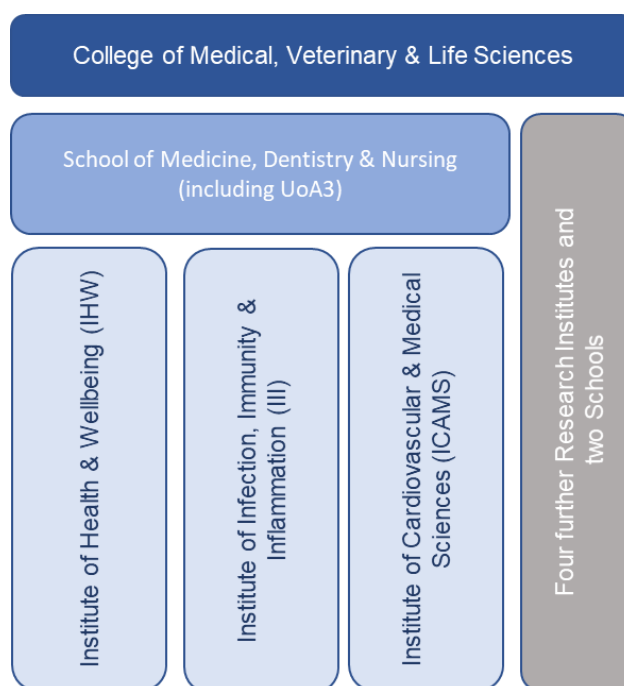


<b>Institution: University of Glasgow</b>
<b>Unit of Assessment:UoA3</b>
<b>1.Unit context and structure, research and impact strategy</b>

## Overview

University of Glasgow's (UofG) UoA3 submission presents research undertaken within the College of Medical, Veterinary & Life Sciences' (MVLS) School of Medicine, Dentistry & Nursing (SoMDN). MVLS comprises three professional Schools and seven thematic Research-intensive Institutes. School and Institute staff work collaboratively, with staff from across UoA3 being affiliated with three MVLS Institutes: Institute of Cardiovascular & Medical Sciences (ICAMS), Institute of Health & Wellbeing (IHW), and Institute of Infection, Immunity & Inflammation (III) (Figure 1).

*Figure 1.UoA3 comprises disciplinary strengths from across the School of Medicine, Dentistry & Nursing and is strongly affiliated with three of MVLS' seven Research Institutes*



The REF2014 UoA3 submission included only Dentistry. Subsequent strategic planning broadened research infrastructure within the well-established SoMDN, with new appointments to strengthen research capacity in Nursing. UoA3 now represents Dentistry (n=11FTE), Human Nutrition (n=5.8FTE) and Nursing (n=3FTE). These three disciplines share an integrative, translational approach to research, encompassing basic sciences and clinical and public health applications, in order to investigate and manage life-course health problems and healthcare solutions that cross conventional research boundaries.

Our work is informed and shaped by dynamic two-way interactions with stakeholders including patient groups, communities, NHS and other practitioners, industry, and policy makers, supported and nurtured by the highly collaborative UofG clinical research environment represented in other UoAs. Over the review period, UoA3 has collaborated with UofG Research Institutes on 48 awards, worth £8.7m.

## Unit-level environment template (REF5b)

Focused on major clinical and societal public health concerns, our research and impact strengths include clinical trials, big data, and mechanistic science, in particular:

- i. Clinical trials of innovative interventions to combat some of the most prevalent non-communicable diseases (obesity, type-2 diabetes, Crohn's disease, periodontal disease, and dental caries)
- ii. Evaluating public health interventions by record linkage using high quality routinely collected 'big data' national datasets, that incorporate health and social care
- iii. Human factors research in healthcare system design and implementation
- iv. Unravelling the interactions between human microbiome and host in health and disease using clinical samples, multi-'omics' and advanced bioinformatics
- v. Molecular and microbiological work aligned to antimicrobial resistance surveillance for new and improved antimicrobials and biomarker discovery

Since January 2014, our international collaborations have produced 41.4% of our research outputs. Excluding self-citations, the 778 research outputs have 12,700 citations (16.3 per output), all with Field-Weighted Citation Impacts (FWCI) well above Russell Group averages. Two researchers [Crozier, now honorary, and **Lean**] have repeatedly made the Clarivate Analytics lists of the world's 1% most highly-cited authors.

