provides personal training on issues such as time management, and team working. The student will be fully integrated into a team; they will attend and contribute to regular team and group meetings. They are expected to complete a written report at the end of their studies detailing the experiments they performed and the experience they had whilst at Syngenta. This report forms a key piece of learning and feedback for both the student and Syngenta. Students are exposed to a wide range of science seminars on site that cover both

research and business topics. These include presentations on Patents and IP as well as the agricultural business and the challenges facing the world in sustainably feeding a growing population. We have a strong external seminar series where scientists from academia and other businesses present. This series is also open to students and they are actively encouraged to attend. They are also expected to give at least one seminar on site during their stay. Every year we hold a 'CASE day' where all CASE students and post-docs funded by Syngenta are brought together for a two day workshop. Students present their work either in a poster or a talk to their peers and Syngenta scientists. Prizes are given for the best talks and posters. The students are given feedback on their presentations and posters from senior Syngenta scientists. This is an important event in that students meet each other and see the whole research portfolio of CASE and post docs we fund. This provides a networking opportunity for the students and some have met academics at these events that have led to further post-doctoral studies. The training provided fits into the BBSRC/Vitae Skills statement, providing transferrable skills for employment in a wide range of Biosciences. Many CASE students go onto permanent employment at Syngenta; currently 11 ex CASE students are employed in Biological Sciences at Jealott's Hill, out of a total of 29 PhD level employees, which is an indication of how successful our training is in preparing them for employment.

Industrial Sector & Portfolio

Syngenta is the world's largest Agriscience company and the training sector is in all aspects of Agriscience.

Current ICP partners

TITLE	INDUSTRY SUPERVISOR	COLLABORATING RESEARCH ORG.	ACADEMIC SUPERVISOR
Validation of TOK potassium channels from phytopathogenic fungi as a promising new target for agricultural fungicides	A Corran	University of Portsmouth	A. Lewis
Elucidation of Molecular and Metabolic Networks Underlying Health Related Quality Traits in Tomato Fruit.	C. Baxter	Royal Holloway	P. Fraser
The Biochemical and Molecular Characterisation of Colour Intensity and Retention in Fresh and Dried Pepper Fruit.	C. Baxter	Royal Holloway	P Fraser
A New Strategy for Counteracting Multiple Herbicide Resistance in Grass Weeds	D Hughes	Durham University	R Edwards
Characterisation of mutations in the succinate dehydrogenase gene for potential fungicide resistance in <i>Ramularia collo-cygni</i>	D Ranner	University of Southampton	J Fountaine
Investigating the cost of adaptation in weed populations with evolved resistance to glyphosate	Kaundun	University of Warwick	P Neve
Functional genomic approaches to enhance wheat defence against stress	P Kilby	Newcastle University	A Gatehouse
Informatics for	M Seymour	Newcastle University	C Steinbeck

metabolomics			
Comparative and functional analysis of the <i>Mycosphaerella graminicola</i> Cytochrome P450 gene family	M Courbot	EBI	K Hammond-
		Rothamsted	Kosac
Genetic screens for essentiality and pathogenesis in <i>Mycosphaerella graminicola</i>	M Csukai	University of Exeter	K Haynes
Responses of the <i>Phytophthora infestans</i> metabolome and transcriptome to 'mock infection' and chemical inhibition	M Csukai	James Hutton Institute	S Whisson
The role of protein ubiquitination / sumoylation in the wheat programmed cell death (PCD) response induced by the fungal pathogen <i>Mycosphaerella graminicola</i> (<i>Septoria tritici</i>)	N Pain	Durham University	Ari Sadanandom
Tomato root stock	R Ramsay	University of Nottingham	Graham Seymour
<i>Drosophila</i> as a Tool for Identifying the Mode-Of-Action of Insecticides: A Chemical Genetics Approach.	J Goodchild	University of Manchester	R Baines
Molecular studies of meiotic recombination in <i>Arabidopsis thaliana</i> and <i>Triticum aestivum</i>	J Melichar	University of Cambridge	I Henderson
Characterising the biological, biochemical and genomic response of honeybees to neonicotinoid exposure	M Daniels	Rothamsted	C Bass
VLCFA elongase inhibitors by Understanding in vivo specificity of quantitative activity profiling	S Oliver	Imperial College London	E Tate
Carotenoid Cleavage Dioxygenases Enzymology & Roles In Plant Hormone Biosynthesis	D Brocklehurst	University of Warwick	T Bugg
Development of a model for a.i. uptake in formulation into human skin.	J Wright	University of Nottingham	F Rose
MicroRNA (miRNA) "fingerprints" as biomarkers of chemical-induced carcinogenesis	R Currie	Imperial College London	N Gooderham
Production and evaluation of a primary human cell-based microfluidic culture system for acute and chronic hepatotoxicity testing	R Currie	University of Nottingham	A Bennett

Identifying molecular causes of developmental delays in bone ossification: insights from the Med31 mutant mouse	R Duran	University of Manchester	K Hentges
Understanding the mechanisms underlying organogenesis: Insights from the EHC mutant mouse	E Barnes	University of Manchester	K Hentges
An integrated mathematical model of lipoprotein metabolism	R Currie	University of Reading	M Tindall
The role of vesicular neurotransmitter transporters and acetylcholine receptor subunits in an identified neural circuit in <i>Drosophila</i>	Jim Goodchild	University of Manchester	R Baines
Functional pharmacology of positive allosteric modulators of cis-loop ligand-gated ion channels	Jim Goodchild	UCL	Neil Millar
The biological and molecular factors influencing the control of two whitefly species (<i>Bemisia tabaci</i> and <i>Trialeurodes vaporariorum</i>) on different host plants	Russell Slater	Rothamsted and University of Exeter	Chris Bass and Richard French-Constant
Investigating differences between attachment, penetration and infection of <i>P. penetrans</i> strains and isolates of globally important parasites, <i>Meloidogyne</i> spp. and the potato cyst nematodes <i>Globodera rostochiensis</i> and <i>G. pallida</i>	Tom Hewlett and Anthony Flemming	James Hutton Institute	Vivian Block
The role of soil structure in the degradation of crop protection products	Robin Oliver and Irene Bramke	University of York	Thorunn Helgason

