Institution: The University of Huddersfield

Unit of Assessment: 8 Chemistry

a. Overview

A major objective of the University is to become a research-led institution. Correspondingly, strong strategic and financial support from both the University and the School (i.e. Faculty) of Applied Sciences has enabled the Department of Chemistry to both consolidate its research base and expand its research portfolio since RAE2008.

In REF2014 we are submitting 16 staff (14.6 FTE) working in three areas: *Synthetic and Physical Organic Chemistry*, *Materials and Catalysis,* and *Supramolecular and Structural Chemistry.* Our programmes incorporate both fundamental and applied research, providing a basis for growth and enabling us to capitalise on a diversity of income streams. We have continued to encourage collaborative and interdisciplinary research, through joint programmes with industry and other universities, and many of our staff work at the interfaces with biology, pharmacy, engineering and physics. Since 2008, we have progressively expanded the Innovative Physical Organic Solutions unit (IPOS) in the Department, as a vehicle to exploit our expertise for the direct benefit of industry.

b. Research strategy

b1 Our objectives

Guided by the University's long-term aim to become an internationally-recognised, research-led institution, the UoA has identified the following key objectives:

a) to grow the research programmes of our Research Groups in areas where we have the ability to deliver internationally recognised scientific excellence and socio-economic impact;
b) to guide the focus of our Research Groups to match industrial, governmental and EU priorities, thereby growing and diversifying our funding base;
c) to facilitate collaborative research, via both academic and industrial pathways (beyond and within the University);
d) to sustain a vibrant graduate school, to provide the intellectual and cultural stimulus needed for postgraduate training;
e) to ensure our research has an impact on teaching, through lecture courses, undergraduate project work in our research labs and student involvement in seminar and visitor programmes;
f) to engage with the public locally and nationally, in schools, and through public lectures and other media activities.

These objectives are aligned with those of the University. The targeted recruitment of staff and pro-active research management together with the expansion of the infrastructural research base, which have proved successful over the past five years, will continue.

The success of this strategy is evidenced by the progress that the Department has made since RAE2008. We are now submitting 14.6 FTE (16 staff), compared with 10 in 2008. Our research is concentrated in three, rather than two, professorially-led Research Groups. Many staff work in more than one Group but principal memberships are as follows: *[P = professor, EP = emeritus professor, R= reader, SL = senior lecturer, SRF = senior research fellow.]*

(i) **Synthetic and Physical Organic Chemistry** (incorporating IPOS): **Sweeney** (P), Laws (P), **Hemming** (R), **Moran** (SL), Morris (SL), **Gill** (SRF), **Heron** (SRF), Gabbutt (SRF); IPOS**: Page** (P), **Atherton** (P) and in supporting roles: Powles (SRF), Stirling (SRF);
(ii) **Materials and Catalysis: Brown** (P), Charsley (EP), Parkes (R), **Cooke** (SL), **Lamont** (SL), **Panchmatia** (SRF);
(iii) **Supramolecular and Structural Chemistry: Rice** (P), **Elliott** (SL), **Gillie** (SL), **Harding** (SL), **Patmore** (SRF).

Our publication rate and our research student numbers have more than doubled since 2008. External income, from industry and governmental sources (including £3.6M from the European Regional Development Fund [ERDF]) has exceeded £7M during the assessment period. Currently eight Postdoctoral Research Assistants are in post, spread between the three Groups, with 46 postgraduate research (PGR) students (Oct 2013). The standard of research facilities and instrumentation in the Department has undergone a step-change. We now have 21 compared to 15 research laboratories, representing over £9M of University investment. The number of Chemistry staff has increased by 25%. Appointments have included a Royal Society Industry Fellow (**Sweeney**) and a Royal Society University Research Fellow (**Patmore**). Additionally the

Innovative Physical Organic Solutions unit (IPOS) has been progressively expanded, stimulated by a £3.6M ERDF grant in 2008.