**Developing our research culture:** [UofG Research Strategy](#) places research culture and career development at the fore. Our approach to promoting a culture of research integrity has formed case studies for the UK Research Integrity Office and the Royal Society. All PIs/postgraduate students are required to undertake research integrity training and adhere to the University's Code of Practice in research, propagating the principle that good research practice ensures confidence in the validity of our research outputs.

Supported by University Library staff, we have mandated that all primary research publications be fully compliant with Open Access (OA) policies, and 100% of our researchers are ORCID registered.

### 1]Dentistry

Our internationally recognised multidisciplinary group brings together expertise in dental public health, clinical dental specialities, epidemiology, social science, immunology, and infection biology. Synergies across these areas underpin our strengths to relate biological sciences to epidemiology and evaluation of complex interventions, to gain deeper understanding of the determinants of population health. Our bench-to-clinic philosophy is supported by the recently established Glasgow Dental Clinical Research Facility (GDCRF, Section 3). We aim to embed knowledge exchange activities with key stakeholders (NHS staff and patients, parents, government, policy-makers, education staff), and to co-design, conduct, interpret and translate our research into policy and practice.

Our research strategy centres on two complementary areas:

1. **Community Oral Health** – Improving population oral health, reducing inequalities across the life-course (particularly children and older adults), and head and neck cancer.
2. **Oral Sciences** – Infection biology of complex communities and immuno-pathogenesis of oral disease, including impacts on systemic health.

Our strategic objectives (2014-2020) were: greater focus on the oral health of older adults, improving joint working between Community Oral Health and Oral Sciences, enhancing interdisciplinary relationships with MVLS Research Institutes, and building the Scottish Oral Health Research

## Unit-level environment template (REF5b)

Collaboration (SOHRC) across Scotland's three Dental Schools, the Edinburgh Dental Institute and NHS Education for Scotland. These objectives have been achieved, as outlined below.

### Research and Impact Achievements:

#### **Community Oral Health**

We lead the evaluation of Childsmile – the national child oral health improvement programme. Our methodologies, including population-wide individual-level data-linkage studies, a large randomised controlled trial in education settings, and an economic evaluation with IHW [**Macpherson, Conway, Sherriff, McMahon, Ross**], have recently (2019) been evaluated by the European Commission as Best Public Health Practice in achieving Sustainable Development Goals relating to Non-Communicable Diseases (**UoA3REF Impact Case**).

Studies related to prevention in dental practice extend beyond child oral health to periodontal disease and oral cancer, and involve cross-cutting areas of work as part of the SOHRC, and partnerships on several NIHR-funded clinical trials [**Ross, Macpherson, Sherriff, Conway, Culshaw**].

We pioneered a cross-sectoral (health and social care) population-wide routine administrative data-linkage study assessing the oral health of looked-after children. The results contributed to the Scottish Government policy to provide free dental treatment for care-experienced young people [**Conway, McMahon, Macpherson**].

We play a central role in international collaborative epidemiology of head and neck cancer with the International Agency for Research on Cancer (IARC). We led the development of the IARC monograph on social inequalities and cancer and contributed to the UK Joint Committee on Vaccination and Immunisation's recommendation, and government policy change to extend HPV vaccination to include boys [**Conway, McMahon**]. We are also now leading work-packages on the EU Horizon2020-funded HEADSpAcE study, investigating inequalities in late-stage head and neck cancer and providing opportunities to characterise the under-explored role of the oral microbiome/mycobiome in pathogenesis [**Conway, McMahon, Ross, Ramage**].

Incorporating organisational science ('human factors') into our work has allowed a ground-breaking systems approach to oral health research, including tests of organisational improvement for prevention in general practice, funded by the Chief Scientist Office [**Ross, Conway, Macpherson**]. Working with the SOHRC and the Care Inspectorate, we led nation-wide co-designed research initiatives for older adults in residential care homes, showing that organizational human factors are key to promoting daily dental/oral care. This research is a featured 'success story' on the funder's website (Dunhill Medical Trust) as a model for other aspects of routine care delivery in this setting [**Ross, Sherriff, Macpherson**].

