Institution: University of East Anglia

Unit of Assessment: 3A - Allied Health Professions, Dentistry, Nursing and Pharmacy: Pharmacy

a. Overview

This submission to Unit of Assessment 3A from the University of East Anglia (UEA) comprises faculty from the School of Pharmacy. The School began in 2003 as the School of Chemical Sciences and Pharmacy, the first new school of pharmacy in the UK for 30 years. Following the expansion in staff and strong profile in RAE 2008, it became independent of Chemical Sciences and is now one of six Schools within the Faculty of Science at UEA. The three research sections in the School are **Medicinal Chemistry**, **Pharmaceutical Cell Biology**, and **Drug Delivery and Pharmaceutical Materials**. In addition, the **Medicines Management** section focuses on pharmacy practice and has contributed to health and education policy in the UK.

Our outputs over the REF period have appeared in high impact journals including *Science*, *Nature Chem. Biol.*, *Proc. Natl. Acad. Sci.*, *Angew. Chem. Int. Ed.* and *J. Am. Chem. Soc.* (58% of outputs were in journals with IF >10). Grant holdings, over the REF period, from UK Research Councils, charities, the National Institute for Health Research (NIHR), EU and industry were £12M, a substantial increase over the total of £4.8M in the previous RAE period. There are established collaborations with other Schools at UEA, notably Biological Sciences, Chemistry and Medicine. We also developed closer links with researchers in the Norwich Research Park (NRP), a grouping that comprises three BBSRC-funded institutes: the John Innes Centre (JIC), Institute for Food Research (IFR) and the Genome Analysis Centre (TGAC) as well as the Sainsbury Laboratory and the Norfolk and Norwich University Hospital (NNUH), in addition to UEA, the academic anchor institution of the NRP.

The University has made substantial investments in the School of Pharmacy throughout the REF period. This took the form of new recruitment of fourteen staff, as well as complete refurbishment of several key laboratories for medicinal chemistry, pharmacology and drug delivery, and the purchase of major equipment, most notably in the form of new NMR (nuclear magnetic resonance) facilities.

b. Research strategy

The strategy of Pharmacy at UEA is to develop and maintain all our research sections through investment in the relevant infrastructure, in current faculty and their research teams and through strategic appointments. As an overarching theme, we focus on ***cancer*** and ***inflammation***. Research in both these therapeutic areas is facilitated by the School's strengths in *nucleic acids*, *natural products*, *cell signalling*, *nanomaterials* and *pharmaceutical characterisation*. Our wide-ranging skill set covering biology, chemistry and drug delivery has fostered the establishment and growth of interdisciplinary collaborations within the wider NRP context of the University, hospital and BBSRC research institutes.

Overview of significant changes at UEA

The School of Pharmacy was established as a separate entity in 2010. The success of Pharmacy in RAE 2008, the steady increase in staff numbers and the performance in the University league tables generated the impetus to create the independent School, though it still benefits from its close proximity to the School of Chemistry via collaborations and shared infrastructure.

Coupled to this strategic change has been a firm and tangible commitment of the University to the new School. There are substantial improvements to the research infrastructure including a new, well-equipped Drug Discovery and Delivery Suite, a new NMR Facility and a completely refurbished and equipped Molecular Pharmacology Laboratory. There has also been significant investment in new staff at senior and more junior level and these have already made an impact on our publication outputs and grant income. Indeed, we have made five appointments in 2013 alone.

Another important and highly beneficial development that took place in the current REF period has been the enhanced influence and contribution of the Norwich Research Park (NRP), the alliance

between its component institutions. As a multidisciplinary subject, pharmacy benefits from the increased integration of the NRP as a research unit. Over the period of the REF, we have established collaborations with JIC and IFR (detailed below) and have joint studentships, research projects, a joint appointment **(Baldelli-Bombelli** in nanomaterials, with IFR) and shared access to equipment and facilities.

Objectives and activities in Pharmacy research over the next five years

The Pharmacy strategy over the next five years will be to support and nurture internationally leading research in the focused areas listed above that have a high potential to benefit human healthcare. New appointments have been made to complement the existing research sections (detailed below). The faculty of the School is relatively young, with a large number of new academics building their research portfolios and we will continue to invest in the people in post, through the identification of required equipment and resources (see Section d). The university has committed to a fund-raising initiative to raise money for a new building for Pharmacy, with the aim for its completion by 2018.