Institution-wide, over £100M has been spent on infrastructure and facilities over the past ten years, much of it to strengthen the research base. The University is financially sound; the Department has a substantial capital reserve, and investment is continuing.

b2 Mechanisms for securing success:
Our research strategy is informed by our Chemistry Research International Advisory Board (IAB). Membership includes Prof R Grubbs [Cal. Tech.], Prof H Kroto [Florida State], Prof W Jones [Cambridge], Dr J Casci [Johnson Matthey] and Prof D MacMillan [Princeton]. Meetings are held in person or by Skype. Additionally, operational guidance and financial support is offered by the Department Research Committee, made up of the Group Leaders, Head of Department, Dean of School and School's Director of Research.

b2i University support:
The Research and Enterprise (R&E) Directorate provides central support:

a) R&E staff help with identifying external funding sources and proposal writing. A business development manager (BDM) for Chemistry is able to advise and even lead on some applications (e.g. KTP/TSB). A local consultancy company (KITE) is contracted to guide European funding applications.
b) The University Research Fund allocates £1.5-2.0M annually for studentships, research staff and capital expenditure in areas of strategic importance, awarded against competitive bidding. In recent years, the Department of Chemistry has regularly attracted £500k+ pa.
c) Further central funds are available (for staff and for research students) under a series of headings, examples of which are the Collaborative Venture Fund, the Conference Presentation Fund and the Research Networking Fund.
d) The Researcher Hub building (2012 - £2.6M) is available for conferences and meetings, and provides IT/office space for visitors (http://hud.ac/oc). It also hosts the University Graduate School, providing generic support for PGR activities.
e) The 3M Buckley Innovation Centre (3MBIC http://hud.ac./n7) is a £13M facility adjacent to the University, opened in 2012 and funded by ERDF, Kirklees Council and the University. It allows access to University expertise/facilities for regional companies which establish offices and labs in the Centre.

b2ii Match with government policy and industrial needs:

a) Our research themes overlap with Research Council priorities: catalysis and sustainability (e.g. **Brown, Moran, Gill, Sweeney**), healthcare (e.g. **Page**, **Hemming, Harding** [with Pharmacy and Biology]) energy (photovoltaics [**Elliott**], batteries and fuel cells [**Panchmatia**] nuclear fuels [**Cooke**, in collaboration with Physics], and electronic and magnetic materials [**Gillie**]).
b) The Department has strengthened industry-facing activities through the expansion of the Innovative Physical Organic Solutions unit, **IPOS** (http://hud.ac/n8), and by appointments of former chemical industry staff (**Gill** [AZ], **Atherton** [ICI/Zeneca/Avecia], and staff with strong industrial links (**Sweeney** [RS Industry Fellow], and **Heron** and Gabbutt). Current directly-funding project partners include Johnson-Matthey, Agilent, ACAL, Bruker, Fuji, Croda, Syngenta, MEL Chemicals, Solvay, Dstl, Essilor, QinetiQ, AstraZeneca, GSK and others.
c) An initiative is under way to bring together physical chemists and synthetic chemists to work on long-range catalytic processes for industry end-users in pharmaceutical and fine chemical synthesis. This "translational catalysis" initiative is being led by **Sweeney,** and the research plans and target reactions/syntheses are being guided by a steering group (from Merck, Peakdale, Albany Molecular, Pfizer, GSK and Novartis). The resulting projects will span the existing three Research Groups.

b3 Strategy within Research Groups in Chemistry:
b3i Synthetic and Physical Organic Chemistry (Group Leader: Sweeney) (http://hud.ac/n9).
This Group has grown out of the Biomolecular Sciences Research Centre (2008). The work of **Sweeney, Gill, Heron,** Gabbutt (all 2011) and **Moran** can be described as molecular engineering,