#### **Oral Sciences**

We have pioneered internationally recognised preclinical models of oral biofilm infections, which have supported our inclusion as a stakeholder and funded partner in the £12M National Biofilms Innovation Centre. Funded by BBSRC, Wellcome, Innovate UK and GSK, we have applied our expertise to complex biofilm communities and microbiome sequencing technologies to map the biogeography of the oral cavity and develop appropriate biofilm models [**Ramage, Riggio, Culshaw**]. These have been used to screen and evaluate promising anti-biofilm strategies with industry funding (GSK, Unilever, Nestle Purina, Dentsply), now driving bench-to-chairside studies. They have also facilitated joint working between Community Oral Health and Oral Sciences research teams in elucidating important links between salivary immunology, microbiome, and dental plaque composition and oral disease outcomes [**Culshaw, Macpherson, Sherriff, Ramage, Conway**].

Establishing the GDCRF in 2016, in partnership with the NHS, has been a major achievement. This has facilitated collaborations with academia (Mira, Valencia; Prospect Consortium), industry (GSK, Dentsply Sirona, AFYX Therapeutics), and the NHS, with a step change in our clinical trials capacity [**Culshaw, Ramage, Guzik, Conway**], supporting six PhD projects, with awards from industry and funding bodies totalling £720,000.

Using pre-clinical experimental models and human tissue from clinically characterised patients, in collaboration with expertise and facilities at the MVLS Institutes of ICAMS and III, we have identified novel inflammatory mechanisms. These discoveries have provided an understanding for targeting these pathways by repurposing existing therapeutics, which strengthens the evidence for integrating dental care into holistic healthcare for patients with autoimmune arthritis [**Culshaw**] and cardiovascular disease [**Guzik**]. Our work, within a Europe-wide study, has also developed enhanced vaccine surveillance programmes to better understand how pneumococcal vaccines impact young children [**Smith**].

A Wellcome Trust Strategic Award for Medical Mycology allowed us to collaborate nationally in assessing and correlating clinical outcomes associated with *Candida albicans* biofilm formation. This has increased understanding of the molecular basis of biofilm formation, enabling us to apply techniques and expertise directly to the emergent 'super yeast' *Candida auris*, in collaboration with Public Health England [**Ramage**].

## 2]Human Nutrition

As a new addition to UoA3, Human Nutrition includes academic and clinical academic researchers, medical, nursing, and dietetic professionals, and aims to inform and change practice/policy to enhance health, at individual and population levels. The group encompasses research-skills in molecular, clinical, and public health aspects of Human Nutrition, conceptualised as the body of integrated sciences which underpins all biomedical and health research. The research strategy is to anticipate, respond to, and then inform, research priorities and funding calls of health and food-sector agencies, in three strategic areas:

- **Obesity and Metabolic Health** - molecular, physiological, and clinical influences of diet and lifestyle strategies, to understand, prevent and treat obesity and its metabolic consequences, notably type 2 diabetes and accelerated cardiovascular diseases.
- **Life course nutrition, childhood, and growth** - access to food and nutrients, eating behaviours throughout the lifecycle, and influence on health trajectories, particularly to improve the nutritional status of underweight children and adults.
- **Gut Microbiome, Diet and Exercise** - interaction of lifestyle components with gut microbiome composition and function in non-communicable diseases; designing personalised therapies via dietary manipulation of the microbiome.

## Research and Impact Achievements:

### **Obesity and Metabolic Health**

Following seminal work relating the Metabolic Syndrome to ectopic fat accumulation and large waists, the Diabetes UK-funded Diabetes Remission Clinical Trial (DiRECT) [PIs **Lean**; Taylor at Newcastle], using the Counterweight-Plus weight management programme originally developed by **Lean**, and its economic analyses [**Lean** and IHW], have radically changed our understanding of type-2 diabetes, and driven a management paradigm-shift internationally (>c.1000 citations from 15 papers in 3 years). European and US guidelines now target remission by interventions based on DiRECT through the reversible process of excess body-fat accumulation in ectopic sites, notably liver and pancreas, which impairs vital organ functions. The 5-year evaluation of real-life translational impacts of DiRECT, the largest single project ever funded by Diabetes UK, is ongoing [**Lean**, ICAMS, Robertson Centre for Biostatistics (IHW)], supported by external collaborations on “-omics” and genetic aspects of remission [**Lean** and ICAMS] (**UoA1REF Impact Case**).

