

**Institution:** University of Sheffield

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

### a. Overview

Sheffield's Schools of Clinical Dentistry, Nursing and Midwifery and Human Communication Sciences work under the strategic leadership of the Faculty of Medicine, Dentistry and Health (formed 2008). Since then the three departments have enhanced their high quality research environment as demonstrated by:

- Publication of over 620 peer-reviewed research papers
- £9.5M investment in research infrastructure
- Dentistry returning 23.6 FTE staff, Communication Science 7 and Nursing 2.6 to REF2014
- Double the numbers of PhD students completed per returned member of staff
- Mean grant income of £214K for each returned FTE member of staff with grants from NIHR, MRC, EPSRC, ESRC, BBSRC, EU, industry, the Wellcome Trust and NIH (USA)
- Collaborations with industrial partners generating £4.9M revenue (£3.8M to the Unit)

**The School of Clinical Dentistry** (Dentistry) remains at the forefront of international dental research. It has sustained an upward trajectory for research quality. Research is aligned to three interdisciplinary groups; Integrated Bioscience, Person-centred & Population Oral Health and Bioengineering & Health Technologies. Dentistry's distinctive contribution is the integration of clinical and basic research within and across groups. Key achievements include the highest levels of recruitment to NIHR Portfolio studies, patient-centred outcomes for the evaluation of healthcare, a new bone cement for ear surgery and informing national policy on oral cancer screening.

**The Department of Human Communication Sciences** (Communication Science) is one of the most influential of its kind internationally. Its interdisciplinary research explores communication and the management of communication disorders in novel ways. Research returned in UoA3 focuses on the psychological, biological and social bases of communication with clinical and educational applications. Key achievements include one of the largest published clinical trials of computerised treatment for apraxia of speech and national roll-out of programmes to support language development in disadvantaged children.

**The School of Nursing and Midwifery** (Nursing) advances world class research in health and social care, contributing to the wellbeing and welfare of communities all over the world. Nursing research is unified under a theme of Health and Care Across the Life Course that brings together academics from diverse backgrounds including nursing, midwifery and social science who work in close partnership with a range of service users. Since 2008 Nursing research has informed key policy and practice developments in promoting dignity for older people, enhancing palliative care, the design of care environments for children and knowledge translation in health and social care.

### b. Research strategy

#### Achievement of strategic aims since 2008

**Dentistry's** objectives were to increase collaboration and to build upon established strengths to deliver critical mass, vitality and impact.

The School has collaborated widely as evidenced by 80/93 (87%) of the outputs in REF2 being produced with colleagues from other departments, national and international universities or organisations. Research income to the School also rose from £1M in 2007/8 to £2.4M in 2012/13.

To build on its strengths Dentistry consolidated its research into three interdisciplinary groups.

**Integrated bioscience** (iBio) (Lead: Hunter) comprises clinical and biomedical scientists conducting world class research in: 1. *Head and Neck Cancer*, focussed on molecular mechanisms of tumour invasion and metastasis, in vitro models of cancer and novel diagnostics; 2. *Infection and Immunity*, investigating microbial biofilms and applied microbiology, host-pathogen interactions, treatment and diagnosis; and 3. *Neuroscience*, focussed on neuropathic, inflammatory and cancer pain and management of trigeminal nerve injuries.

iBio highlights include evaluations of oral cancer screening, which have informed UK and international policy (eg. through the UK National Screening Committee and US Preventive

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Services Task Force). Sheffield is conducting the first clinical trial in cancer diagnosis using a micro-fluidic chip (Lab-on-a-chip); the largest single site oral cancer trial in the UK. This work is strengthened by our participation in the Sheffield CRUK/YCR Cancer Centre (Awarded 2011. Speight on Centre Executive). In partnership with Smith and Nephew and Microlab, Douglas developed Smart Wound dressings that detect and remove bacteria (funded by the Technology Strategy Board). Sheffield's underpinning pre-clinical and clinical studies in nerve regeneration and repair have established Sheffield as the main UK tertiary referral service for the surgical management of trigeminal nerve injuries.