aligning with **Hemming**'s work in heterocyclic chemistry. **Page** and Laws continue their work in physical organic chemistry and on β-lactams and β-lactamase. **Heron** and Gabbutt's research on photochromic and thermochromic heterocycles is very successful in terms of outputs (patents and publications) and income generation (£338k in 2012/13). EPSRC grants are currently held by **Gill** (with Novartis, dehydrogenation under continuous flow) and **Sweeney** (with IC, Leeds and UCL on flow oxidation processes). **Page** and **Atherton** work in physical organic and biological chemistry. They collaborate with industry as IPOS (http://hud.ac/n8), which now generates £600k pa through industrial research projects. Succession planning for IPOS has Drs N Powles and M Stirling progressively taking over leadership. There are six full-time and one part-time research students in IPOS and five support staff. The unit carries out both fundamental (e.g. ammonia as a green reaction solvent [seven papers, one patent application]) and applied research, largely in process chemistry.

Carbohydrate Chemistry: this was an area of strength in the 2008 submission and remains so, led by Professor A Laws, with Visiting Professor M Sinnott, Drs G Morris (2010 ex-Nottingham), V Kontogiorgos and A Smith. As a consequence of the interdisciplinary nature of this research, and for the sake of coherence in the biology submission, these staff are being submitted to UoA 5.

b3ii Materials and Catalysis (Group Leader: Brown) (http://hud.ac/oa)
Work on novel thermal methods for materials synthesis and characterisation remains a theme (**Brown,** Parkes and Emeritus Professor Charsley [RAE 2008]), with applications in solid acid/base catalysis (**Brown**) and solid adsorbents (**Brown** and Parkes). Several collaborative projects in these areas have been funded by industry over the assessment period (e.g. Dstl [current PDRA], MEL Chemicals, JM, Purolite Intl). **Lamont** continues her work on adsorbates on metal surfaces, mainly using photoelectron diffraction (Fritz-Haber Institute, Berlin). Our work in computational materials science has grown over the assessment period, through **Cooke** (2007-) and **Panchmatia** (2011-), leading to an increasing number of fertile collaborative programmes both outside and within the Department. **Cooke** and **Panchmatia**, with **Elliott**, are members of the University High Performance Computing (HPC) Research Group, providing access to two mid-range clusters at Huddersfield and the new Hartree Centre at Daresbury (STFC).

b3iii Supramolecular and Structural Chemistry (Group Leader: Rice) (http://hud.ac/ob)
Formerly part of the Materials and Catalysis Group (2008), this Group's research covers coordination chemistry, from materials to supramolecular chemistry. **Rice** works on the self-assembly of metallo-supramolecular architectures producing, for example, re-programmable supramolecular systems. He runs the new Bruker X-ray diffraction lab (see section d) and acts as Departmental crystallographer. **Elliott** is focused on the synthesis of transition metal complexes containing 1,2,3-triazole ligand frameworks and is increasingly using modelling techniques through the HPC group. **Patmore** joined in 2013 as a Royal Society University Research Fellow, with work in metal-metal bonding. **Harding's** interests are in self-assembled species; she works with **Rice** and with many other groups (e.g. Batten, Monash; Ward, Sheffield) specialising in ESI-MS characterisation of supramolecular complexes. **Gillie's** work covers the synthesis and characterization of functional metal oxide materials, specifically the correlation of structure-composition relations.

c. People, including:
c1 Staffing strategy and staff development

c1i Staff recruitment
All appointments are made strategically to ensure critical mass in areas of research strength, and to maximise exploitation of our well-found laboratories and facilities. An example of the success of this policy is provided by the four fixed-term early career appointments made in 2007 (**Cooke, Moran, Harding** and **Elliott**) which have now been converted to permanent posts and are integral to our REF2014 submission. During the REF period we have created a number of Senior Research Fellowships as tenure track appointments for researchers who can demonstrate sustainability. We expect those appointed to ultimately move smoothly into permanent positions. SRFs are currently held by **Gill** (ex-AZ) **Panchmatia** (ex-Bath), **Heron** and Gabbutt (ex-Leeds). Similarly a Royal Society University Research Fellowship is held by **Patmore** (ex-Sheffield).