Complementary skills from Human Nutrition and the Scottish Universities Environmental Research Centre (SUERC) have facilitated ground-breaking BBSRC-funded work to reduce appetite and weight gain using a bioactive dietary fibre metabolite (propionate) stimulating colonic release of GLP-1. Inulin propionate-ester (IPE) was invented in Glasgow [**Morrison, Preston**] and co-developed with Imperial College London (ICL) resulting in a joint patent and current spin-out company development, with 11 papers within the current REF period [**Morrison, Preston**]. Exploiting Glasgow's strong clinical trials research environment, and its status as Scotland's only European

## Unit-level environment template (REF5b)

Association for the Study of Obesity (EASO) Centre for Obesity Management, the NIHR-funded iPREVENT study (collaboration: ICL) assesses IPE for preventing weight gain in young adults [Morrison, Preston, Lean].

### ***Life-course nutrition, childhood, and growth***

Our nutritional screening tools support delivery of UK Clinical Quality Indicators in Food, Fluid and Nutritional Care. The Paediatric Yorkhill Malnutrition Score (PYMS) is used routinely in all paediatric hospitals in NHS Scotland and across the UK [Gerasimidis, Wright, NHS]. Research on the use and design of growth charts involves collaboration with Hong Kong, California, and Germany [Wright]. A tool developed in Kenya and Pakistan to assess eating behaviours, in both healthy and malnourished children, informs low-/middle-income countries' (LMIC) service planning [Wright]. International collaborations [Preston], funded by Bill and Melinda Gates Foundation in ten LMICs, is setting new cut-offs for exclusive breastfeeding, using deuterium oxide dilution (United Nations (UN) and World Health Organisation (WHO) calls).

Multidisciplinary studies have defined an emerging nutritional challenge from iodine insufficiency, an essential nutrient often lacking in UK diets, and scoped strategies for prophylaxis around pregnancy. Collaboration with the seaweed industry adds translational capacity for novel approaches to influence iodine flux into food supplies [Combet and Lean] (UoA3REF Impact Case).

### ***Gut Microbiome, Diet, Exercise in Health & Disease***

The Plant Products and Human Nutrition Laboratory (established by Lean and Crozier) pioneered characterisation of dietary flavonoids/polyphenolics, their metabolic pathways, and potential health impacts, and has added complementary research expertise in dietary plant bioactives and microbial/whole-body metabolism [Edwards, Combet]. A large cross-institute, multidisciplinary study with ICAMS (BBSRC) [Edwards, Combet, Morrison, Preston], investigating interactions between microbiome, food-matrix, and flavonoid metabolism to generate more bioavailable phenolic acid, directly informs industry about ingredient selections and product designs to enhance health.

Collaborations with NHS colleagues have revealed how food ingredients and the microbiome interact on inflammatory bowel disease, to elucidate the mechanisms behind dietary induction of remission. Follow-on, multi-source seed-funding generated novel dietary therapies to manipulate the microbiome (Helmsley Trust and Nestle (USD1.2M) [Gerasimidis, NHS]. The world's largest RCT of Faecal Material Transplantation (FMT) for ulcerative colitis [Gerasimidis NIHR-EME, £2.5M] facilitated establishing a UK-wide FMT research network, with MHRA-accredited and GMP-operated FMT research bank at University of Birmingham.

## **3]Nursing**

UofG's strategic decision to strengthen Nursing research capacity established the Florence Nightingale Chair in Clinical Nursing (2016) [Johnston] in partnership with the NHS and the Florence Nightingale Foundation. Two additional tenured appointments and two post-doctoral NHS staff provide early critical mass in this fledgling research theme. This initiative underscores the University's commitment to developing new translational research excellence in nursing.

Since 2016, the group has begun to establish its research direction and reputation, directed at generating evidence-based changes in practice and policy which will promote and support the implementation of person-centred supportive and palliative care for people with life-limiting and multimorbid conditions.

We bring together interdisciplinary expertise in systematic reviews, mixed-methods research, implementation science and qualitative research, collaborating with key stakeholders, patients, carers, clinicians and the third sector, to inform, co-design, interpret and disseminate our research into practice. Strategic research areas are:

- **Supporting self-management** - long-term personalised support for people with life-limiting conditions such as stroke and cancers.



## Unit-level environment template (REF5b)

- **Living with and dying from advanced disease** - enhancing quality of life, addressing physical, psychosocial and spiritual needs of people with advanced disease, and their families/carers.