Person-centred and Population Oral Health (PAPOR) (Lead: Baker) is one of the largest dental public health, social and behavioural science groups in the UK. Interdisciplinary research bridges social and clinical science in three areas: 1. *Children and Young People* to improve the oral health experiences of young people by giving them an active voice in their treatment and the research in which they participate; 2. *Evaluation of Health Care* for local and national decision making; and 3. *Person-Reported Outcomes* studies the impacts of oral health. PAPOR's Cochrane reviews of powered toothbrushes (with Manchester, Birmingham and Bristol), have had extensive public and industrial impact and informed national policy (see impact case study).

Bioengineering and Health Technologies (Lead: Hatton) has advanced research on biomaterials and medical devices to repair or replace human tissues to restore functionality and aesthetics in the head and neck. Successes include identification of chondrogenic stem cells in human synovial fluid and the development of new materials to stimulate bone regeneration, which led to a new bone cement for ear surgery (see impact case study). Advanced manufacturing research has led to the fabrication of custom metallic and polymer scaffold implants for facial reconstruction.

**Human Communication Sciences** achieved its strategic aims to develop interdisciplinary research, maximise dissemination and increase funding. For example, cognitive neuroscience research investigated the bio-behavioural basis of speech, language and literacy. Applied research encompassed cognitive neurorehabilitation of acquired speech and language impairments including computerised therapy programmes. Research on speech and literacy in children expanded into cross-linguistic work in education and the effects of social disadvantage. Knowledge exchange involved the development of treatment software for speech and language disorders, accessible information, and customised tests (see impact case study). The importance of this research is evident through publications in high ranking journals and dissemination to non-academic users via journals dedicated to clinical and educational management.

Funding goals were achieved with £1.2M income to the Unit from RCUK, charities, the NHS and industry, enabling staff appointments to enrich research teams. The Neuroscience and Developmental Research Group (Lead: Cowell) has led on cognitive neuroscience research, which has underpinned biologically plausible models of speech and language, leading to novel treatments for anomia and apraxia of speech. Developmental research has been pivotal in creating national programmes to evaluate and enhance delivery of communication and literacy teaching. Basic research in the biobehavioural and psychosocial basis of communication provided a sound theoretical foundation for knowledge exchange to speech and language therapy and education.

**Nursing and Midwifery** has prioritised the quality of users' experience and nurtured relationships with sponsors and partners to deliver inter-professional research.

It consolidated its position as a leading centre for research into the experiences of people using health and social care and their family carers. Nursing work since 2008 has been highly influential in policy and practice developments internationally in relation to: dignity in care for older people, improving care home environments, the design of care environments for children and young people, sexual health and knowledge exchange in the South Yorkshire CLARHC. Active links with major academic and third sector organisations nationally and internationally throughout Europe, North America and Australasia have helped staff secure £1.7M income to the Unit.

Health and Care Across the Life Course (Lead: Nolan) is the focus for Nursing research. Successes since 2008 include work with older people and family carers that mark major contributions to Age UKs' national *My Home Life* initiative, contributing to the development of the Swedish National Carers Competence Centre, policy debates on family care across Europe, and the application of the *Senses Framework* to promote dignity for older people (see impact case study). Palliative care research with New Zealand has generated educational materials for

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practitioners, of which 3100 copies have been issued. Work with children to develop better hospital environments has been used by architects designing hospitals in the UK and Australia.

**Changes to Research Environment since 2008**

The last 6 years have seen many changes in the external research environment with the roles and priorities of NIHR, RCUK, and other health funders evolving. The three departments have seen these changes as opportunities to prioritise and grow their research. Consequently the departments have increased RCUK funding to £5M (£2.2M to the Unit of Assessment), proactively engaged with NIHR (16 projects totalling £2M to the Unit) and been involved in EU collaborations generating £1.1M income for the Unit.

Responses to national and international priorities have emphasised clinical and translational work and greater roles for clinical researchers. Close relationships with Sheffield Teaching Hospitals Foundation Trust (STH) provide access to clinical facilities, patients and healthcare expertise. Numerous joint projects including trials and other evaluations (for example, diagnostic tests for oral cancer) mean that with its NHS partners Dentistry has the highest recruitment rate to NIHR Oral and Dental portfolio studies nationally (2011-12: 203 patients recruited, South Yorks 1<sup>st</sup> of 25 CLRNs and STH 1<sup>st</sup> of 300 Trusts), providing a considerable evidence base for the discipline. Dentistry devised key parts of the successful proposal for an Academic Health Science Network for Yorkshire and the Humber to translate research findings to health and wealth generation.