The School will continue to develop links with local (UEA, NRP) and more distant (UK and International) collaborators. For example, we are further strengthening links to Europe. **Baldelli-Bombelli** is a partner in an EU consortium involving a local industrial partner and colleagues in Italy that focuses on delivering oligonucleotide therapeutics (Marie Curie IAPP program "DNA-TRAP" (€647K), and **Ganesan** is the sole UK partner in an EU-funded consortium (A-PARADDISE), starting in 2014, targeting neglected diseases via epigenetics (€334K).

A key development over the REF period was the £26M investment into NRP by the Treasury in the March 2011 budget. This funding is being invested in infrastructure including a new building for Innovation. Members of the Pharmacy faculty have been involved in commercialisation and in establishing spinout companies (see Research Group section, particularly **Ganesan** and **Sherwood**) and this will facilitate further activities in the enterprise area by providing necessary infrastructure and facilities and further promoting a culture of intellectual property protection, development and support.

Mechanisms for the development, promotion and dissemination of research

Faculty attend and present at research seminar programmes within the School and across the NRP. **Sherwood** has initiated a cross-faculty bimonthly meeting focused on melanoma research, which includes pharmacists, biologists, clinicians and pathologists. **Khimyak** has established an open forum on the application of magnetic resonance methodologies in the NRP, and **O'Connell** set up a regional group for the British Society for Immunology to create a forum for researchers in Norwich and East Anglia with an interest in inflammation and immunology. The School has an Annual Research Day that includes external speakers and attendees from academia, clinical practice and industry. All early career researchers, including post-graduates and post-doctoral scientists present either a poster or oral communication.

The School supports its researchers, whether PhD students, early career researchers or established faculty through research investment funds and support for conference attendance and presentation. Researchers within Pharmacy work closely with the UEA media office to promote their research to a wider audience via the local and national press. There is a press officer based in the Science Faculty who works closely with members of the School to promote their research. Both the School and the University have funds available for researchers to cover 'gold' Article Processing Charges in Open Access journals.

Research Groupings and their Achievements

Medicinal Chemistry

The section was highlighted in RAE 2008 for its achievements and we have ensured that this area has broadened while maintaining emphasis in our key research activities. Thus, **Searcey** has extended his work on *nucleic acids* and *biologically active natural products*, applying them to targets in cancer and inflammation. He showed for the first time that small molecules could promote the formation of a higher order DNA structure at room temperature, without the need for high temperature annealing (*Chem. Commun.* **2011**, 8262). In the natural product area, **Searcey**

demonstrated that analogues of the duocarmycins can be rationally designed to be metabolically activated in specific tumours (*Chem. Commun.* **2011**, 12062). His expertise in both the DNA and cancer areas has been complemented by two new hires: **Waller** achieved the first demonstration of G-quadruplex structures in gene regulation, showing that disruption of this structure can lead to enhancement of gene expression (*J. Am. Chem. Soc*. **2009**, 12628). **Ganesan**, appointed as Professor of Chemical Biology in 2011, completed the first total synthesis of burkholdac B (*Org. Lett*. **2011**, 6334), a natural product with potent anticancer activity.

Besides the traditional cancer and inflammation targets, an increasingly important approach is that of *epigenetics*. The School has invested in this area with the appointment of **Ganesan** who works on chromatin-modifying enzymes including histone deacetylases and demethylases. He heads a network of EU investigators in epigenetics (COST Action TD0905, Epigenetics: Bench to Bedside) and in his previous position at the University of Southampton founded the drug discovery spinout company *Karus Therapeutics*. *Epigenetics* was further strengthened with the arrival of **Atasoylu** in 2013 as a Research Fellow. He comes to us from the Structural Genomics Consortium in Oxford, a leading institute for structural work and drug discovery applications in this field.

Hamilton works on carbohydrates and microbial biochemistry and was part of an international team that identified bacillithiol as a wholly new, low molecular weight thiol (equivalent to glutathione in function) in Gram-positive bacteria, including serious pathogens such as ***Staphylococcus aureus*** and ***Bacillus anthracis*** (*Nature Chem. Biol*. **2009**, 625). He subsequently completed the first total synthesis of bacillithiol (*Angew. Chem*. *Int. Ed*. **2011**, 7101) and has out-licensed the product to a US biotech company. The work of **Matthews** on dendrimers and calixarenes bridges the areas of medicinal chemistry and drug delivery and is focused on *novel materials for drug delivery*. For example, she disclosed a dendrimeric multicalixarene structure that has great potential in delivery of nucleic acids and peptide drugs (*Chem. Commun*. **2010**, 8665).