Unique Selling Point

“We provide training at both the personal and scientific levels in an industrial environment”

Challenges

Sometimes Licensing Departments at Universities and Institutes are difficult to deal with. Academics don't want to give the students their stipend from us but want to keep it for their lab consumables. “It would be unfair if two students in the lab earned different salaries” is often said

Overcome – building long term relationships is the best way to overcome these

UCB ICP

Lead contact: Dr Tom Crabbe [tom.crabbe@ucb.com]

Operational contact: Dr Martin Procter [martin.procter@ucb.com]

Website & Social Media: <http://www.ucb.com/> , www.ucbpharma.co.uk,
<https://www.youtube.com/user/UCB>, <https://www.linkedin.com/company/ucb-pharma>

@ucb_news

Summary

The UCB Training Programme is centred on working in drug discovery research at our Slough campus.

UCB sponsored projects range from early, fundamental research, which aim to provide a either a better understanding of disease pathology or the establishment of a novel technological approach, to projects that are more closely aligned to on-going drug discovery efforts. Publications are encouraged wherever possible, and generally there are no restrictions placed on confidentiality aside from the standard short delay to assess suitability for patenting.

While the student is based at their University, formal meetings between the UCB supervisor, academic supervisor and student occur generally quarterly. These meetings give the student experience of formal presentation writing and delivery. These meetings allow UCB to assess progress of the project and the development of the student as a whole. UCB also receives regular written reports from the student, again improving important scientific skills.

On arrival for their placement at UCB, students are immediately integrated into a functional department (for example Protein Expression and Purification) and the sub-group containing the UCB Supervisor. We will also routinely appoint a UCB Mentor who will be on-hand in the lab to help with technical aspects of the project and to make sure equipment availability and reagent supply are coordinated with the student's time at UCB. Students will receive appropriate training in all necessary procedures (for example Health and Safety in the Lab) before beginning their work. During their placement, students are required to present their work in group meetings on a weekly basis and be subject to scientific challenge and reciprocate when other group members are presenting. The UCB Supervisor and Mentor will provide regular feedback on student performance whilst joint meetings between student, UCB staff and academic supervisor are also scheduled to ensure the student's progress is in-line with expectations and to plan activities to be performed at UCB. The students' placement at UCB operates in a flexible manner to fit round the needs of their project. The overall length of time spent in Slough generally ranges from 3-6 months in total, arranged in one block or split into shorter slots. Where the student's project is suitable, UCB looks for ways to apply the student's research to an on-going in-house project so they can see how their efforts can be applied to a live drug discovery effort.

Once a year we hold a "PhD studentship day" when all PhD students we are currently funding get together to present their work and network. This event is attended by over 100 people, which includes the PhD students, many of their supervisors, the UCB supervisors, and senior UCB

management. The 2014 event was held at the Royal College of Surgeons in London, where we had eight oral presentations from our final year students. All students at an earlier stage of their studies are expected to present posters (36 posters this year). Questioning is often unpredictable and tough but it is widely regarded as a high quality day of science and enjoyed (in the end) by all!

The students are also able to spend time on other aspects of normal work-life such as contributing to debates, attending seminars and joining sports and social activities. For example, UCB hosts a weekly seminar, where an external academic or internal expert gives a lecture on a topic related to human disease or drug discovery. UCB also holds Patient Focus meetings where the student can learn at first-hand about the lives of people living with disease and how their research may one day provide solutions to the problems these patients face.

Continuous improvement is recognised as a necessary element to our training program and we are starting to gather feedback from existing and past students on how we could improve.

As a case study we would like to highlight the project performed by Hannah Maple entitled "Towards High Throughput Fragment Screening by Mass Spectrometry." Hannah's PhD research work (2007-2011) directly impacted UCB's ability to introduce a Mass Spectrometry screening assay into routine project work. Her proof of concept studies gave us the confidence to add more resource, enabling a fully automated assay to be developed. This also enabled Hannah to directly see how the research she was developing in the academic setting could be translated into industrial application. Hannah appreciated her time at UCB for the science training it provided, the flexibility of our approach and the experience of working alongside enthusiastic and collaborative drug-discovery scientists. She has taken the learnings from UCB forward into her current position as IEU Metabolomics Manager at Bristol University.

Industrial Sector & Portfolio

UCB is a thriving biopharmaceutical company engaged in the discovery and development of new treatments for a variety of diseases. Areas where there is direct overlap between UCB's interests and BBSRC's strategic remit include focussing on the development of interventions to improve human health and wellbeing throughout life, particularly in the areas of musculoskeletal, immune system, and cognition. The UK's site in Slough has a fully-integrated infrastructure to enable all aspects of drug discovery from protein expression, antibody generation, medicinal chemistry, computer aided drug discovery, biological testing, biophysical evaluation, and through to large scale protein production. Our in house expertise is supported by an innovation supernetwork of academic and company partners worldwide.