We developed a Primary Care Network to conduct trials and observational projects. This includes FiCTION, one of the largest UK primary dental care trials in collaboration with the Universities of Cardiff, Dundee, Glasgow, Leeds, London, and Newcastle together with 45 dental practices to evaluate fillings in children's teeth. Dentistry formed the Dental Arm of the Yorkshire Public Health Observatory bridging policy and practice and providing region specific data on oral health.

Accordingly research in this UoA has informed UK policy on cancer screening, support for family carers (one third of all Swedish municipalities) and guidelines on preventive dentistry (powered toothbrushes). INCENTIVE is an NIHR funded evaluation of new ways to commission NHS dentistry designed so that its findings will be incorporated into the new dental service contracts.

The formation of the new Faculty of Medicine, Dentistry and Health (2008), its Healthcare Gateway and Sheffield Research Centres were responses to this new landscape. The University has invested £650K in the Sheffield Healthcare Gateway to increase interactions with business and industry, providing a point of access to our facilities and expertise so maximising our user involvement, income and impact. The Gateway has generated new industrial collaborations and the award of two Faculty/Industrial Training Grants with Pfizer and JRI (both to Dentistry).

**Vision - Future Strategy (2014-2019)**

The vision common to all three departments is based on five closely related propositions: user engagement, clinical and translational research, collaboration, sustainability, and mechanisms to promote and disseminate research.

User engagement

User involvement through NHS services is integral to healthcare research, giving relevance to practice, policy and dissemination. Public and Patient Involvement is facilitated by strong South Yorkshire CLRN leadership, local patient representatives (Smith, Chair of Sheffield LINK) and direct patient contact.

This philosophy is exemplified by Curtis (Nursing) and Marshman (Dentistry) whose expertise in working directly with children will be used to evaluate health programmes. It is also reflected in Fricke's (Communication Science) expanding work with children in schools (e.g., Nuffield Early Language Intervention) and related education initiatives (e.g., Every Sheffield Child Articulate and Literate, Sheffield City Council). We will fortify existing link with adults through local and national advocacy groups such as the Stroke Association. Dentistry's lively public engagement programme will incorporate outreach and in-reach with EU Researchers' Nights, Engineering and Science Week lectures and our interactive exhibit at the Eureka children's science museum, Halifax.

We will strengthen links with NHS organisations (including STH, Public Health England, Yorkshire and Humber LETB, Health Education England, Centre for Workforce Intelligence, Department of Health) to align research to local and national priorities. Our research committees and project

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steering groups include NHS representatives.

Clinical and translational research is a national priority and will be fostered within interdisciplinary research groups by linking clinical researchers, social scientists and NHS partners. For example, Charles Clifford Dental Hospital achieved Academic Directorate status within Sheffield Teaching Hospitals Foundation Trust (STH) giving it access to NIHR support and resources; its Oral and Dental Research Executive (Chair: Brook) is cross-represented with Dentistry. The Academic Health Science Network for Yorkshire and the Humber is designed to expedite uptake of research findings to generate health and wealth.

Collaboration: Outward focus increases vitality and will be developed by building on strong and lively interdisciplinary links with leading researchers to sustain critical mass and exploit opportunities. We will collaborate within Sheffield (e.g., SchARR and Sociology), other HEIs with complimentary expertise (e.g., Otago, UCLA) and major third sector players with common interests such as AGE UK. Industry collaboration will be enhanced via the Sheffield Healthcare Gateway and the University's Industrial Knowledge Forge (InKForge) initiative as demonstrated by Knowledge Exchange with Balfour Beatty, John Laing, STH, Glaxosmithkline and local authorities. Staff will organise and participate in KE events, Faculty industry days and national KTNs.

Interdisciplinary and collaborative research is supported via the Sheffield research centres. For example, Dentistry is working with five, including the CRUK/YCR Sheffield Cancer Centre and two EPSRC sponsored centres (Tissue Engineering and Regenerative Medicine DTC, and the Centre for Innovative Manufacturing for Medical Devices). Interdisciplinary Training Networks on *The Construction of Human Perfection* (with English, Engineering and Law) and *Synthetic Biology* (Chemistry and Engineering) bring additional PhD studentships.