In addition to our major research themes, the medicinal chemistry group has developed new analytical and spectroscopic techniques and molecular probes relevant to drug discovery. These have included molecular probes for peptide dynamics (*Angew. Chem*. *Int. Ed.* **2010**, 3612), NMR methods for measuring dihedral angles (*J. Am. Chem. Soc*. **2010**, 8225), cell permeable antagonists of calcium signalling (*Nature Chem. Biol.* **2009**, 220) and fluorescent sensors selective for zinc (*J. Org. Chem.* **2008**, 8212).

Pharmaceutical Cell Biology

The section has focused on *cancer* and *inflammation*, with an emphasis on their underlying cellular pathways as potential therapeutic targets. **O'Connell** demonstrated, for the first time, that the effects of lipopolysaccharide are mediated through the Nrf2 pathway and that this is a potential target for therapeutic intervention in sepsis *(J. Immunol.* **2008**, 6730). **Mueller** investigates G protein-coupled receptors (GPCRs), particularly the targeting of chemokine receptors in inflammation and metastasis (*J. Immunol.* **2008**, 6713). Given the importance of GPCRs in drug discovery, the School has appointed **McCormick** in 2013. His research focuses on immunological and neurological disorders, particularly dopamine and cannabinoid receptors and he has discovered a new function for dopamine in sleep regulation (*PLoS Biol.* **2012**, e1001347). Another recent appointment (in 2011) **Sherwood** has investigated the link between the Wnt signalling pathway and cancer and has shown that a modified Wnt5a-derived peptide prevents melanoma cell invasion (*Proc. Natl. Acad. Sci.* **2009**, 19473). She holds a patent on peptides targeting this pathway, and is a co-founder of the spinout company *WntResearch*.

The section has forged collaborations with other researchers within Pharmacy as well as Biological Sciences and Medicine in the University and the NRP research institutes and hospital. This has resulted in joint publications that have reported the biological activity of natural product like scaffolds (*Chem. Sci*. **2011**, 2232), the cellular uptake of inorganic complexes (*Chem. Commun.* **2012**, 6627) and fluorescent drug delivery vehicles (*J. Am. Chem. Soc.* **2008**, 2892).

Drug Delivery and Pharmaceutical Materials

The section was noted in RAE 2008 for its research and continues to flourish in the application of combined physicochemical methods for predicting stability and crystallisation behaviour of complex pharmaceutical formulations. **Qi** has applied these in cases where traditional methodologies are

limited (*Mol. Pharm*. **2013**, 918), while **Fabian** provides computational expertise in predicting structure and physical properties of polymorphs (*Adv. Mater*. **2009**, 3905) and co-crystals (*Proc. Natl. Acad. Sci*. **2010**, 13216). **Saeed** was appointed in 2013 and works on advanced polymeric materials for drug delivery (*Chem. Commun.* **2012**, 585). The appointment of **Khimyak** as Chair has led to the application of advanced NMR methods to probe intermolecular interactions and dynamics (*Science* **2010**, 1053) and increased use of this technique for the analysis of soft materials.

A recent strategic initiative is the design of nanoscale pharmaceutics, led by two junior appointments. **Baldelli-Bombelli** highlighted the importance of understanding how the protein corona is involved in the delivery of pharmaceuticals using nanoparticulate carriers (*J. Am. Chem. Soc.* **2010**, 5761), and **Al-Jamal** successfully determined the pharmacological profile of various nanomaterials as carriers for drug, gene and radionuclide delivery (*J. Am. Chem. Soc.* **2012**, 13256) including the design of novel liposomes using temperature sensitive peptides (*ACS Nano* **2012**, 9335).

c. People, including:

i. Staffing strategy and staff development

Staffing strategy linking to research strategy

In the 2008 RAE, both *medicinal chemistry* and *drug delivery* were highlighted by the panel for their research excellence and new appointments have been made to further strengthen these areas. In *medicinal chemistry*, the appointments of **Ganesan** and **Atasoylu**, with a focus on *natural products*, *epigenetics* and *combinatorial chemistry*, and **Waller** with her expertise in drug-DNA interactions complement the research of **Searcey** and **Hamilton** that was already in place.