Current ICP Partners

The following table illustrates the ongoing and committed BBSRC supported PhD's that UCB helps to sponsor:

Name	Technology/ Project Area	University Contact	Student	Dates
Edinburgh	Explaining allosteric modulation of protein function by energy/entropy localisation	Julien Michel	TBC	2015-2019
Dundee	Global analysis of pharmacophoric space	Prof Andrew Hopkins	TBC	2015-2019
Oxford	Dynamic Pharmacophore	Prof Mark Sansom	TBC	2014-2018
Oxford	DNA-protein conjugates	Prof Ben Davis	Ben Bower	2014-2018

KCL	Mapping dynamics of receptor-ligand interactions in living cells	Simon Ameer-Beg	Camille Perrin	2014-2018
UCL	Assessing druggability using atomistic simulation	Prof Francesco Gervasio	Vladimiras Oleinikovas	2014-2018
Manchester	Prediction of the disposition of substrates of active transporters in the liver	Aleksandra Galetin	Shelby Barnett	2014-2018
KCL	Expression and function of IL-17 family members in humans	Leonie Taams	Lachrisa Burns	2014-2018
UCL	To investigate the role of a novel, tolerance-inducing NCE on intracellular protein trafficking in immune cells	Shane Minogue & Prof David Sansom	Daniel Janman	2014-2018
Bristol	Developing an in vitro model of Glomerulosclerosis	Prof Moin Saleem	Jack Tuffin	2013-2017
Queen Mary	The effects of neutrophil derived microparticles on macrophage function	Prof Mauro Perretti	Hefin Jones	2013-2017
Oxford	Multiscale Molecular Simulations of Small GTPase/Membrane Interactions	Prof Mark Sansom	Elizabeth Jefferys	2013-2017
Cambridge / CCDC	The automatic detection of small molecule binding hotspots and assessment of their utility in binding mode prediction	Colin Groom / Prof Tom Blundell	Christopher Radoux	2013-2017
Edinburgh	Control of alpha-synuclein fibril assembly through peptide stapling: implications for Parkinson's disease	Tilo Kunath	Fergus McWhinnie	2013-2017
UCL	Regulation of cell death at TNF-R1 signalling complex II by linear ubiquitination	Prof Henning Walczak	Matthias Reichert	2012-2016
Glasgow	Engineering the CHO host cell to improve protein production	Prof Neil Bulleid	Chloe Stoye	2012-2016
Kings College	Allosteric modulation of IgE with respect to interaction with FcεRI and CD23	Prof James McDonnell	Elizabeth Allan	2012-2016
Leeds (Astbury)	Membrane protein folding and function studied by mass spectrometry	Prof Alison Ashcroft	Thomas Watkinson	2012-2016
Leicester	Structures, Interactions and Mechanisms of Action of Secreted Protein Regulators of Wnt Signalling: Laying the Foundations for Future Drug Discovery	Prof Mark Carr	Saleha Patel	2012-2016
UCL	Analysis and prediction of antibody stability and B-cell epitopes	Prof Andrew Martin	Tom Northey	2012-2016
Southampton	Expression and activity of WISP-1 in Pulmonary Fibrosis	Prof Donna Davies	Lyndsy Ambler	2012-2016
Oxford	Paradoxical effect of anti-TNF on Th17 responses	Richard Williams	Federica Borghese	2012-2016
Glasgow	Engineering cells for antibody production	Prof Neil Bulleid	Fiona Chalmers	2012-2016
Kent	Unravelling the relationship between IgG yield, recovered/observed clonal numbers and specific integration site on the yield of IgG in CHO cells	Prof Mark Smales	Teddy Jenkins	2012-2016
Bristol	Scope and limitations of capillary flow NMR as a Screening technology	Matt Crump	Matthew Goodwin	2011-2015
Strathclyde	Understanding in vivo processing of therapeutic Mabs; investigating the clinical relevance of post translational	David Watson	Pauline MacLure	2011-2015

		modifications; potential impact on immunogenicity.			
	Oxford	Site selective chemical labeling of proteins	Ben Davis	Peter Crane	2011-2015
	Oxford	Structure-based identification of inhibitors of the bromodomain-chromatin interactions	Prof Conway	Brian Wilson	2011-2015
	Cambridge	Understanding and modulating interactions at protein-protein interfaces	Prof Tom Blundell	Harry Jubb	2011-2015

Unique Selling Point

'Inspired by patients, driven by science'

Our USP is that students are housed and integrated into the same single building as the rest of our UK-based research scientists, all of whom are engaged in the discovery and application of chemicals and biologicals as novel therapeutics using cutting-edge technologies. This unique environment means that students are inevitably exposed to the ups and downs of most aspects of pre-clinical drug discovery and feel part of a talented and passionate workforce. Expectations are set high and students are stretched to reach their goals through challenge and defence of their work so it is no surprise that the vast majority succeed in their training and continue to develop a career in scientific research.

This full integration of the students into the very fabric of the research campus means that they benefit from the same general scientific exposure that all the UCB employees enjoy through our external seminar series and regular UCB science presentations.

UCB is a truly patient-centric organisation, and all our projects have the patient driving everything we do. One inspirational way this manifests itself is that we have regular patient focus days. This is where we invite patients, medical experts, and associated charities to come to UCB and talk to our organisation about how their disease affects them on a daily basis. This is a truly grounding experience to understand first-hand how the therapies UCB are developing will have a positive impact on the lives of patients, and is something that can be easy to forget when working in the laboratory on early stage research.

Challenges

1. Finding the resources to allow student research training to progress successfully alongside our normal drug discovery programs
2. Making sure that students feel part of the UCB team
3. Ensuring feedback is routinely given and always helps student development
4. Involving academic partners in the research at Slough
5. Continuous improvement
6. Formalising the training program
7. Capturing data associated with a student outside their project, e.g. training record, career choices after completion etc.
8. Building the training network – alumni etc.

Unilever ICP



Lead & Operational contact: Dr Rebecca Ginger [rebecca.ginger@unilever.com]

Website & Social Media:

<http://www.unilever.co.uk/innovation/researchanddevelopment/>

<http://www.unilever.com/innovation/centres/colworth/>

Facebook: <https://www.facebook.com/unilever>

Twitter: <https://twitter.com/unilever>

LinkedIn: <https://www.linkedin.com/company/unilever>



Summary

Unilever is one of the world's leading manufacturers of fast moving consumer goods with sales in 190 countries. The Unilever business is aligned around 4 product categories in Foods, Refreshment, Personal Care and Home Care with dedicated R&D professionals firmly embedded into each category. R&D also supports longer-term research for all categories through the Strategic Science Group and in addition a considerable amount of scientific research is conducted as part of the Safety and Environmental Assurance Centre (SEAC).

