

Institution: University of Glasgow
Unit of Assessment: Unit 3, Allied Health Professions, Dentistry, Nursing and Pharmacy
a. Overview

The submission for UoA 3 relates to activity within Dentistry. Following a major successful restructure of the University in 2010, Dentistry was incorporated, as one of three professional schools (Dentistry, Medicine, Nursing & Healthcare), into the School of Medicine, itself part of the College of Medical, Veterinary & Life Sciences (MVLS). MVLS brought together three former biomedical faculties, resulting in a College with 432 academic staff, 5718 students, and an annual turnover in excess of £200m. In addition to the three Schools of Medicine, Veterinary Medicine and Life Sciences, there are seven Research Institutes, established to ensure focus of College research in areas of international excellence, with close collaborations between institutes and schools. The vibrant research community that has resulted from this new structure has provided an outstanding environment within which dental research has thrived, with significant increases in research staff, doctoral students, external funding and publications.

Glasgow Dental School (GDS) manages its own educational and research activities, and all UoA 3 returned staff sit within it. Research at GDS is led by a Director of Dental Research, who chairs the strategic Dental School Research Committee, and is also the Research Convenor for the School of Medicine, thus sitting on the MVLS College Research & Knowledge Transfer Committee. The latter provides very valuable interfaces with the full range of biomedical research expertise in the MVLS research institutes. The GDS Clinical Research Management Group, chaired by a senior clinical academic, drives policy and leadership on operational and governance matters, with representation and active engagement from local NHS managers and NHS R&D to ensure that the requirements of both organisations are met.

GDS plays a critical role in serving one of the largest dental patient bases in the UK, since approximately a third of Scotland's population (1.2 million) lies within our Health Board area of NHS Greater Glasgow & Clyde. It therefore provides a crucial research focus and opportunity to improve Scotland's oral and dental health, which has been capitalised upon through close interaction with the Health Board, Scottish Government and their health improvement priorities.

There are two strong, focussed research groups within GDS, namely Community Oral Health and Infection & Immunity. Each has a group lead reporting to the Research Committee.

The **Community Oral Health Group (COH)** focuses on health inequalities research across the life course, concentrating particularly on oral health in children and head and neck cancer in adults. In the past year, in line with government priorities, COH has established a further programme of work around inequalities in the oral health of older people. Much of the work, (supported by grant funding of c. £4m) has informed recent national oral health policy, particularly development of the highly respected and successful Childsmile programme, with significant international interest in our approach to the development and evaluation of this population-based health promotion programme (see impact case, REF3a).

The **Infection & Immunity Group (I&I)** focuses on the role of microorganisms in the immuno-pathogenesis of oral disease and its impact on systemic health. Funding from a variety of sources (c.£3m), including RCUK, government and industry, has enabled us to adopt a 'bench to chair-side' philosophy, where we have been successful in working with key stakeholders to improve the clinical management of oral infections through improved understanding of host-pathogen interactions, and to enhance patient safety.

There is increasing collaborative working between the two research groups, including joint funding, PhD students and research staff. This synergy, which provides a rich skill set, is being pro-actively nurtured to provide a strong biological underpinning to our understanding of the epidemiological determinants of population health, throughout the life course. Additionally, both groups have strong collaborative links with the respective Research Institutes within the MVLS College, namely the Institutes of Health & Wellbeing (IHW) and Infection, Immunity & Inflammation (III), benefitting significantly from the intellectual and infrastructure resources available for research through the collegiate structure. Each Group also has significant external links, both national and international, for example EU FP7 funding linked to research on rheumatoid arthritis and periodontal disease.

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Over the past four years, GDS has been a lead stakeholder in development of the Chief Scientist Office (CSO)-approved Oral Health Research Strategy for Scotland, which includes formalisation of research interactions between the Scottish dental schools. The latter has been facilitated by establishing a Scottish Oral Health Research Collaboration, which has identified research synergies and is supported by an SFC-funded administrator based at GDS.