In *drug delivery and pharmaceutical materials*, the appointment of **Khimyak**, with his research into advanced materials, soft matter and gel-based delivery systems, complements the work of **Qi** and **Saeed**. **Fabian** brings expertise in computational and crystallographic studies of the solid phase that further enhance this area of research. The appointments in nanomaterials (**Al-Jamal**, **Baldelli-Bombelli**) facilitate cross-disciplinary research with **Matthews** in *medicinal chemistry*, particularly with regard to peptide-based drug delivery.

Significant investment has also been made in *pharmaceutical cell biology* to increase staffing levels and promote new avenues of research. The appointment of **Sherwood** enhances the *cancer* area and complements the research of **O'Connell**, while **McCormick** overlaps significantly with **Mueller's** work in GPCRs that straddles the areas of *inflammation* and *cancer*.

All the recent appointments in these areas have been made with a focus on strengthening the research in selected areas, with the appointees having established track records of publication in high impact journals and evidence of grant success. For example, since her appointment, **Al-Jamal** has already been awarded a prestigious five-year Prostate Cancer UK Career Development Fellowship (£750K) to support herself and a technician.

To support the implementation of the Concordat to Support the Career Development of Researchers, the University has established a Research Staff Working Group. Chaired by the Pro Vice Chancellor, and comprising representatives of academic staff and researchers from all Faculties, the Group steers the University's strategy for career development and monitors implementation of activities. In addition, departmental research staff coordinators have been appointed in all areas to act as points of contact and mentors for research staff.

Support of faculty and early career researchers

All faculty and post-doctoral staff have a mentor, with new staff having a specially trained senior mentor who can aid them with writing grant applications, setting up a laboratory and other aspects of independent research. Annual appraisal by a senior colleague, usually not in the same area, complements the mentoring system and allows the faculty member to discuss goals for the future in an informal atmosphere and in a more general (non-specialist) sense.

The School operates a workload model, focused on teaching hours and contact time, which seeks to balance teaching duties across the School. Teaching contact time for all new appointments is

kept at a low level, and under 25 hours in the first year. The Centre for Staff and Educational Development runs continuing professional development courses throughout the year, many of which are concerned with generic and transferable skills that are important in research.

Peer review of grant applications

The University has a well-developed process of internal peer review for grant applications. Exploiting the expertise of successful colleagues, the process supports the development of new funding applications, particularly for early career researchers. It is mandatory for all applications to the UK Research Councils and NIHR. All applications that do not go through university committees, and that are valued at over £50K, are subject to a similar level of internal review by the School's Research Committee. The implementation of these processes has seen the grant success rate in Pharmacy increase from 34% in 2010/11 to 79% in 2012/13.

Equality and diversity

The School works closely with the Equality and Diversity officers within UEA. There were five female appointments during the REF period and **O'Connell** chairs a committee with regard to the Athena SWAN Charter, which recognises and celebrates good employment practice for women working in science, engineering and technology in higher education and research. The School has received the Bronze award and will shortly submit for the Silver award. All the faculty undergo equality and diversity training and in the last year have attended courses specially developed for the School. This is now part of the induction process for new faculty, post-docs and post-graduate students.

ii. Research students

Postgraduate research plays a vital role in the School and we are committed to high quality supervision for graduate students at both PhD and Masters level so as to equip the researchers of the future with both specific and generic research skills.

Where laboratories have recently been refurbished, we have reconfigured them so as to incorporate office space for researchers and PhD students or assign space in the School near to their laboratory. There is a dedicated computer room containing 50 workstations for student use.

The supervisory arrangements are set out by a Code of Practice as ratified by the University Learning and Teaching Quality Committee. All students have three formal meetings a year with their full advisory panel to monitor progress. In order to enhance generic communication skills and monitor subject-specific progress, students attend weekly seminars in their research groups, with similar arrangements in place in each group. For example, in the Medicinal Chemistry group, there are weekly meetings rotating, in turn, between a journal club, a problem session and a progress talk. Once a year, the research groups come together for the Annual Research Day, which features posters from all 1st and 2nd year PhD students and presentations by final year students, alongside others from faculty and external speakers. This gives the students experience of presentation in the format of an international meeting. The School has funds (around £14K p.a.) to send students to present their research abroad, including to the annual conferences of the American Chemical Society and the American Association of Pharmaceutical Scientists.