Our company vision is to double the size of the business, whilst reducing our environmental footprint, increasing our positive social impact and making sustainable living commonplace. Three specific health targets set by Unilever are to: (i) help 1 billion people improve their health and wellbeing; (ii) halve the environmental footprint of our products and (iii) source 100% of agricultural raw materials sustainably. Unilever leadership recognise that supporting a strong innovation pipeline is key to enabling the company to meet these ambitious goals.

The company supports industrial partnership studentships as they enable us to (i) help train the next generation of UK bio-scientists, providing an industrial context (ii) collaborate and develop opportunities for our PhD qualified bio-scientists (iii) identify opportunities to conduct high quality research with outstanding UK academic research groups (iv) increase our awareness of the BBSRC remit and the wider range of collaborative opportunities.

Our strong track record of supporting successful PhD training studentships is driven by a highly competitive internal project selection process (in 2013 we reviewed 20 proposals for 6 studentships) which ensures that only good quality, well founded projects with good training opportunities are funded. In addition to providing a strong scientific research training, students on our programme have the opportunity to gain exposure to the full breadth of our research by networking with researchers supporting Unilever's diverse product categories and our world-leading critical functional capability in product safety and environmental assurance (SEAC). In the Strategic Science Group we are able to offer training in cutting edge capabilities such as genomics and close interactions with scientists across 6 global research centres provide opportunities to understand consumer needs in

different cultural contexts. We also provide students with online access to training modules for more general industrial research skills such as intellectual property and patent awareness, open innovation and regulatory affairs.

Case study:

Josephine Moran is studying staphylococcal responses to antimicrobial skin lipids at the University of Liverpool

Antimicrobial fatty acids (AFA) including sapienic acid (16:1 Δ 9) and linoleic acid (18:2 Δ 9, Δ 12), are abundant on healthy mammalian skin where they are proposed to form a barrier against microbial colonisation as there is an inverse correlation between levels of staphylococcal colonization and AFAs. These lipids cause membrane permeabilisation and/or proton motive force disruption and may be crucial in determining the diversity and degree of staphylococcal skin colonisation. Jo has analysed the transcriptomic responses of staphylococcal species to sapienic acid using next generation sequencing RNA-Seq, and in parallel generated and characterised mutant strains with altered lipid resistance. From these approaches, several genes and pathways potentially involved in the responses of both species to skin lipids have been identified. This study has increased our understanding of staphylococcal molecular interactions with host antimicrobial lipids, which could guide the design of novel antimicrobial compounds with potential future applications for skin health.

Publications

Coates, R and Moran, J and Horsburgh, MJ (2014) Staphylococci: colonizers and pathogens of human skin. *Future Microbiology*, 9 (1). pp. 75-91.

Kenny, John G., Moran, Josephine, Kolar, Stacey L., Ulanov, Alexander, Li, Zhong, Shaw, Lindsey N., Josefsson, Elisabet and Horsburgh, Malcolm J. (2013) Mannitol Utilisation is Required for Protection of *Staphylococcus aureus* from Human Skin Antimicrobial Fatty Acids. *PLoS ONE*, 8 (7). e67698.

Industrial Sector & Portfolio

Unilever R&D employs over 6,000 professionals across six global R&D centres and 31 major product development centres and is strongly engaged in research in industrial biotechnology, basic bioscience underpinning health and food security. The Unilever portfolio covers a wide range of products and includes some of the world's best known brands such as: Knorr, Hellmann's, Flora, PG tips, Lipton, Magnum, Dove, Vaseline, Lynx/Axe, Signal, Persil, Cif, Domestos, Lifebuoy, Marmite and Pot Noodle. Unilever has led the Food Producers sector in the Dow Jones Sustainability World Indexes for 13 consecutive years and plans to source all its agricultural raw materials sustainably by 2020.

Unilever currently has 32 'live partnership projects' with 19 different academic partners. The studentships comprise a mixture of ICP (80%) and iCASE (20%) awards. 40% of the projects are running with Unilever's strategic grid partners (Cambridge, Cranfield, Liverpool, Manchester, Nottingham) and the remaining 60% with a broad range of other academic institutions drawn from across the UK (Aberdeen, Aberystwyth, Aston, Bradford, Cardiff, Durham, Glasgow, IFR, John Moores, KCL, LSHTM & Rothamsted, Newcastle, Southampton, Surrey, UCL).

Although the majority of Unilever studentship supervisors are located at our Colworth site in Bedfordshire, (drawn from the strategic science group, category research and SEAC), we also have supervisors located at our Port Sunlight labs on the Wirral and at our Vlaardingen site in the Netherlands. Projects cover a broad range of bioscience including novel enzymes for laundry applications, synthetic biology routes to functional proteins for foods and cosmetic applications, genetic, epigenetic, microbiomic and systems approaches to study human ageing, hair and skin biology, host-microbial interactions related to health and

hygiene, effects of diet on metabolic health, optimisation of phytochemical content in processed foods, sustainable sources of plant products including palm oil, flavour components, drought resistant crops and biomaterials.

Unique Selling Point

“Unilever-partnered studentships help to develop highly skilled bioscientists who are well networked, culturally aware and have an enhanced understanding both of the key role that research plays and of the challenges involved in supporting innovation within a global FMCG business.”

Unilever consumers buy 170 billion Unilever products around the world every year, and our products are used 2 billion times a day by the peoples of the world. Consequently a research discovery that is successfully translated into a product development can have an enormous impact on global health. Students who choose to work on a Unilever-partnered project have the opportunity to participate in fundamental bioscience research which has the potential to be developed and leveraged on a global scale to improve the future health and wellbeing of billions of consumers across the planet. The global alignment of our research projects across our R&D labs in Europe, America and Asia affords students with a unique opportunity to interact with industrial scientists around the world and to appreciate the cultural challenges and opportunities that exist within a multinational fast moving consumer goods environment.