b. Research Strategy

Organisationally, a key strategic objective for the period 2009-2013 was to ensure research activity was focussed and mapped onto clearly defined research group priorities. This has been highly successful for both COH and I&I, with key staff appointments and promotions, success in gaining external grant income (281% increase between 2009 and 2013), a significantly increased number of enrolled and successful PhD students (16 doctoral degrees awarded) and an output of peer-reviewed publications appropriate to the scale of the groups (COH:75; I&I:92). The third research group included in the RAE 2008 submission (Biotechnology & Craniofacial Sciences) did not succeed in consolidating and building its critical mass. As a result, we have withdrawn from this theme, releasing funding to reinvest in the COH and I&I Groups. A second strategic objective, successfully achieved, was to reduce the number of research masters students (2008:16; 2013:4) in favour of doctoral students (2008:7; 2013:14) to provide the capacity to undertake more extensive and comprehensive pieces of research. Finally, we aimed to link closely with the relevant Research Institutes, namely IHW for the COH Group (which has particularly strengthened its capability in health economics research, with a funded joint Research Fellow and a joint PhD student) and ILL for the I&I Group (strengthened through co-funded projects focussing on the immunopathogenesis of oral and systemic disease), links which are flourishing.

In 2008, the COH Group's research objectives were to identify risk factors associated with social deprivation and their impact on oral health outcomes, particularly in relation to child oral health and head & neck cancer. Focus in this area has resulted in an extensive output of published research in high impact journals, e.g. *Nature*, *Nature Genetics*. Ongoing evaluation, particularly of the Childsmile programme, has shown the intervention to have impacted directly on health and policy. The staffing strategy implemented to support this strategic direction has been extremely successful, permitting a multidisciplinary approach to addressing complex social, behavioural and biological factors underlying population oral health and inequalities.

In 2008 the I&I Group's 5 year objectives were focused on the management of infections of biofilm origin, specifically investigating how manipulation of pathogenic biofilms by the host and chemotherapeutics influences oral and systemic health. These objectives have been successfully realized and are evidenced through key publications representing high profile international collaborations (*Ann Rheum Dis*; *PLoS Pathogens*; *Arthritis & Rheumatism*). Improvement in the quality of our research outputs has been facilitated by income generation from prestigious sources, including the European Union FP7 (**Culshaw**), Wellcome Trust (**Ramage**), BBSRC (**Ramage, Culshaw, Robertson**), as well as industry (GlaxoSmithKline [**Ramage**]) and government (Scottish Clinical Research Excellence Development Scheme [**Culshaw**]).

- ***The future strategic objectives for research***

Having consolidated and strengthened the two focused themes, with a credible critical mass of researchers, the two groups have set clear research objectives for the future. The main objective of the COH Group is to further develop its role in understanding and addressing oral health inequalities across the life course, through the development, implementation and evaluation of complex interventions. A secondary aim is to fully exploit and utilise existing data sources and advances in record linkage capabilities to address key research questions in the area of health inequalities. There has been increasing interaction between this group and the I&I Group in relation to the microbiology and immunology of dental caries as part of the research linked to Childsmile, and there is significant scope for further collaboration on biomarkers associated with ageing and oral disease in the elderly. This has now developed into a major theme at a national level through the Scottish Oral Health Research Collaboration.

The I&I Group's aims over the next 5 years will be to extend its success and align more closely with Research Council strategic objectives. It aims to develop its research strategy to maintain and

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strengthen the existing collaboration with COH (e.g. Childsmile) and to build upon this through investigation of chronic diseases of an ageing population, specifically focusing on inflammation. The Group intends to investigate microbiological and immunological factors underpinning oral disease in the elderly. This will be facilitated by embedding key staff members within the IIII to enhance research directed at understanding regulation of immune response in the oral cavity and its contribution to oral and systemic disease, and by continuing to collaborate externally with national and international research groups on high quality grant-funded research.

c. People, including:**I. Staffing strategy and staff development****Staff strategy**

- In a Dental School, the staffing strategy must satisfy teaching as well as research priorities. This is particularly complex for a course dominated by clinical teaching. The Dental School operates a 3-5 year staffing strategy linked to a business plan, which supports succession and developments in research, teaching and administration.
- Since 2008, our strategy for research posts has been to focus available resources on appointment of a small number of highly research active staff to the two identified themes. By reviewing our skill mix we identified deficits, resulting in the active recruitment of statistical (**Sherriff**), and basic and clinical immunological (**Nile & Guzik**) expertise to strengthen the research profile. The COH Research Group now comprises a Professor (**Macpherson**) and Senior Lecturer (**Conway**) in Dental Public Health, a Reader in Epidemiology (**McMahon**) and a Senior Lecturer in Statistics (**Sherriff**) (the latter two are Chartered Statisticians). The recent appointment of a Lecturer in Behavioural Sciences (**Ross**) has greatly strengthened the research capacity and skill-set of the Group. Two members (**Conway and McMahon**) hold Honorary Consultant contracts with the Information Services Division of NHS Scotland, providing outstanding opportunities for data linkage projects. The Group is supported by a team of six researchers, funded by research income, with seven PhD students. The I&I group comprises five clinical (**Bagg, Culshaw, Guzik, Robertson, Smith**) and four non-clinical researchers (**Lappin, Nile, Ramage, Riggio**), including three at professorial level, encompassing microbiological and immunological expertise. These staff are currently supplemented by three postdoctoral fellows, seven PhD students and a technician.