### Research and Impact Achievements:

#### *Supporting self-management*

International collaboration attracted a Horizon2020 award for the LifeChamps project [Kotronoulas], to develop and test a collective intelligence platform to predict, prevent and manage frailty in older people after cancer treatment. It draws on co-production methodologies and emerging developments in digital health, big data, and artificial intelligence.

We lead the UK-wide IMPETUS study [Kidd] using stroke audit data to enhance implementation and evaluation of self-management in community-based rehabilitation (Scottish Stroke Improvement Programme; Sentinel Stroke National Audit Programme).

#### *Living with and dying from advanced disease*

Two PhD clinical academic studentships, eight PhD students, and one post-doctoral fellow are supported by £600k of research funding to develop and test interventions (e.g. music listening) for people with palliative care needs whose symptoms are unresponsive to drugs, including marginalised groups (e.g. prisoners) [Johnston]. Collaborations have been established with six hospices, ICAMS and UofG School of Philosophy to develop palliative care models for people with heart failure.

### Future UoA3 research and impact strategy

The three disciplines share strategic objectives:

- Champion interdisciplinary capacity by increasing collaborations with local and international research groups, LMIC partners, industry, and NHS
- Identify priorities addressing major clinical and societal public health concerns
- Promoting impact, informing practice and policy through partnerships with stakeholders

Integral to our impact strategy is our partnership with key stakeholders (Section 4) to build strong relationships and multi-agency input to funding applications and knowledge exchange activity. Colleagues are exposed to policy/decision-makers by providing networking opportunities and through membership of advisory groups (Section 4).

Each UoA3 discipline has a future strategy based on individual research strengths:

**Dentistry:** Through partnership with key local stakeholders and collaborating with international research groups/networks (e.g. IARC, The Lancet Commission, WHO Collaborating Centres) we aim to generate effective solutions to the big oral/dental public health and clinical challenges, including those in LMICs. We will build on our expertise and achievements, shaped by oral and dental research funding priorities (e.g. James Lind Alliance and NIHR). We will continue to develop our research themes and build on the successes of establishing our GDCRF to harness translation of research, establishing Glasgow as a strong clinical trials site. We will unite our research under a Centre for Oral Health Research, to grow our research ambitions by i) providing identity, to synergise our collaborations and expertise ii) supporting research priorities; and iii) widening impact.

**Human Nutrition:** Prioritisation of our research effort will continue to be directed towards alleviating numerically and economically major health problems, guided by multi-sectoral agencies such as the Diabetes UK/James Lind Alliance. We aim to expand our global health research, pursuing further funding opportunities to work with LMICs on life course nutrition. Planned developments to consolidate research capacity and extend its impacts include: i) creating a virtual centre across UofG for nutrition research, to increase collaborative capacity and efficiency, ii) establishing a new Personalised Nutrition theme, combining expertise in targeted metabolomics, point-of-care functional tests and nutritional-status assessment, harnessing complementary expertise and

## Unit-level environment template (REF5b)

synergies within UoA3, particularly SUERC, for intrinsic labelling of foods with stable isotopes and mass spectrometry.

**Nursing:** Still early in development, we will build on early successes within our core research areas by developing clinical academic capacity and pathways within the NHS, aligning research across the UoA3 themes with existing nursing inputs within Dentistry and Human Nutrition research, and developing more joint PhD supervision teams across MVLS. Our growing patient and public involvement groups will offer an important resource for co-development of clinical research across the University.

## 2. People

There are currently 11 REF-returnable staff in Dentistry, 7 in Human Nutrition (including 2 Scottish Universities Environmental Research Centre (SUERC)) and 3 in Nursing, comprising 12 Professors, 3 Readers, 5 Senior Lecturers and 1 Lecturer. UoA3 leadership is gender-balanced: five (of 12) professorships are held by women.

Staff contracts accommodate clinical, teaching and research portfolios, and our staffing strategy provides an environment to support a research culture and individual career development. Staff are annually assessed at Performance and Development Reviews (P&DR), where discussion of promotion opportunities is mandatory, to encourage a structured career mapping and realistic planning. P&DRs highlight those deserving reward for excellence in overall performance.

Nurturing our staff by providing extensive support and training has brought promotions: Professorships in Dental Public Health [**Conway**], Periodontology & Immunology [**Culshaw**] and Clinical Nutrition [**Gerasimidis**]; Readership in Stable Isotope, Biochemistry [**Morrison**]; Senior Lectureships in Human Factors in Health Care [**Ross**] and Human Nutrition [**Combet**].