Additionally the Department hosts eight fixed-term Postdoctoral Research Assistants who are considered to be full members of the academic staff.

Our staffing strategy has therefore been, in large part, to grow early career researchers into active and experienced members of the Department. However, as research activity grows so does the need for experienced leadership. In this context **Sweeney** was recruited as Professor in 2011, bringing eight co-workers, all funded through Research Council and industry grants.

c1ii Development

The University was granted the Human Resources Excellence in Research Award by the European Commission in 2011 in recognition of the alignment of our processes and plans with the principles of the Concordat to Support the Career Development of Researchers, and with the European Charter for Researchers and Code of Conduct for their Recruitment. Progress in achieving exemplary standards through our action plan is overseen by our Concordat Steering Group, which reports directly to the University's Senior Management Team. We use the UoA-specific results of the national surveys, CROS and PIRLS, to monitor our progress and to benchmark our provision. The School has a 'Concordat Champion' to support compliance. The University Research Staff Association (RSA) represents research staff and consults with Vitae and the UKRSA team. Our training programmes and career development opportunities are aligned to the RCUK/Vitae Researcher Development Framework in order to identify and address systematically the key development needs of research staff and research students. The University has applied for the bronze award under the Athena Swan Charter. We offer flexibility over working hours and we participate in programmes which incorporate family-friendly working (e.g. the recently-appointed Dr G Sweeney, funded through the Daphne Jackson Trust).

Staff development commences on joining the Department and new staff are assigned a research mentor. A Research Development Plan is an integral part of the annual appraisal system. The University Staff Development Programme covers topics such as Research Supervision, Research Project Planning, Publishing Research and Proposal Writing.

Promotion to reader and professor is assessed purely on merit through a transparent annual application process and is not related formulaically to staff numbers. In 2012, **Rice** was promoted to Professor. **Elliott, Moran, Harding** and **Cooke** have all been promoted from Lecturer to Senior Lecturer during the assessment period.

c1iii International staff appointments/visiting scholars:

The Department facilitates research exchange visits by staff to/from other laboratories (e.g. **Brown**: Visiting Professor at U Lyon, 2010, and at U Cagliari, 2013). We have had 15 incoming visits of a month or more since 2008. One-year (plus) visits were made by Drs A Ikhlaq (UET Lahore) and E Andrijanto (Bandung SP, Indonesia).

c1iv Royal Society Fellowships:

We currently have two RS Fellowships. **Sweeney** is a Royal Society Industry Fellow with AstraZeneca (2010-13). He is the only chemist to have been appointed for a second consecutive term. He is the founding member and chairman of the new Royal Society College of Industry Fellows, designed to disseminate good practice through the Industry Fellows Scheme. **Patmore** is a Royal Society University Research Fellow (2013-).

c2 Research students

Numbers of research students(FTE): 08/09:**17.9**; 09/10:**24.2**; 10/11:**25.1**; 11/12:**40.4**; 12/13:**42.7**

Research student recruitment, enrolment, monitoring and assessment conform to QAA guidelines and are managed by the Department's Director of Graduate Education (**Brown**) and an administrative assistant, supported centrally by the Graduate School. A University Research Scholarship scheme allows us to accept three or four outstanding research students per annum who otherwise could not afford tuition costs. The Department funds bursaries for typically four new research students in Chemistry per annum. The Department currently holds industry-funded PhD

grants (including industrial CASE awards) with GSK, Astra Zeneca, Croda and Bruker, and an EPSRC Organic Synthesis Studentship. A further BBSRC studentship is shared with Biology. Many overseas students are funded by their governments. A balance of students with first degrees from this and from other universities, and from abroad, is maintained, and a strict application/interview process is followed in all cases. Enrolment is restricted to three start dates each year. A University induction programme is followed by a Departmental training programme. Amongst other things, new students receive a supervisor-personalised list of expectations and requirements. Most students have a second supervisor, and all are assigned a personal tutor (a chemist from outside the Research Group), for pastoral support. A student-driven online mechanism is in place to monitor supervisor/student meetings.