Staff development

- We continue to support and nurture our existing non-clinical and clinical staff through personal development plans (PDPs) facilitated by our University Performance & Development Review (P&DR) process, Consultant Appraisal (Honorary Consultants) and Annual Review of Competence Progression (Honorary StR's), respectively. This has led to promotion to Personal Professorships in Microbiology (**Ramage & Smith**), a Clinical Senior Lectureship in Dental Public Health (**Conway**), a Scottish Clinical Research Excellence Development Scheme Fellowship (**Culshaw**), a Readership in Epidemiology (**McMahon**), and six further promotions for junior members of staff.
- PDPs also encourage staff to attend relevant research training administered through the local University Staff Development Service and NHS R&D (e.g. Good Clinical Practice training), or by external providers (e.g. Cochrane Centre [**Sherriff**]). In addition, staff are supported to visit collaborators' facilities nationally (**Ramage** – Manchester) and internationally (**Conway** – Lyon; **Malcolm** – Boston). Travel to present at conferences is actively encouraged and supported by senior staff. Funding is available from a variety of sources internally, both at University (Bellahouston travel grants) and Dental School levels (allocated travel funding in Section budgets) and staff members are supported to apply for external travel grants.
- Heads of the Research Groups in conjunction with the Head of School provide close supervision and mentoring for junior staff within their groups, ensuring that their development as researchers is fully supported through P&DR. All newly appointed junior academics complete the New Teacher Lecturer Programme, leading to award of the FHEA.

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- All staff in the School complete Equality & Diversity training, either through the University Staff Development Service, or via external organisations such as NHS Education for Scotland where this has been a requirement for external duties. The University joined the Athena Swan charter in August 2011 and the Dental School is an integral part of the School of Medicine application for a Bronze Award to be submitted in the Spring of 2014.

c. II. Research students

Training and supervision of research students

- Staff must complete the Graduate School training for supervisors and have successfully co-supervised at least one postgraduate research student (PGR) before becoming a main supervisor. Re-training is required every five years.
- PGR recruitment is strictly mapped onto established research theme areas. This ensures the focussed research strategy is maintained and that students join a well-established, mature research environment, including access to research institutes, which delivers the academic skill-set and experience to provide high quality supervision. All students have both a main and secondary supervisor and an advisor who sits on the annual review panel.
- PGRs undergo a rigorous annual review process, managed by the MVLS College Graduate School, which is conducted by independent academic staff. This allows 'external' monitoring of research quality and response to any academic difficulties at an early stage.
- PGRs undergo mandatory transferable skills training throughout their period of study, which is co-ordinated by the MVLS College Graduate School. This is based on the Researcher Development Framework, which ensures training in knowledge and intellectual abilities, personal effectiveness, research governance and organisation, engagement, influence and impact. Credit is gained for attending specified courses and workshops, oral presentations at local group meetings or conferences, and other external academic activities.
- PGRs attend local research group meetings in both GDS and the research institutes, providing an opportunity to present data, interact and exchange ideas with fellow students and staff. The School holds a research seminar series, including a PGR evening with prizes for the best presentations. It is also expected that PGRs attend local, national and international meetings, for which research groups make funds available.