Unilever R&D is increasingly seeking to participate in a range of national and international collaborative government funded projects and the BBSRC-partnership studentships offer a key foundation block on which to build successful networks which can enable the establishment of valuable future collaborations.

Challenges

Research within an industrial context has to be flexible to meet the rapidly changing demands of the business as it seeks to operate in a highly competitive environment, whilst responding to shifting consumer needs and trends combined with other external economic influences. This presents a challenge to devise projects with sufficient longevity for a PhD studentship that can still provide value to the company when internal programmes are constantly evolving. For this reason we are careful to select proposals that are aligned to enduring longer-term Unilever research priorities.

Unilever’s animal testing policy clearly states that we are committed to the elimination of animal testing for our products, without compromising on the highest standards of consumer health and product safety. This means that the company cannot support proposals which include or may lead to animal experimentation. This presents both a challenge (as many academic groups see this type of work as ‘normal practice’) but also an opportunity for us to influence the wider research community, firstly to consider carefully whether the use of animals is genuinely necessary to pursue their research goals, and secondly to engage more research groups in the development and evaluation of alternative non-animal approaches to research. Unilever invests heavily in developing and applying alternative approaches to replace animal testing in product safety assessments and through its SEAC researchers works pro-actively within a number of multi-partner consortia to lead this area forward. Over the years a number of partnership studentships projects have contributed to this key area of research.

Speaker Abstracts

Dr Celia Caulcott, Executive Director, Innovation and Skills, BBSRC

Dr Caulcott is BBSRC Executive Director, Innovation and Skills. Trained initially in microbiology and following her PhD she joined Celltech Ltd, where she worked on and subsequently led research on therapeutic recombinant monoclonal antibodies. After working for ICI Pharmaceuticals and the Wellcome Foundation/GSK, Dr Caulcott became an independent bio-pharmaceutical and research management consultant, working on projects for the then DTI and other government departments and agencies including the Food Standards Agency and the Department of Health, as well as for the BBSRC and Medical Research Council. She also worked for the Wellcome Trust, in particular with the Sanger Institute on the Pathogen Genome Sequencing Programme and the Human Genome Project and for Imperial College London developing research strategy.



Since joining the BBSRC in September 2008, she has widened its engagement with businesses associated with agriculture and food in the UK, and placed an emphasis on the importance of the bioscience research base in contributing to knowledge exchange and innovation to benefit society and the economy both within and beyond the UK. She has also had the opportunity to influence very high level skills developments in bioscience, supporting a user-focused approach. Currently she leads on the development of the BBSRC strategy in Industrial Biotechnology and Bioenergy and in establishing the BBSRC innovation strategy, in particular as realised through research and innovation campuses.

Dr David Sweeney, Director (Research, Education and Knowledge Exchange), HEFCE

David Sweeney is Director (Research, Education and Knowledge Exchange). In this role he is responsible for research policy and funding (including the Research Excellence Framework), knowledge exchange and health policy. He is also responsible for the Catalyst Fund, the UK Research Partnership Investment Fund, and HEFCE's international engagement. He works alongside Chris Millward (Director of Policy), who leads on education and skills.



A statistician, David worked at two BBSRC research institutes, developing mathematical models of plant growth before moving into senior management in the IT area, becoming Director of Information Services at Royal Holloway, University of London, and serving in a national role as Chair of the Universities and Colleges Information Systems Association. He became Vice-Principal (Communications, Enterprise and Research) in 2004, responsible for research strategy, the 2008 RAE submission and for developing Royal Holloway's research-led commercial and consultancy activities, knowledge transfer and development programme. He joined HEFCE in 2008 as Director (Research, Innovation and Skills).

David was an adviser to the Australian Research Impact Pilot Exercise, and he has also visited many European countries and Hong Kong to advise on research assessment and funding. In 2012, he was a member of the Finch Group on Open Access to Research

Outputs, and has been working with the research councils, charities, learned societies, other academic groups and publishers to take forward the Finch Group recommendations.

David was awarded an honorary doctorate from the University of Aberdeen in 2012 and is a Fellow of the Royal Statistical Society.

Professor Jerry Roberts, Professor of Plant Biology, University of Nottingham

Professor Jerry Roberts is Assistant Pro-Vice Chancellor for Research at the University of Nottingham and academic champion of the University's Global Food Security priority group. He is Director of the Biotechnology and Biological Sciences Research Council (BBSRC) AgriFood Advanced Training Partnership and of the University of Nottingham's BBSRC Doctoral Training Partnership. He is a member of BBSRC's Bioscience Skills and Careers Strategy Advisory Panel. He chairs the University of Nottingham's Doctoral Training Programme Directors' Board that seeks to advise on, and support the growth of, the University's Doctoral Training Programme portfolio.



Jerry's primary research interests are focused on understanding the molecular and cellular mechanisms responsible for regulating cell separation processes in plants. His work has been funded by BBSRC and has led to the application and granting of a number of patents relating to the manipulation of pod shatter in oil seed rape.

Professor Stuart John Dunbar, Head of Bioscience, Syngenta (Jealott's Hill)

I have worked for Syngenta and its legacy companies since 1985 and my current role is Head of Bioscience at Jealott's Hill International Research Station in Berkshire UK. Syngenta is the world's largest Agriscience Company. Bioscience is a multidisciplinary international group with science ranging from biochemistry, molecular sciences, genetics, neuroscience, analytical chemistry and metabolism. Our role is to understand the mode of action of novel research agrochemicals, their in-vitro SAR, how they are metabolised, taken up and transported in pest and crop species and the mode of resistance. I lead the iCASE programme and am the BBSRC contact for Biological Research. I am also an Adjunct Professor of Cellular and Molecular Sciences at Imperial College. My research interests include Systems Biology, Synthetic Biology, understanding how chemicals and genes work, and Chemical Biology.