Research students attend relevant masters-level modules in their first and second research years. A mixture of bespoke lectures and problem classes by invited lecturers in a range of topics (e.g. Diffraction Techniques for Materials Characterisation) has been introduced. Students benefit from the seminar programmes and international conferences hosted by the Department (see below), and can attend other courses (e.g. on Process Chemistry: IPOS) and workshops (e.g. on Lithium Battery Research: CCP5). Research students give two end-of-year presentations at the Departmental Research Student Conference. Since 2010 final year research students have attended a two-day workshop on preparation for employment run by Dr D Alker (formerly AZ and Pfizer). Decisions on yearly progression (report plus oral exam with an examiner from the Department) are ratified by the Director of Graduate Education. Action or additional monitoring is implemented at these points and at others where progress is not acceptable.

The Research and Enterprise Directorate runs development programmes for research students (e.g. Writing the Thesis, The Oral Exam, Project Planning, Getting Published), and funds for conference attendance and other activities/organisations, as does the Department. Overseas students benefit from English language classes and other support from the International Office. Research students designated to contribute to teaching are required to attend the University Teaching Assistant Preparation (TAPP) programme. Each year three teaching assistantships are appointed from the research student body. They are required to take responsibility for practical classes and tutorials for one year and are awarded an additional 0.5 year's bursary. This popular programme provides valuable experience without undue disruption to research programmes.

Progression monitoring and mentoring procedures are broadly the same for part-time research students, under guidelines which provide these students with typically twice as long to meet progression points and graduation as full-time students. Meetings or telephone conversations are logged in the same way as with full-time students.

d. Income, infrastructure and facilities

Since 2008 the University has spent ca. £5M on capital equipment in the Department, as part of a rolling programme of equipment replacement/acquisition. In addition, over £4M has been spent on upgrading existing laboratories and new laboratories. Currently 21 laboratories are dedicated to research in Chemistry, compared to 15 in 2008, and all the new labs are additional to our estate. IPOS occupies new laboratories (200 m^2 – Page Laboratory) opened in 2009. Agilent added investment of ca. £3M to the original £3.6M ERDF support and the Page Laboratory is now an "Agilent Centre of Excellence", with a range of new equipment and instrumentation covering mass spectrometry, chromatography, spectroscopy, many tandem techniques and a suite of thermal analytical methods, together with facilities for synthesis and process chemistry.

A new 400 MHz multi-nuclear NMR spectrometer has been installed for routine use, to sit alongside the 500 MHz instrument (to be replaced in 2014). The electron microscopy lab houses an FEI SEM with field emission gun, EDX and cryogenic facilities, installed in 2012 to complement the existing Jeol tungsten filament instrument. We also have access to a TEM on campus.

The Department has opened an X-ray diffraction facility in collaboration with Bruker. A new single crystal instrument suitable for protein crystallography, our existing single crystal instrument and two new powder diffractometers (one with high temperature sample chamber) are located in this lab, together with a Bruker small angle X-ray scattering instrument (SAXS).

The University has installed a High Performance Computing (HPC) facility in collaboration with the STFC (Queensgate Grid) (£0.5M initial investment), operated with the School of Engineering. Chemists, particularly **Cooke, Elliott** and **Panchmatia**, are the main users so far, for atomistic and electronic structure simulations using computational techniques such as Classical Molecular Dynamics, Density Functional Theory (DFT) and Time-Dependent DFT.

The continuous programme of instrument upgrading for the Department ensures reliability and access to state-of-the-art research equipment. NMR, X-ray diffraction and electron microscopy are mentioned above. Our mass spectrometry capability includes quantitative (incl. triple quad) and qualitative LC-MS (qToF), with GC and other interfaced MSs through the Department. Virtually all types of chromatography are available for researchers. Analytical and spectroscopic techniques include EPR, ICP-MS, X-ray fluorescence, research grade vis/UV spectrometers with stop-flow systems. Other specialist techniques, such as adsorption calorimetry, a range of feedback-controlled (controlled-rate) thermal methods for synthesis and characterisation (using conventional and microwave heating) are housed in the Research Groups.