Collaborations with the NHS occur through strong clinical links. In addition, Gerrish (Nursing) is a core team leader of South Yorks CLAHRC and the new Yorks & Humber CLAHRC will be hosted from Sheffield. Robinson (Dentistry) is a founder member of the South Yorkshire CLRN and Chair and Vice-Chair (respectively) of the Local and National Specialty Groups for Oral and Dental Research.

Sustainability will be secured by all the above strategies, enhanced by following the Faculty initiative that aligns applications to RCUK strategic priorities. Work involving therapeutic interventions, health services research and health improvement will capitalise on the translational agenda of NIHR, YCR, Wellcome, charities and other funders including industry partners.

The Francis Report gives work on dignity in care across care environments and services greater significance for policy and practice. The high quality interdisciplinary research of PAPOR and Nursing is suited to ESRC funding, whereas cross-linguistic work on communication and literacy disorders is well placed for EU Horizon 2020 funding linking health and demographic change to developments in assistive technology.

Aligning staff to leading researchers will harness expertise. We will strengthen internal peer review of applications. For example, Communication Science has recently formed a health care funding subgroup of its research committee. Other mechanisms in place to realise these plans include departmental research away days and Faculty-supported grant writing initiatives.

Departments also have strategies specific to their context.

Research in Dentistry will make a positive impact on oral health, patient care, the economy and society. To achieve these aims it will:

- Enhance internationally leading fundamental and applied research by consolidating expertise and successes in discovery science in the lab and clinic, identifying translational opportunities for biomarkers, diagnostics and therapeutics in cancer and infection and advancing understanding and treatment of nerve injuries and pain.
- Increase understanding of the basic science that underpins the performance of biomaterials in dental and bone regeneration; translate research from the laboratory to the market; develop more effective evaluations for health technologies
- Develop staff and prepare PGRs and ECRs for work in any setting (see section ci).

Communication Science will deliver research to benefit people with communication disorders. Commitment to knowledge exchange is integral to future planning. To meet these aims it will:

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- Expand upon its record of impact in research on prognostic indicators of treatment success for acquired communication disorders and condition-specific outcome measures for paediatric speech and language impairment. Research will target identified gaps in health, social and education services. The need for targeted and cost-efficient interventions for speech, language and literacy disorders will shape research in adults and children.
- Develop its refurbished accommodation (2013) with state of the art facilities for research with humans. The new Communication Centre (Clegg) will support referral to and from projects involving people with communication disorders and their families.

Nursing will develop and enhance its high quality policy and practice relevant research on enhancing environments of care for diverse user groups (older people, end of life and children). The School is exceptionally well placed to investigate theory and practice in relationship-centred care across the life course, which it is leading globally.

### Mechanisms to develop, promote, and disseminate research

The development and promotion of research is at the heart of all three departments. Departmental Research Committees are responsible for strategy, governance, disbursement of research budgets and PGR oversight. Directors of Research represent research interests throughout their departments and on the Faculty Research and Innovation Committee (FRIC).

FRIC also comprises professional staff from Research & Innovation Services, including the Healthcare Gateway and gives strategic direction to research via shared resources, expertise and policies. It pump-primes discipline hopping and other strategically important research. Clinical research management (ethics, governance and finance) is supported by joint UoS and STH structures to ensure streamlined working with common policies and modes of operation. This structure is operated by a Joint Clinical Research Office with a new Director (Sneddon).

## **c. People, including:**

### **i. Staffing strategy and staff development**

Total research staff numbers have remained stable between 2008 and 2013. Dentistry recruited 9 new academics, Communication Science 5 and Nursing 3. Eleven staff have retired (Dentistry 5, Communication Science 3 and Nursing 3) and 3 have taken posts elsewhere. The success of the strategies outlined below is evidenced by internal promotions to Chair (8 since 2008), Reader (3) and Senior Lecturer (9). Other staff have taken up Chairs in Manchester, UCL and Hull (Yates, Watson, Varley, Hayter)

Staffing strategies focus on recruiting high calibre staff, so that all appointments meet University requirements for research achievement and are within the strategic priorities for research development. For example, Thomson (recruited from Harvard) will increase research links across developmental and neuroscience research in Communication Science. Staff development provides a fair and equal environment to ensure a self-motivated, mutually supportive and committed workforce that can flourish. We employ short and long term approaches to build capacity.