Professor Jackie Hunter CBE, Chief Executive, BBSRC

Professor Jackie Hunter joined BBSRC as Chief Executive in October 2013. Jackie has over thirty years of experience in the bioscience research sector, working across academia and industry and playing a key role in innovative collaborations and partnerships. She holds a personal chair from St George's Hospital Medical School, which was awarded in recognition of her contribution to bioscience research.

Jackie Hunter gained her first degree in Physiology and Psychology at the University of London followed by her PhD which was carried out at the Zoological Society of London. She undertook a Wellcome Trust post-doctoral research fellowship at St George's Hospital Medical School before taking a role in the pharmaceutical sector in 1983.



During her career in industry, as well as leading neurology and gastrointestinal drug discovery and development, Jackie also spent several years developing and leading GSK's external science engagement strategy. In this role she played a central part in fostering effective and innovative collaborations and partnerships between university and institute research groups and the company.

Jackie is a current member of the Council of the University of Hertfordshire and previously served on the Council of Royal Holloway University of London as well as the governing body of the Babraham Institute. From 2004, Jackie was a member of BBSRC Council and BBSRC Strategy Board. She is a fellow of the British Pharmaceutical Society.

She founded OI Pharma Partners in 2010 to support the life science sector in harnessing the power of open innovation. Open innovation allows public and private organisations to use a range of collaborative models to find the best ways to bring ideas to fruition.

Jackie was awarded a CBE in the Queen's Birthday Honours list for Services to the Pharmaceutical Industry as well as the Women of Achievement in Science, Engineering and Technology (SET) awards in the category SET Discovery, Innovation and Entrepreneurship in 2010.

Harry Kelly PhD FRSC, Director Chemistry Operations, Respiratory Therapy Area, GSK

Harry joined the company as a medicinal chemist in 1987 after completing his BSc and PhD at the University of Glasgow. He took on roles of increasing responsibility which, in 1999, resulted in him being appointed leader of a medicinal chemistry programme designed to identify a novel treatment for cardiovascular diseases. Since May 2003, Harry has been the Operations Manager at Stevenage, where he is responsible for safety within the chemistry laboratories and recruitment of the highest quality chemists from diverse backgrounds.



He recruits chemistry graduates, postgraduates and over 40 chemistry industrial placement students from across Europe each year. He played a major role in the successful application for the Quality Mark of GSK's UK chemistry industrial placement programme by the National Council for Work Experience and the University Vocational Awards Council and is the director for GSK's Professional Development programmes with the University of Kent

(Postgraduate Certificate) and University of Strathclyde (MPhil/PhD) for chemistry employees in the UK.

Professor Gary Lye, Professor of Biochemical Engineering, UCL

Gary Lye (<http://www.ucl.ac.uk/biochemeng/people/academic/lye-g>) is Professor of Biochemical Engineering at UCL. He is Director of the EPSRC Centre for Doctoral Training (CDT) in Bioprocess Engineering and is Deputy Head of the UCL Department of Biochemical Engineering. He leads the multidisciplinary Industrial Biotechnology research group that addresses the synthesis of value-added chemicals and pharmaceuticals from renewable feedstocks). He has broad research interests on the application of microscale, single-use and synthetic biology technologies to the rapid design,



optimisation and scale-up of biocatalytic processes. He was a member of the UK government's Industrial Biotechnology Innovation and Growth Team and currently sits on the Industrial Biotechnology Leadership Forum (IBLF) Skills Working Group.

Professor Chris Thomas, Professor of Microbiology, University of Birmingham

Chris Thomas read Biochemistry at The Queen's College, Oxford and then a DPhil in Microbiology at Linacre College, Oxford before an MRC Travelling Fellowship to study bacterial plasmids at UC San Diego in 1977 when gene cloning was just starting. In 1980 he returned to a Lectureship in Genetics at the University of Birmingham where he has spent the rest of his academic career, being promoted to a personal Chair in 1991. He became the first Director of the Biosciences Graduate Research School in 1999 and the first Director of the University Graduate School in 2004. From 2009 until 2013 he was Director of Graduate Research in the College of Life and Environmental Sciences. His particular interest has been in postgraduate training with a view to producing the best possible PhD graduates.



He currently has no formal management lead position other than as Birmingham lead within the BBSRC-funded DTP with Warwick and Leicester Universities in which he takes particular responsibility for the training running things like the SpeedPhD Induction course and the Coniston Team Skills Course. He is still active in research with his lab focused on the ways bacteria make antibiotics (with a view to developing new antibiotics) and the genetic elements, plasmids, that promote spread of antibiotic resistance. He is particularly active in two Societies, being Treasurer of both the Society for General Microbiology and the International Society for Plasmid Biology (which he helped to found in 2004).

Dr Isolde Haeuser-Hahn, Alliance Management, Bayer CropScience AG

I am a biologist by training and studied at the universities of Gießen, Freiburg and Kiel in Germany. After a Ph. D. thesis on the occurrence of the chlorophyllide oxidoreductase under different light regimes, I was very much interested in research on plant disease defense reactions and worked as postdoctoral fellow at the Max-Planck Institute for Plant Breeding Research in Cologne. In 1988 I joined Bayer AG as lab leader in the biotechnology department in the corporate research center in Leverkusen with a focus on agricultural science. In 2000 I transferred to Bayer CropScience AG with a focus on product and project support of fungicides and supervision of an international team in anti-resistance management. In 2007 I lead the group “screening and safeners” in herbicide research in Frankfurt.



Since 2011 I am in Research and Development - Alliance Management. Tasks are e.g. manage contracts during their whole life cycle from negotiation to post-contractual obligations, evaluate and integrate new emerging technologies and further expand scientific networks.