Postgraduate students are encouraged to undertake limited amounts of undergraduate teaching to aid their personal development, with both local support and attendance on the University Graduate Teaching Assistant Training & Development Programme.

d. Income, infrastructure and facilities

- Since 2008 the two research groups have generated in excess of £6m (**COH**: £3.7m; **I&I**: £2.9m) from national and international funding bodies, including local government (CSO, Scottish Government, NHS, Technology Strategy Board); Research Councils (BBSRC, MRC); Wellcome Trust; FP7; charities (Sir Jules Thorn); and industry (GSK, BluTest, Dunhill Trust, Fulhold, Gilead, W&H, Pet Plan).
- The I&I group has engaged a number of different stakeholders in order to conduct *in vitro* and *in vivo* research. A key funding stream has been through interaction with GSK, which has supported three PhD studentships in collaboration with BBSRC, and several research projects based on oral biofilms (**Ramage/Culshaw**). The latter led to a Technology Strategy Board funded Knowledge Transfer Partnership to develop and commercialise biofilm models in conjunction with BluTest Laboratories (**Ramage/Bagg**). Work on systemic implications of oral disease resulted in funding from FP7, CSO and Marie Curie (**Culshaw**). Studies in comparative oral microbiology were supported by Pet Plan and the Horse Betting Levy Board (**Riggio**). Joint research grants with the MVLS IIII now total £1.2m.
- The two research groups have contrasting infrastructural requirements, but these are satisfied for both. The I&I group occupies dedicated laboratory space of 200m², fully equipped to pursue a variety of experimental approaches to investigate immuno-pathogenesis, and particularly well

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established for microbiological research. These laboratories are augmented by access to additional state-of-the-art facilities that have resulted from recent strategic investments by the MVLS College, for example the Glasgow Biomedical Research Centre and Glasgow Polyomics. A University funded Research Technician maintains the GDS laboratories, supports PGR students and is responsible for purchasing.

- For the COH group, data linkage of health, administrative, and research data is a cornerstone of its research and part of the Scottish and UK research agenda. The group has a strong IT infrastructure and there are well established, robust data security procedures for managing and analysing data, led by our two senior academics in epidemiology/statistics. This has been recognised by its recent selection as a pilot site for remote data access via the Scottish Health Information Programme (SHIP). This access facilitates three major externally-funded projects: a pathfinder project leading the way for cross-sectoral linkage between social, education, and health datasets (focusing on dental health of looked after children); ‘HOPSCOTCH’, a CSO funded project linking human papillomavirus status to vaccination and health outcomes; and Childsmile evaluation linking a vast range of Childsmile intervention datasets from multiple settings with a variety of dental service, oral health and general health outcomes. A video-conferencing suite facilitates the multiple interactions with external parties and collaborators, which are central to this Group’s work.
- In collaboration with NHS R&D we are currently building a dedicated Clinical Research Facility at GDS. This facility, which incorporates two dental chairs for clinical procedures and specimen collection, and an interview room, will support both Groups’ activities.
- The Senior Lecturer in Statistics (**Sherriff**) runs a statistical advisory service for all research staff and students, providing tailored support in research methodology and statistics. **McMahon** and **Sherriff** also run a Research Methods course within the Dental School to complement and enhance the training provided by the MVLS College.

Administrative support is provided locally from our Research Administrative Assistant and from the MVLS College, facilitating grant application and post award procedures.

e. Collaboration and contribution to the discipline or research base

➤ *Collaboration with external bodies, industry and government agencies*

- Both groups undertake focussed research of clinical relevance via collaboration with government and industry to tackle important national priorities in oral health across the age spectrum. This is exemplified by child and ageing research activities within COH centred on government priorities, with which the I&I group has become increasingly involved by providing biological underpinning. The latter has demonstrated continued interaction through responsive discussions with its key industrial sponsor GSK, both via Investigator Initiated Programmes and through strategic BBSRC CASE industry sponsored schemes to investigate and develop our understanding of the immunopathogenesis of oral disease and to improve methods in oral consumer health in adult and ageing populations (**Ramage & Culshaw**). **Sherriff** has acted as a Statistical Consultant for the Food Standards Agency Scotland on a number of high profile projects since 2006, monitoring the Scottish diet.

➤ *Response to national or international priorities*

- Our continued work on health inequalities research maps directly onto a major priority area for the Scottish Government, WHO and the International Association of Dental Research. The work in relation to child oral health has informed recent national oral health policy (e.g. the Childsmile programme). Epidemiological research and Cochrane Reviews on prevention and improving outcomes of head and neck cancer have informed Health Scotland oral health and alcohol guidance advice and, through membership of a NICE Advisory Group (**Conway**), UK guidance. We play a leading role in the Scottish Oral Health Research Collaboration for which a key strategic focus into the future is oral health of the elderly, supporting the Scottish Government’s strategy for older people (*Caring for Smiles*). We also map onto Wellcome Trust focus areas through our work on chronic oral diseases in ageing populations and their influence on systemic

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disease, e.g. periodontitis, rheumatoid arthritis and candidosis (**Culshaw, Ramage**). Both research groups also map to the MRC's strategic plan on 'Life Course Perspective'.