Staff in all departments contribute to teaching, student support and administration and many have clinical commitments. Workload models reconcile these pressures and best utilise successful researchers' time. This includes appointing 19.4 FTE teaching staff to liberate research capacity.

Dentistry has sustained growth with a new professor in Restorative Dentistry (Martin), key appointments (Hunter, Hunt, Colley, Lambert, Vettore, Lala) and senior promotions (Andrew, Baker, Bingle, Atkins, Benson, Crawford, Gibson, Lambert, Miller, Stafford, Whawell). This growth was accomplished by careful planning, alignment to strategy and sustained development of research and PG taught programmes (supported by two PGT administrators to liberate academic time). Clinical career academics have been supported by the recruitment of 7 NIHR Academic Clinical Fellows and 2 Lecturers with approval to recruit a further 2 in 2014-15. Two staff have been awarded clinical doctoral training fellowships (NIHR & CRUK).

All three departments remain committed to growing future leadership by appointing early career researchers (Fricke, Spencer, Hunt, Colley) into lectureships created via retirement and new investment. Service commitments prevent many staff taking sabbaticals, but 10 have used this opportunity, back-filled by university teachers and assistants. The three departments have employed 55 RAs since 2008 including 2 EU Marie Curie Research Fellows.

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In 2012 the University was awarded the *HR Excellence in Research* award from the European Commission. We are committed to applying the 7 principles of the *UK Concordat for the Career Development of Researchers*. An exemplar of initiatives which develop researchers in this UoA is 'The Sheffield Crucible'. This flagship programme invests £160k to offer participants intensive residential workshops on: (1) 'Looking outwards' - the role of researchers and research in society; (2) 'Your research community, your networks' and (3) 'Yourself' that focuses on the individual skills required to be a more innovative, enterprising and creative researcher.

Early career researchers (ECRs) develop within their research groups, drawing on the expertise of other researchers and NHS clinicians. ECRs are represented on departmental research committees.

Professional development for ECRs is championed by the Faculty Early Career Group (Lead: Stafford, Dentistry). This is supplemented by the *Think Ahead* framework (shortlisted for a Times Higher Education award in 2011) for ECRs which includes tailored inductions, professional career training, career support and a mentoring programme. Content is balanced between provision for ECRs aspiring to be independent researchers and those working towards other goals. ECRs are exposed to different disciplines as many events facilitate networking across disciplines (e.g. *Broadening Horizons*, *GradSchool*, *Springboard for Women*). The Sheffield Crucible also develops interdisciplinary working, innovation, wider perspectives on research and the power of research to impact on society.

Internal, Faculty and University funded PGR studentships and scholarships (27 fully funded and 10 part funded since 2008) (see Research Students below) are combined with a Research Fund to pump-prime new projects (£138k to this UoA since 2008), enabling ECRs to recruit students. The need for start-up funds is reduced by the operation of laboratories as core facilities. ECRs are mentored in supervision and co-supervise their first PGR student with a more senior academic.

Staff development is supported by a probationary programme, with research aims that are regularly reviewed by Heads of Unit and the Faculty Pro-Vice Chancellor. Whilst new lecturers are protected from heavy teaching burdens, they participate in the University *Certificate in Learning and Teaching*, which includes research supervisory skills.

Established staff take part in the University's Staff Review and Development Scheme or NHS annual appraisals. Both processes involve performance indicators for research outputs, grant income and PGR supervision, reviews of progress and the identification of development needs. Reviews feed into staff development for academic and research staff such as training in PhD supervision, grant applications and management of RAs.

The University has explicit procedures for staff progression, based on achievement commensurate to their grade, with an annual formal peer-reviewed promotion round for which all staff may apply.

The University's flagship Women Academic Returners programme (WARP) funds female researchers so that they can prioritise research after returning from a career break. Eight researchers from the unit have benefitted from WARP since 2008. Support for equality and diversity is evidenced by the promotion and appointments of women to senior appointments (Dentistry, 3 of 7 heads of unit, 3 of 5 directors and 4 of 12 professors; Nursing Dean and 3 of 4 professors; Communication Science HoD, 4 of 6 professors, Athena Swan Bronze 2013). Eighteen of the 35 staff returned in REF14 are female.