In addition to the School-based activities, students in Pharmacy are members of the Science Graduate School, which runs courses and workshops for research students; each student must attain 10 credits in each academic year (30 credits overall for a PhD) in order to graduate. This is centrally maintained at the University level and allows PhD students from all disciplines in the Science Faculty (and beyond) to work together, learn from experiences across the areas and develop either specific or generic skills. For example, the NMR course is run by the relevant lecturers in the Schools of Chemistry and Pharmacy, while the Centre for Staff and Educational Development run courses on communication skills.

Pharmacy was a key player in the recent award to the NRP of a Doctoral Training Centre from the BBSRC and members of the School jointly supervise students with colleagues elsewhere on the NRP. For example, **Searcey** is working with Professor Rob Field of the JIC on the study of new antimicrobial peptides. The University has invested in PhD studentships over the last five years through Dean's studentships/VC studentships and the School has similarly maintained a portfolio

of supported students. **Searcey** and **Waller** have received studentship funding from *Novartis* (starting in 2011, 2012 and 2013 respectively), while **Khimyak** received an EPSRC CASE award from *Bristol-Myers Squibb* in 2010. Additional industrial studentship funding in the School has come from *AstraZeneca*, *BASF*, *Colorcon*, *Merck, Sharp and Dome*, and *UCB Parma*.

PGR-led research has had significant impact. For example, a cell penetrating peptide developed by Richard Steel, working with **Searcey**, has been commercialised and is sold as a chemical biology tool (the subject of one of our impact case studies).

d. Income, infrastructure and facilities

Income

The School has significant research income from the Research Councils, NIHR, major charities and from industry, more than doubling its income since RAE 2008. Thus, members of faculty obtained grant funding from BBSRC (£1.1M), MRC (both responsive mode and Developmental Pathway Funding Scheme, £876K), NIHR (£2M) and EPSRC (£1.3M). Groups in both Pharmaceutical Materials and Medicinal Chemistry currently hold funding from the European Union (£403K). Charitable funding has been received from the Association for International Cancer Research, the Leukaemia Research Fund, the Kay Kendall Research Trust, the Leverhulme Trust, Prostate Cancer UK and from the Royal Society (Total: £1.9M). Industry funding has been received from *AstraZeneca, BASF, Colorcon*, *Evotec*, *GlaxoSmithKline*, *Novartis* and *Rosemont Pharmaceuticals* (Total: £872K).

Infrastructure and facilities

A distinct new feature of the NRP is our 'Virtual Technology Centre'. Here large equipment and facilities (including technical support) are accessible via one portal to all NRP staff. This unique resource brings together a huge range of up-to-date platforms including equipment for nuclear magnetic resonance and X-ray crystallisation robotics, fluorescence activated cell sorting, and proteomics and metabolomics facilities with state-of-the-art mass spectrometers. The Henry Wellcome Laboratory for Biomedical Cell Imaging provides imaging technology via conventional and multi-photon confocal microscopes, and image-processing facilities. Next generation sequencing and bioinformatics core services are provided by The Genome Analysis Centre. The Sainsbury Laboratory has proteomics and next generation sequencing capability and a plant-specific high throughput confocal imaging system (OPERA). The Disease Modelling Unit, a 4000 cage, individually ventilated, transgenic mouse facility, occupies the top floor of the Biomedical Research Centre.

The arrival of **Khimyak** was followed by the significant transformation of NMR facilities, including purchase of several new instruments. A suite of solid state (400 and 300 MHz) and high-resolution solution state (400, two 500 and 800 MHz) NMR spectrometers with capability of working with gels, emulsions and colloidal systems (i.e. gel probes at 400 and 800 MHz) provides a unique opportunity to study pharmaceutically relevant systems ranging from small molecules to polymers, solid-state pharmaceutics and soft materials. This facility forms a core of magnetic resonance groups across the NRP, coordinated by **Khimyak**, and complemented by the magnetic resonance imaging capability in the hospital and electron paramagnetic resonance facility in UEA's School of Chemistry.

Within Pharmacy, the School has high-quality laboratory space shared across the three research groupings in order to further promote collaborative projects. This includes three chemistry laboratories that can house up to thirty researchers with dedicated fume hoods. All the required facilities for synthetic chemistry and biophysical studies are available, including preparative, semi-preparative and analytical HPLCs, automated flash chromatography, a peptide synthesiser, UV, fluorescence and IR spectrometers and a molecular modelling facility. Five pharmaceutics and materials laboratories contain extensive equipment including several DSCs, FT-IR, hot melt extrusion and tableting machines. The pharmacology laboratories contain tissue culture facilities with six flow cabinets, several incubators for cell culture work, alongside RT-PCR facilities, fluorescence, luminescence, absorbance and energy transfer plate readers, a TIRF-modified confocal microscope, a label free signal detection system for cell signalling, microscopes, and

other small equipment.