➤ *Promotion of collaborative research with partners*

- Following the University re-structure we strategically maintained our focus on the dental sciences within GDS, but are aligned to Research Institutes. These associations allow our research staff to collaborate and gain access to resources through a pooling of expertise and equipment and participate in joint PhD student supervision between GDS and Institutes (e.g. **Oliver-Bell, ILLI; Anopa, IHW**). We have also engaged with the University commercialisation strategy, by linking with local enterprises through Knowledge Transfer Partnerships to exchange technologies, resulting in mutually beneficial outcomes (**Ramage/Bagg**). At a local level, Scottish Government and University funding has provided support for two joint PhD students across the two research groups, exploiting expertise in both and facilitating closer integration within GDS. Externally, we provide funds to allow our junior researchers to attend local, national and international meetings, and have encouraged staff and students to undertake research exchanges to partner laboratories in academia (**Conway**, WHO International Agency for Research in Cancer, Lyon; **Malcolm**, University of Valencia) and industry (**Smith, W&H; Jose, GSK**). **Conway** also leads one of 14 centres of the International Agency for Research on Cancer (ARCAGE) and is a member of the International Head and Neck Cancer Epidemiology Consortium (INHANCE). A long-standing and productive collaboration between the I&I Group (**Lappin & Nile**) and the Dental School at Ege University, Turkey, has resulted in a total of 16 peer-reviewed papers, 9 of which were published during the REF period. The I&I group (**Culshaw**) is also pursuing joint grant-funded research with the Universities of Krakow, Boston, Valencia, Amsterdam (ACTA) and Oxford, resulting in 5 publications since 2008.

➤ *Indicators of influence*

- During the REF period, **Conway** won the Colgate BSODR Clinical Research Prize followed by the IADR/Unilever Hatton Award; he was also awarded a Union of International Cancer Control Fellowship, an IARC Visiting Scientist Award and a Bellahouston Travel Award. **Culshaw** delivered the TC White Prize Lecture at the Royal College of Physicians & Surgeons, Glasgow in 2011.
- Since 2008, our research-active staff members have been appointed office bearers in a variety of research organisations, including the British Society for Oral and Dental Research (BSODR) (**Riggio** and **Macpherson** – Councillors); the Oral Microbiology and Immunology Group of BSODR (**Riggio** [Secretary], **Culshaw & Nile**) and the British Society for Medical Mycology (**Ramage** [Secretary]). **Bagg** is a Scottish Lead for the Oral & Dental Specialty Group of the UKCRN. We are engaged with industrial partners as key opinion leaders in aspects of oral health Advisory Board activities (**Ramage**). Staff are also involved in high profile committee activities, e.g. Chair of the National Childsmile Evaluation Board, Chair and Editor of the National Dental Inspection Programme and Chair of HTA appointed Steering Group Cardiff (**Macpherson**); Chair of National Dental Advisory Committee (**Bagg**); Chair of the Dental Informatics Group in Scotland (**Conway**).

Involvement in scientific publishing and peer review is a key component of our research profile. **Sherriff** is a non-clinical Advisor for the *Cochrane Oral Health Group*, and a Statistical Reviewer for *Archives of Disease in Childhood*; **McMahon** is an Associate Editor of *Frontiers in Epidemiology*, a Statistical Advisor to *PLoS Medicine* and a member of the Editorial Board of *Pharmacoepidemiology & Drug Safety*; **Conway** is an Associate Editor of *BMC Cancer* and *Journal of Theory & Practice of Public Health*, and on the Editorial Board of *Oral Oncology*. **Ramage** is an Associate Editor for *Critical Reviews in Microbiology* and the *Journal of Clinical and Investigative Dentistry*, **Riggio** is an Associate Editor for the *Journal of Medical Microbiology* and **Smith** is an Associate Editor for the *Journal of Hospital Infection*. Collectively, we also undertake a variety of reviewer activities for funding bodies, such as MRC, Wellcome Trust, CSO, CRUK, NIHR, ESRC, Action Medical Research, international funding bodies, and high impact journals in our field.