All three departments have lively internal staff development programmes. Professorial leads and Directors of Research foster research in individual meetings to discuss plans. Weekly research meetings with internal and external speakers and annual Research Days act across research groups for large cross-cutting projects, and allow staff to disseminate findings and meet research visitors. Six clinical staff are working for PhDs funded internally or as extended SpR programmes.

Procedures to facilitate exchange between academia and industry (via the Sheffield Gateway) and with the NHS are outlined in section b.

**Fostering Good Research Practices (GRP)**

The University recognises that research environments must be underpinned by cultures of integrity. The University's *Good R&I Practices Policy* (2011) reflects world-wide best practice, is the product of consultation and contains Sheffield specific case studies (one written by Nursing). The

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Policy asserts that GRP is as much about how people are respected as scientific rigour. Health research is particularly regulated. The University Research Ethics Committee (UREC) *Ethics Policy for Research Involving Human Participants, Personal Data and Human Tissue* contains specialist policy on ethics review of health research and guidance on research with people with learning disabilities and children and young people.

Sheffield is the only Russell Group university to deliver compulsory GRP training for all its research students (PGRs). This training is delivered along cognate discipline lines by academics and ECRs. 95% of PGRs who completed PRES 2013 agree that their understanding of integrity has developed (sector average = 83%). Robinson (Dentistry) was a guest speaker at the 2012 UREC workshop on authorship. The University's *Research Governance Framework* applies to all healthcare research and the University interprets health care research broadly. Departments have University Ethics Committees for projects outside the NHS, which follow UREC's guidance.

**ii. Research students**

Seventy-four students have completed PhDs; a 111% increase since 2008 per FTE staff member returned.

All disciplines benchmark themselves against the University's *Research Student Proposition* (2012), which outlines what research students can expect and what Sheffield expects in return. The QAA's institutional review (2012) praised Sheffield's provision for research students as good practice and made no criticisms. This marked significant progress on the 2008 audit. QA now consists of an annual review to which PGRs contribute their perspectives on the quality of provision, a thematic review and biennial survey. As the Head of the Faculty Graduate School, and Chair of the University's *Doctoral Researcher Development Committee*, Douglas (Dentistry) has played a pivotal role in driving forward the wide range of initiatives that have enhanced and quality assured the University's PGR provision.

PGRs play an important part in department research cultures and act as a stimulus for change. Integrated into research teams to inculcate skills and good practice, their work contributes to and benefits from staff expertise. In addition, split-site, CASE and interdisciplinary students cement collaborations. Collectively, 32 current students are co-supervised with other departments.

University studentships are available annually; the three departments have been awarded 9 since 2008. In addition, Dentistry supports 6 internal studentships and 5 PhD Fee Scholarships annually. The departments have received 8 CASE awards with a total value of £750k from RCUK, SMEs or large multinationals (Ceramisys, Renovo, GSK, Haemostix). Other studentships are funded by charities (Stroke Association), overseas government bodies, the NHS and SY/CLAHRC.

Sheffield maintains robust policies for PGR selection, induction and support (different elements of induction are covered at University, Faculty and department level, which the QAA regarded as "thorough"). The Faculty established a Graduate School in 2011 (Lead: Douglas, Dentistry).

Vibrant UG and PGT programmes provide potential PGRs. 'High Achiever' events allow departments to identify and groom high calibre alumni. The units participate in the Sheffield Undergraduate Research Experience (SURE) scheme, which offers vacation scholarships to promising UGs; giving them research experience and for ECRs to gain supervision experience. Dentistry re-launched (2009) its intercalated BMedSci to give undergraduates the opportunity of a year of intensive research training as a stepping stone into academia. Eight students have completed the programme; 4 gained firsts and 3 have won national or international prizes. Dentistry has also pioneered 4 year integrated MSc/PhD programmes to nurture future PGRs and had two EU Marie Curie Initial Training Network Students.