Dr Rich A Borman, Academic Liaison Manager, GSK

Originally trained as a pharmacologist, Rich has held a variety of roles within both academia and industry. With a BSc (Hons) in Pharmacology from the University of Manchester, he undertook a challenging PhD at Queen Mary, University of London, investigating serotonergic control mechanisms in human gastrointestinal function, investigations that were continued during post-doctoral studies at the University of Southampton. This was followed by 8 years at a small Biotech (Pharmagene), during which Rich started to transition into a Business Development role. Finally moving to big Pharma, Rich has spent the last 9 years with GSK, the last 5 years of which have been spent within the Academic Liaison group.



In his current role in Academic Liaison, Rich has taken responsibility for organising and running GSK's PhD studentship programmes, in addition to negotiating and executing a range of agreements with academia (in the UK and worldwide). These vary in size and breadth, from simple material transfer agreements though to multi-year, multi-million pound collaboration and consortium agreements. With the experience of 5 years in Academic Liaison and with over 650 agreements negotiated, Rich has built up strong working relationships with a substantial number of Universities and funding bodies, obviously including the UK research councils.

Professor Alison G Smith, Professor of Plant Biochemistry, University of Cambridge

Alison Smith is Professor of Plant Biochemistry at the University of Cambridge, UK, and the PI of the Cambridge BBSRC DTP. Her research interests are focussed around the metabolism of plants, algae and bacteria, in particular of vitamins and cofactors, and of biofuel precursors. Current projects include developing strategies for metabolic engineering of plants and algae to enhance production of vitamins, and hydrocarbons that might be suitable as biofuels. A second area is understanding algal-bacterial interactions, following Smith's discovery that half of known microalgal species need an external source of vitamin B12, which they get from bacteria - in turn the bacteria get fixed carbon from the algae. This has implications both for the production of dense algal cultures in open ponds and for aquatic ecosystems generally.



In 2007, Smith founded the Algal Biotechnology Consortium with other biologists and engineers in Cambridge (ABC), the interests of which are in exploiting algae for biomass and biodiesel production, remediation of waste streams including water and CO₂, the production of biological solar panels, and as a platform for the production of high value and bulk chemicals. She is actively engaged in activities aimed at promoting the use of microalgae for biotechnological purposes, and advocacy of biological solutions to bioenergy challenges. Her work has always been interdisciplinary, interacting with chemists, physicists, mathematicians and engineers, and has helped in cementing interactions with colleagues in Cambridge to offer similar cross-discipline training in the BBSRC DTP, as evidenced by the fact that 15-20% of our cohort of students come with degrees in non-biological subjects.

Samantha Aspinall, Professional Training & Development, University of Leeds

I work at the University of Leeds part time, I also have a training and development consultancy which means I work with a number of Universities across the UK. I work with academics, research staff and research students focusing on their professional development needs. My specialisms include developing training programmes for grant applications, facilitating interdisciplinary collaborations and working with people on career path development.

I design and deliver workshops on leadership, collaboration, cohort building, creative thinking, building confidence, enterprise, networking and communication. I have worked with NESTA to design and deliver their Crucible programme and co-write Crucible in a Box, an interdisciplinary programme for early career researchers.



I have recently been appointed to the BBSRC Bioscience Skills and Careers Strategy Panel (commencing January 2015). This panel is responsible for developing and maintaining our policies to support the supply of trained people in the biosciences relevant to its user communities.

Phil Clare, Associate Director, Research Services and Head of Knowledge Exchange, University of Oxford

Phil is part of the senior management team in Research Services at the University of Oxford. Research Services works with the academic divisions to support all aspects of research strategy and negotiates and administers research grants and contracts. The team is also responsible for research ethics and integrity, clinical trials governance, IP rights due diligence and related Knowledge Exchange activities. This includes developing new ways for the University to work with industry and coordinating knowledge exchange activity across the university. Phil is responsible for the Knowledge Exchange and Impact Team (KEIT) and the Intellectual Property Rights Management Team. He negotiates some strategic contracts and works closely with Isis Innovation Ltd, the University's wholly-owned technology transfer company. He works with the University's Pro Vice Chancellor, Research to support the regional agenda and the Local Enterprise Partnership and is determined to find more ways to improve Oxford's Innovation Ecosystem.



Phil worked previously at the Universities of Bath and Bournemouth in a variety of roles related to Research Management and Commercialisation, and for the UK Research Office in Brussels focusing on European research funding.

He is a member of the HEFCE Research and Knowledge Exchange Committee of Council and a board member of PraxisUnico, the leading UK organisation for commercialisation and technology transfer, and has previously been on the board of ARMA, the Association of Research Managers and Administrators. He is a registered technology transfer professional (RTTP). He is also a director of Fluvial Innovations Ltd, a student startup, and Oxford Charity Football League Ltd, a social enterprise.

Dr David McAllister, Head of Skills and Careers, BBSRC

David McAllister is currently Head of Skills and Careers at BBSRC, following a number of science policy and operational roles within BBSRC, including managing the technology and e-science portfolios. He currently leads the development of BBSRC's strategic activities directed towards ensuring bioscientists possess the skills and knowledge needed for careers in research and to underpin strategically important sectors of the UK economy. He holds a degree and PhD in parasitology from the University of Glasgow.