Departmental technical staff manage and maintain all instrumentation. The X-ray diffraction, NMR, electron microscopy and mass spectrometry facilities have dedicated technicians who also provide user services. Almost all technical staff are graduates and many have PhDs.

The Department's strategy for attracting external funding has been reshaped since RAE 2008. Our target of doubling research income has been more than achieved through a mix of funding sources, mainly from industry and research organisations. Income in-kind has been received through the use of Central Facilities, through time on HECTOR (one of the UK's national super-computing facilities) and also through beam-time (neutron and EM) and solid state NMR. Industrial support has been through Knowledge Transfer Partnerships (with Yorkshire Water and Burmatex), through directly industry-funded projects (e.g. with Essilor [£206k] and QinetiQ [£132k]) and through CASE awards (e.g. with GSK and AZ). The establishment of the 3M Buckley Innovation Centre (where we have dedicated lab space housing instrumentation [e.g. XRF] for projects with tenants) has also increased our exposure to industrial partners.

The Department will maintain a balance of fundamental research and research capable of attracting industrial funding. The University Collaborative Venture Fund exemplifies its willingness to support early stage industrial collaboration. A strand of our strategy for accessing support for fundamental work will be through increased membership of networks and consortia. With the help of local consultancy KITE (specialising in EU bids) we will apply this approach to Horizon2020 funding. Underpinning this, the Department provides the well-found laboratories necessary for research, and provides pump-priming funds for new staff.

About half the submitted staff carry out consultancy, including those in IPOS. In addition, IPOS staff run a series of three-day courses (eight in 2012*)* for industrialists on process chemistry (**Atherton,** Powles and Stirling), both in the UK and abroad.

e. Collaboration and contribution to the discipline or research base

e1 Collaboration:

All our researchers collaborate with other universities and/or industry. Within the University, inter-disciplinary research is facilitated, especially within the School (of Applied Sciences). For example, **Page, Hemming, Moran** and Laws (UoA 5) have programmes with microbiologist Humphreys, with molecular biologists Georgopoulos and Collett, and with pharmacologist Javid. Both inter-university and interdisciplinary research is exemplified by **Sweeney**'s EPSRC-funded project with chemists (Leeds, IC) and chemical engineers (IC, UCL) on flow oxidation processes. In other examples, **Brown** collaborates with K Wilson (Aston) (seven papers), with N R Shiju (Amsterdam, seven papers) on solid acid and acid/base bifunctional catalysts, and was part of an interdisciplinary Engineering/Chemistry UKIERI collaborative programme between Huddersfield and the Indian Institute of Petroleum (2009-2011). **Cooke** and **Panchmatia** work with Cywinski (Physics) and the larger ThorEA community modelling thoria phase behaviour, with the University of Copenhagen on $CaCO_3$ biomineralisation and with Uppsala and Duisburg-Essen on magnetic ordering and switching of metal-organic molecules.

Industrial collaboration is the main focus of IPOS's work, and has resulted in **Atherton** receiving a Society of Chemical Industry (SCI) **"Chemistry for Industry"** award in 2013 in recognition of his "contribution to process chemistry" and **Page** receiving the same award in 2011 for work "which provides a potential major benefit to society". **Heron** and Gabbutt's work with Essilor SA (Fr) and Vivimed Laboratories (Europe) on photochromic heterocycles has been described in 14 papers since 2008, and five patents (PCT WO 2008030226, 2008028930, 2008029194, 2009109546, and EP2098520, 2009). Recent work on electrochromic heterocycles has generated new IP (EP13184771.7 and 13184780.8 [filed 17.09.2013]). Collaboration with the pharmaceutical industry (e.g. GSK, Astra Zeneca) is key to **Sweeney's, Gill's, Moran's, Hemming's** and **Page's** work, and will be central to the planned work on long-range catalytic processes referred to above (b2ii). Additional industrially-funded research has been carried out with Solvay, QinetiQ, Dstl, MEL Chemicals, Purolite Intl, BP, Johnson-Matthey, Sharp Labs, Syngenta, Bakhu Pharma, and others.