Students are allocated at least two supervisors. Progress is assessed monthly in online supervisor reports and annually by Faculty driven assessments, oral examinations and presentations at department seminars (the QAA noted that mechanisms to monitor formal meetings with supervisors were effective). A dedicated Department PGR tutor holds three open meetings a year to handle matters of general concern and which all PGRs attend. New students can take part in the Faculty peer mentoring scheme, and attend the Faculty's 7-day Postgraduate Induction Course, which assists with the transition to PGR and introduces the skills they will gain during their PhD. Topics include: networking; plagiarism and unfair means; literature searching and use of Endnote; how to be an effective researcher; introduction to scientific thinking; health and safety;

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laboratory skills and data handling; research ethics and integrity.

Project specific training is supplemented by a Doctoral Development Programme (DDP, also commended by the QAA), which provides both transferable and craft-specific training bespoke to individual PGR needs. The DDP combines generic skills, broad scholarship and wider engagement with the community of scholars, all monitored with an e-Portfolio. Communication Science is also part of the ESRC White Rose Doctoral Training Programme in Social Sciences, offering specialist modules in clinical linguistics and related topics. 97% of PGRs who completed PRES 2013 agree that their skills in applying research methods, tools and techniques have developed during their programme (sector average = 88%).

All students present their research at national or international meetings, publish in peer reviewed journals and enter competitions. Dentistry has had notable successes with 16 prizes since 2008 (6 international: European Academy of Paediatric Dentistry, Hatton Award of International Association for Dental Research, Ivoclar prize for biomaterials research, TERMIS World Congress and Saudi International Conference (twice)). PGRs who wish to may teach undergraduates or PGTs.

**d. Income, infrastructure and facilities**

Since 2008, the three departments have gained more than £10.5M in competitive research income with total income per returned staff member increasing by 43% (£142k to £214k).

Dentistry partnered the EPSRC Centre for Innovative Manufacturing in Medical Devices (£6.9M, £220k to the Unit PI: Hatton), MRC/AstraZeneca drug repurposing call (PI: Andrew, £1.2M, £585K to the Unit), BBSRC/Pfizer Industrial Partnership Award (PI: Boissonade, £0.8M, £422K to the Unit), EPSRC (Next Generation components and systems for biomedical imaging, PI: Hunter, £1M, £52k to the Unit), with Electrical Engineering) and EU FP7 to benefit SMEs (PI: Miller, £1.2M, £500k to the Unit). Communication Science research has been funded in: biobehavioural science of speech (PI: Cowell, £77k, ESRC), aphasia neurolinguistics, neurorehabilitation and accessible information (PI: Herbert, £169k Stroke Association, Yorkshire Concept, SY-CLARHC) and child communication assessment and intervention (£451k PI: Fricke, EPSRC, Nuffield, Education Endowment Fund). Nursing has secured grant income from the NIHR, SDO (PI: Ingleton, £424k, for transition to palliative care), SY-CLARHC (PI: Ryan £722k to Unit) and EU (PI: Nolan: £560k, £112k to Unit).

Funding acquisition has been strengthened by consolidating research in groups, internal peer review of applications, red lining weeks and the infrastructural developments outlined below.

Infrastructure

Faculty wide infrastructure and policies are overseen by the Joint Clinical Research Office (University and STH) and by the University's Research and Innovation Services. Central services support research governance and ethics management for NHS projects and NRES applications.

Dentistry appointed a Research Support Officer (2008) who works jointly between the School and CCDH, maintaining a comprehensive library of available funding, supporting applications to Portfolio funders and to industry, and gaining post-award regulatory approvals. Accordingly RCUK grant awards have risen from none in 07/08 to a 60% success rate (3/5) in 2012/13, generating £1M funding to the Unit.

Red Lining Weeks encourage staff to clear their diaries to focus on research, such as finalising papers and writing grant applications. Simultaneous weeks across the Faculty allow meetings with collaborators, research support and commercialisation staff.

Facilities

Dentistry opened its new £5.5M research wing in 2008 and has invested a further £996k in core facilities. The wing created over 660m<sup>2</sup> of research laboratories and offices for research staff and PGRs. The laboratories include core facilities for cell culture and tissue engineering, cell and molecular biology, proteomics, materials science, histology, advanced microscopy, microbiology and in vivo electrophysiology. Dentistry also has open access computing with over 30 work stations. Across the Faculty central facilities allow mass spectroscopy, DNA sequencing, monoclonal antibody production, flow and image cytometry, confocal microscopy and animal care. In 2013, both Communication Science and Nursing moved to newly refurbished sites (£1.3M and £1.7M respectively) with centrally located state of the art research facilities, bringing them closer to major collaborators.