Investment in facilities has been substantial. Two laboratories were refurbished just before the last RAE (in 2007) and now house the **Ganesan**, **Waller** and **Matthews** research groups. In 2010, further investment was made in laboratories known as the Drug Discovery and Delivery Suite. The medicinal chemistry section of these high specification labs houses the **Searcey** and **Hamilton** research groups. To enhance research in microbiology (including protein expression for assay development), particularly with regard to the work of **Hamilton**, **Saeed**, **Al-Jamal** and **Mueller**, a laboratory specifically for this type of work was fully refurbished in 2011, as were the **O'Connell** and **Mueller** labs in 2008. The **Sherwood** and **McCormick** laboratories were reconfigured on their arrival. The Atomic Force Microscopy suite was enhanced in 2011 with the development of a new laboratory and the purchase of a JPK Nanowizard 3 AFM to add to the machines already available.

e. Collaboration or contribution to the discipline or research base

Searcey collaborates with a number of groups in the UK to study natural products and their interactions with DNA as potential antitumor agents. These are also the focus of international collaborations with Japan (Okayama University) and the USA (Scripps Research Institute). He sits on the Scientific Advisory Board for the Association for International Cancer Research, is a member of the EPSRC College and acts on the editorial advisory board of a number of journals, including *Future Medicinal Chemistry*. He is a member of the Faculty of 1000. His research has attracted funding from industry during the current period, including PhD studentships from *UCB Parma* and *Novartis*.

In the *natural products* area, **Hamilton's** collaboration with John Hellman at Cornell University in the USA and others determined the structure and biochemical pathways associated with the new biological thiol bacillithiol. An American biotech company is marketing his newly synthesised bacillithiol as a chemical biology tool. He is also a consultant for the Technology Transfer Division of the Wellcome Trust and an international grant review member for the Hellenic Republic Ministry of Education.

Ganesan is chair of the EU COST Action "Epigenetics: Bench to Bedside". He works closely with Riccardo Baron in the US and Andrea Mattevi in Italy on the epigenetic enzyme lysine specific demethylases. He is a committee member of the IUPAC Subcommittee for Medicinal Chemistry and Drug Development and Treasurer of the High-throughput Chemistry and New Technologies Group, Royal Society of Chemistry. He is an editor for *PLoS One*, *British Journal of Pharmaceutical Science* and *Marine Drugs*.

Both **O'Connell** and **Sherwood** have built strong local collaborative networks in the areas of *inflammation* and *cancer*. **O'Connell** holds one BBSRC grant and two joint BBSRC-funded studentships from the DRINC programme to study dietary flavonoids and their effects on inflammatory pathways, in collaboration with Dr. Colin Kay (UEA School of Medicine). She also had two NRP studentships over the REF period with researchers from IFR and JIC which focus on the role of natural products in inflammation. **O'Connell** was a member of the advisory board for the Phase III clinical trial of the drug Bardoxolone for *Abbott Global* (now *Abbvie*) and *Reata Pharmaceuticals*. She is Chair-elect of the Biological Systems panel of the Biochemical Society, Secretary and founder of the East Anglia Regional British Society for Immunology (BSI) and Treasurer of the Nutritional Immunology group of the BSI. **Sherwood** works closely with the Randall Moon group at the University of Washington on the Wnt signalling pathway and her PhD students have had research placements there.

In the *novel materials for drug delivery* area, **Matthews** has extensive international links with South Korea (Korea University) and France (CNRS, Lyon) in the areas of dendrimers and carbohydrate recognition. **Qi** has strong relationships with industry, with funding from *BASF*, *Colorcon*, *Anasys Biosystems*, *Merck Serono* and *AstraZeneca*. **Fabian** works with the Cambridge Crystallography Database Service, who currently fund a PhD student in his laboratory, and he is a co-editor of *Acta Crystallographica A*. **Khimyak** is leading on the NRP-wide collaborative network for the use of NMR in research and has received funding from *Bristol-Myers Squibb*. He is a member of the Committee of the Royal Society of Chemistry NMR Discussion Group and the external advisory board of *Alkermes Pharmaceuticals*.