e2 Staff contributions to discipline:

There are currently six visiting professors affiliated with the Department, appointed for two-year terms. Four are academic and two are from industry. Huddersfield staff hold Visiting Professorships at the Universities of Lyon and Cagliari (**Brown),** at the University of Palma (**Page)** and at the Sheffield Institute for Translational Neuroscience, Harwell Catalysis Hub, and Nuffield Dept of Clinical Medicine, Oxford (**Sweeney**).

Three members of the Department are editors or are on editorial boards of major journals (*J. Chem. Res., J. Phys. Org. Chem., Dyes and Pigment*).

Since 2008 seven conferences have been organised in Huddersfield:

2008 RSC Thermal Methods Group meeting (**Brown**);

2009 RSC Regional Dalton meeting (**Rice**);

2011 RSC Organic Reaction Mechanism Group Winter meeting (**Atherton**, Laws);

2011 CCP5 National and 2012 Regional meetings (**Cooke**);

2013 RSC Awards (Prof R Taylor and Prof D MacMillan FRS) conference (**Sweeney**, **Gill**);

2013 Drug Discovery: Leveraging Academic Impact Through Novel Fragments (**Sweeney**);

2013 Workshop on Advances in Lithium Batteries Research (**Panchmatia**).

The Department hosts the Huddersfield Section of the Royal Society of Chemistry (chair: **Moran**). **Page** sits on the RSC Chemistry Biology Interface Divn Co and is current chair of the RSC Disciplinary Co. **Sweeney** is a member of the BMCS Co of the RSC, and has been invited to join the Biotechnology Group Co. **Rice** sits on the Macrocyclic and Supramolecular Chemistry panel. **Hemming** is/has been Member/Secretary of the RSC Heterocyclic and Synthesis Group Co. **Moran** is a member of the RSC NE Region Steering Group.

The SCI Yorkshire and Humber Regional Group meets in the Department and **Sweeney** currently chairs the Co. **Moran** is on the Young Chemists Panel, SCI.

Four staff are members of the EPSRC College of Peers. **Sweeney** is a member of the Steering Group for the EPSRC Grand Challenge Dial-a-Molecule (and coordinator of seven DaM events). **Rice** is a member of the Management Access Panel for the EPSRC National Crystallography Service.

As a Department, we are represented on NORSC (Northern Sustainable Chemistry Consortium). Other external roles include: **Brown**: member, Defence Scientific Review Co, 2002-2009; **Cooke**: CCP5 Exec Co, 2010-. **Hemming**: member of the Intl Soc Heterocyclic Chemistry Co, 2009-11; organiser: 19th and 20th Grasmere RSC Heterocyclic Chem conferences, 2009,2011, RSC-SCI Joint UK-Italy meeting on Heterocyclic Chemistry 2010, RSC Heterocyclic Group one-day meetings, six since 2008; **Heron**: member of Intl ISOP organising Co Yokohoma, 2010 and Berlin, 2013; member of Intl Adv Co ISOP, 2002-. **Panchmatia:** organiser: Indo-UK scientific seminar Co, Bangalore, 2013. **Sweeney**: member of leadership team Prion Chemical Biology Network, co-organizer (with D MacMillan FRS) of UK-USA Synthesis Workshops 2004, 2007.

A total of 36 invited lectures at international conferences have been presented by staff since 2008. A further 12 invited lectures have been given at overseas universities during the assessment period. Typically 25 invited lectures per annum are given at universities and other institutions in the UK by Huddersfield staff.

All members of staff engage in refereeing journal articles and external examining of research degrees. Two textbooks (by Visiting Professors H Maskill and M Sinnott) and 16 book chapters/major review articles have been produced since 2008.