Strategic investments in Nursing since 2016 have enabled a Professorship [**Johnston**], Reader [**Kidd**], Lecturer [**Kotronoulas**] and Honorary Professor [Stewart, Torrens, University of Adelaide] to strengthen work in palliative care and heart failure.

### Staff mentoring, training and development

**New staff:** Robust staff and postgraduate inductions include equality and diversity policies, work-life balance, and recognition of diversity of cultural and academic backgrounds.

New lecturers participate in the University's [Early Career Development Programme](#), for training and support for research leadership, including pairing of Early Career Researchers (ECRs) with mentors for specific guidance, and external speakers to widen horizons. The ambition is that all new lecturers will obtain their Postgraduate Certificate in Academic Practice allowing promotion to Senior Lecturer within five years.

**Mentoring:** A formal bespoke mentorship scheme for all UoA3 staff was piloted and evaluated in 2018 [Combet]: 100% of respondents recommended its full implementation, and this is now highly valued routine practice.

**Early Career Researchers:** The MVLS Network for Early Career Researcher Development (NERD) holds regular events including writing workshops, mock grant panels, information sessions on academic/non-academic career paths, writing for impact, intra-network grant/fellowship reviewing, sessions on REF, sessions on developing interactions with clinicians and industry, and social events to promote networking. The small size of UoA3 allows ECRs to benefit from frequent engagement with leaders.

**Partnership approach to mentoring and collaboration:** All research staff are formally affiliated with Research Institutes; whose research meetings and seminars promote interdisciplinary collaborations. Smaller UoA3 group activities encourage cross-theme networking and collaboration.

## Unit-level environment template (REF5b)

Innovative 'writing boot-camps' (theses, grant applications and manuscripts) are very popular among staff and Postgraduate Researchers (PGRs).

**Supporting undergraduates and clinicians to engage with research:** We actively engage undergraduate students in ongoing research through intercalated BSc programmes, elective studies, summer research placements and initiatives such as Academy of Medical Sciences-Wellcome Trust INSPIRE Programme. Introduction to research at undergraduate level yields successful applications to the MRC Clinical Research Training Fellowship, investigating leukocyte migration to the oral cavity [Culshaw and (III)], with students progressing on to both research and clinical academic pathways (PhD students: Reilly MRC CRTF, Creaney EU). We encourage our own clinical and research staff to pursue higher degrees, and academic staff with honorary NHS contracts assist in the recruitment of NHS colleagues to our higher degree programmes.

Through GDCRF (Section 3), we promote a sustainable research culture, supporting 'Masters by Research' projects for clinical trainees and project leadership by NHS consultant colleagues. Glasgow hosted Scotland's first-ever research Dental Core Training position (0.4FTE) from 2019.

### PGR students

Our success in securing highly competitive studentships from research councils, charities, and Scottish government (CASE/BBSRC/MRC/ESRC), overseas government sponsors, the NHS and industry (GSK Nestle, Nutricia, Mylan) has driven a substantial increase in UoA3 PGR numbers.

We have had **58.55** Doctoral Degrees Awarded (DDA) by supervisor load (2.96 DDAs per FTE) during this REF period, more than double those in 2008/9-2012/13 (25.61). At the REF census date, we had **47.04** doctoral students registered, with improved gender balance, from 84% female in 2013/14 to 59% in 2019/20, and more international students (20.06 in 2013/14, 29.85 in 2019/20).

This large growth in our UoA3 PGR community demonstrates the value of our high-quality environment for training and development, with interdisciplinary academic and pastoral support facilitating positive career destinations. Each discipline has an embedded Deputy PGR Convenor to provide strategic input to the PGR programmes over recruitment, support, quality assurance, completion, and final destinations.

Our research students have won many external awards and accolades, e.g. the annual Nutrition Society postgraduate prize (2015, 2017, 2019), selection to European Nutrition Leadership Platform (2 students), Oral and Dental Research Trust GSK Award, FAPESP SPRINT research exchange participant (2019), competitively-awarded fully-funded Scholarship to University of Sao Paulo on the molecular basis of inflammatory disease (2019), EADPH Glaxosmithkline Research Award (2019), and, at BSODR-2020, the Junior Colgate prize and Septodent Research poster prize.