Delegate List

Name	Surname	Institution / Company	Email
Susan	Anderson	University of Nottingham	susan.anderson@nottingham.ac.uk
Samantha	Aspinall	University of Leeds	s.l.aspinall@leeds.ac.uk
Andy	Bailey	University of Bristol	andy.bailey@bristol.ac.uk
Ilaria	Bellantuono	University of Sheffield	i.bellantuono@sheffield.ac.uk
Rob	Beynon	University of Liverpool	r.beynon@liverpool.ac.uk
Clare	Bhunoo	BBSRC	clare.bhunoo@bbsrc.ac.uk
Ray	Boot-Handford	University of Manchester	ray.boot-handford@manchester.ac.uk
Richard	Borman	GlaxoSmithKline	richard.a.borman@gsk.com
Leo	Brady	University of Bristol	l.brady@bristol.ac.uk
Martin	Buck	Imperial College	m.buck@imperial.ac.uk
Raymond	Bujdoso	University of Cambridge	rb202@cam.ac.uk
Celia	Caulcott	BBSRC	celia.caulcott@bbsrc.ac.uk
Tracey	Chapman	University of East Anglia	tracey.chapman@uea.ac.uk
Tim	Cheek	Newcastle University	tim.cheek@ncl.ac.uk
Phil	Clare	PraxisUnico	phil.clare@admin.ox.ac.uk
Kate	Conway	NBI	kate.conway@nbi.ac.uk
David	Conway	London SHTM	david.conway@lshtm.ac.uk
Tom	Crabbe	UCB	tom.crabbe@ucb.com
Fiona	Cunningham	Royal Veterinary College	fcunningham@rvc.ac.uk
Simon	Cutler	BBSRC	simon.cutler@bbsrc.ac.uk
Katherine	Denby	University of Warwick	k.j.denby@warwick.ac.uk
Stuart	Dunbar	Syngenta	stuart.dunbar@syngenta.com
Nicola	Easen	BBSRC	nicola.easen@bbsrc.ac.uk
Jonathan	Elliott	Royal Veterinary College	jelliott@rvc.ac.uk
John	Elvin	MedImmune	elvinj@medimmune.com
Avril	Ferris	BBSRC	avril.ferris@bbsrc.ac.uk
Rebecca	Ginger	Unilever	rebecca.ginger@unilever.com
Carl	Goodyear	University of Glasgow	carl.goodyear@glasgow.ac.uk
Kleoniki	Gounaris	Imperial College	k.gounaris@imperial.ac.uk
Clare	Green	University of Leeds	c.j.green@leeds.ac.uk
Isolde	Haeuser-Hahn	Bayer	isolde.haeuser-hahn@bayer.com
Jacqui	Hall	MedImmune	halljr@medimmune.com
Debbie	Hall	BBSRC	debbie.hall@bbsrc.ac.uk
Keith	Hallinan	Unilever	keith.hallinan@unilever.com
Bryan	Hanley	KTN	bryan.hanley@ktn-uk.org
Rob	Hardwick	BBSRC	robert.hardwick@bbsrc.ac.uk
Sue	Hewitt	NBI	drsuehewitt@gmail.com
Mal	Horsburgh	University of Liverpool	m.j.horsburgh@liverpool.ac.uk
Jackie	Hunter	BBSRC	jackie.hunter@bbsrc.ac.uk

Vincent	Jansen	Royal Holloway	vincent.jansen@rhul.ac.uk
Huw	Jones	KTN	huw.jones@ktn-uk.org
Harry	Kelly	GlaxoSmithKline	harry.a.kelly@gsk.com
Mike	Lant	Syngenta	mike.lant@syngenta.com
Anna	Lawless	University of Manchester	anna.lawless@manchester.ac.uk
Karen	Lewis	BBSRC	karen.lewis@bbsrc.ac.uk
Keith	Lindsey	University of Durham	keith.lindsey@durham.ac.uk
Simon	Livingston	Nestlé	simon.livings@rdyo.nestle.com
Gary	Lye	University College London	g.lye@ucl.ac.uk
Lesley	MacVinish	University of Cambridge	ljm1000@cam.ac.uk
Kelly	Matzen	Oxitec	kelly.matzen@oxitec.com
David	McAllister	BBSRC	david.mcallister@bbsrc.ac.uk
Lynda	Moore	Pirbright Institute	lynda.moore@pirbright.ac.uk
Neil	Morrison	Oxitec	neil.morrison@oxitec.com
Pieter	Ouwerkerk	Bayer	pieter.ouwerkerk@bayer.com
Stewart	Owen	AstraZeneca	stewart.owen@astrazeneca.com
Michelle	Peckham	University of Leeds	m.peckham@leeds.ac.uk
Darren	Pirt	BBSRC	darren.pirt@bbsrc.ac.uk
Caroline	Pope	University of Edinburgh	caroline.pope@ed.ac.uk
Gail	Preston	University of Oxford	gail.preston@plants.ox.ac.uk
Martin	Procter	UCB	martin.procter@ucb.com
Jerry	Roberts	University of Nottingham	jeremy.roberts@nottingham.ac.uk
Ian	Roberts	University of Manchester	i.s.roberts@manchester.ac.uk
Ezio	Rosato	University of Leicester	er6@leicester.ac.uk
Mark	Sansom	University of Oxford	mark.sansom@bioch.ox.ac.uk
Liz	Shaw	University of Reading	e.j.shaw@reading.ac.uk
Graeme	Smith	AstraZeneca	graeme.smith2@astrazeneca.com
Alison	Smith	University of Cambridge	as25@cam.ac.uk
Samantha	Southern	University of Bristol	samantha.southern@bristol.ac.uk
Irina	Stancheva	University of Edinburgh	istancheva@ed.ac.uk
Louise	Stanley	University of Dundee	l.z.stanley@dundee.ac.uk
Suzy	Stoodley	University of Cambridge	ss492@cam.ac.uk
Hira	Sudan	GlaxoSmithKline	hira.l.sudan@gsk.com
Ramana	Sundara	Nestlé	ramana.sundara@rdyo.nestle.com
David	Sweeney	HEFCE	d.sweeney@hefce.ac.uk
Freddie	Theodoulou	Rothamsted Research	freddie.theodoulou@rothamsted.ac.uk
Chris	Thomas	University of Birmingham	c.m.thomas@bham.ac.uk
Geraint	Thomas	University College London	g.thomas@ucl.ac.uk
Bill	Whittingham	Syngenta	william.whittingham@syngenta.com

Notes

Notes

Notes