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**e. Collaboration or contribution to the discipline or research base**

Collaborations have supported a thriving research environment and a growing body of interdisciplinary projects. The departments have collaborated widely across academia, the health sector, industry and with the public. For example, Dentistry has worked with world class researchers in 19 other departments at Sheffield (including the centres outlined in section d), 24 national and 27 international institutions (e.g., RICE, Yale, Sao Paulo and Limerick: with whom Dentistry has published 15 papers and gained £432k (£310k to the Unit)) and 20 industrial partners including Eli Lilly, AstraZeneca, Renovo, Proctor & Gamble and Johnson & Johnson. Sustained relationships (e.g. GSK and Pfizer, £1M) have brought stability and allowed long term planning.

Contributions to the disciplines are demonstrated by the 34 significant honours and awards received since 2008 including:

- Speight: American Academy of Oral and Maxillofacial Pathology Award for outstanding professional leadership (2008) and the IADR Distinguished Scientist Award (2008)
- Baker and Robinson: IADR Giddon Award for the best paper published in the field of behavioural sciences and dentistry in 2012.
- Van Noort: BDA John Tomes Medal for Services to Dentistry (2009).
- The BSODR Colgate Junior (2011, 2012, 2013) and Unilever (2008, 2010) poster prizes.
- Ingleton: Best research presentation at the Health Services Research Network (2012) annual symposium
- Whiteside: Author of a "top 10 most cited article" in *Journal of the International Phonetic Association*.

Staff have served on 12 international bodies, including Presidents of the International Association of Oral Pathologists (Speight) and the Behavioural, Epidemiological and Health Services Research Group of IADR (Baker) and have examined 21 overseas PhDs in 15 countries. International recognition is further evident from invitations to share expertise across the globe. Staff hold 15 Visiting Chairs in 11 countries and have delivered 81 keynote/ invited lectures to international organisations. A further 56 such invitations have come from the UK. For example, Speight and van Noort have given the prestigious Graham Embery Lecture at the BSODR meeting (2011, 2012).

As a corollary to this expertise staff advise numerous governmental, regulatory and educational organisations. For example, Thomson (Communication Science) is a member of the UNESCO Scientific Advisory Panel and Nolan (Nursing) led the International Advisory Group of the National Family Carers Competence Centre, Sweden. Other staff have served on bodies in the UK and 12 other countries including the US, Japan, Finland, Hong Kong, South Africa and Jordan.

Sheffield has become a national focus for UK oral and dental research, with strong representation on the BSODR management committee (Speight, past-President; Robinson, Editor; Whawell, Awards Chair; Farthing, Asst-Treasurer). Staff have held Presidencies in 4 of the British dental specialist societies (Community Dentistry, Robinson; Periodontology, Griffiths; Paediatric Dentistry, Rodd; Oral and Dental Research, Speight). Dentistry organised the 2011 BSODR research meeting, hosted a national summit of oral and dental research stakeholders (2010) and negotiations between the dental research community and the Wellcome Trust. Staff have served on 37 other national dental organisations since 2008.

Sheffield researchers have organised six international conferences (including the Pan European Federation of IADR, 2008, with 1500 delegates) and a further 16 national meetings (eg. Robinson has devised the scientific content of all BSODR meetings since 2008).

Six staff have held editorships of peer-reviewed journals, including two for the International Journal of Paediatric Dentistry (Rodd and Deery). Two others are Section Editors. Staff hold editorial board responsibilities for 46 and review manuscripts for more than 105 journals

Our expertise is widely sought for reviewing research grant applications. Staff review for 9 international (for example, Ingleton (Nursing) chaired the Norwegian Research Council Programme on Health and Care Services) and 29 UK funding agencies including BBSRC, ESRC, EPSRC, MRC, NIHR, HTA and the Wellcome Trust. Gerrish (Nursing) is a Trustee of the General Nursing Council Trust for England and Wales.