**PGR student recruitment:** Recruitment of PGR students is based purely on candidate quality. Students with apparent, or declared, protected characteristics receive full support throughout their studies. Our highly successful MSc Taught Programmes (Human Nutrition, Oral Surgery, Endodontics, Oral Sciences, and Nursing), have created pipelines of outstanding students, identified by Programme Directors as strong candidates for PhD programmes (21 across UoA3), who start their PhDs with firm grounding in Research Methods gained from their MSc.

**PGR student research environment:** Inductions familiarise students with the environment, staff, and fellow students, and outline Graduate School policies, [PGR Code of Practice](#), and academic and pastoral support.

PhD students have at least two supervisors, including an experienced primary supervisor, who attend mandatory rolling training workshops (every 5 years). To develop our supervisor capacity, less experienced supervisors join a peer network forum, to discuss supervision, policy, and regulation with experienced colleagues.



## Unit-level environment template (REF5b)

**PGR training and support:** A Training Needs Assessment with the supervisory team in the first 2-3 months, and repeated annually, informs development of training portfolio. Two independent academic reviewers assess progress and identify any academic or personal issues that may affect progress.

Complementing external courses, the Graduate School provides an extensive programme of taught courses, many aligned to the Researcher Development Framework (VITAE). Students must accumulate 20 training credits. Certain courses are mandatory, including Research Integrity, Research Data Management and Equality & Diversity. Preparation of grant applications is a core element of the comprehensive research skills training programme provided for PG students. Family-friendly and culturally sensitive social activities such as quiz nights, day trips to the country, and national food evenings build cohesion within our PhD community and lead to fruitful collaborations.

UoA3 provides a strong and supportive network for all students, especially those facing personal problems. We encourage students to engage with University support services if needed and deal sympathetically with suspensions requests. Our annual review process ensured that support and contingency plans were in place, enabling students affected by COVID-19 restrictions to apply for fully-funded extensions, of which, three were awarded.

**PGR Career development:** Our students are encouraged to engage in knowledge exchange and public engagement activities (e.g. social media) to maximise impact from their own research (Section 4). They are supported in identifying industrial and clinical placements and writing applications for grants, fellowships, and post-doctoral positions. Many part-time PhD students return to their employer, often in a promoted post. A high proportion of our PhD graduates embark on academic careers, in the UK and internationally. We have made conscious, very successful and mutually beneficial efforts to nurture lasting research collaborations with our PhD graduates, generating future publications, collaborative grants, and shared graduate students.

### Equality, diversity, and inclusion (ED&I)

We adhere to UofG ED&I Policies, requiring mandatory ED&I and unconscious bias training for academic staff. SoMDN holds Silver Athena SWAN accreditation, and our Self-Assessment team shares best practice initiatives across UoA3, supporting measures including flexible working. We include diversity as a standing item at all management meetings. We interpret 'inclusion' to be more than gender balance and seek to provide an environment where all people feel welcome and can flourish without discrimination.

**Combet** provides leadership for UoA3's equality engagement efforts through the promotion of initiatives such as International Women's Day and 'Women in Research Network' (a cross-College initiative bringing female staff together) with ~100 attendees per event.

All those involved in REF processes (including output review and selection) within UoA3 have undertaken mandatory training, including ED&I principles, unconscious bias, and sensitive data handling. In accordance with UofG's Code of Practice, outputs were selected and allocated to authors to maximise the UoA's GPA. An interim equality impact assessment of our methodology indicated no significant bias against any protected characteristic.

## 3. Income, infrastructure, and facilities

### Research Income

Since 2014, all UoA3-submitted staff have held grants. The total £9.89m research income averages £1.41m per year, at £499k per FTE over the review period. Our aim has been to diversify our funding portfolio, and major funders include the MRC, BBSRC, Diabetes UK, the European Commission, NIHR, GSK, and the Chief Scientist Office, representing a steady increase in awards from Research Councils, UK charities, and industry over time.

## Unit-level environment template (REF5b)

Research quality has demonstrably generated continued, and increased, funding. For example, the initial £2.4m funding for DiRECT [**Lean**], by Diabetes UK, was based on a solid track record of previous completed projects. Its success has been followed by separate funding for two extensions, for cost-effectiveness analysis, and for international exploration of its results in Kuwait.

### Infrastructure

Our research, and research training, is designed to resonate with UofG's core values and priorities: *"Our mission is to undertake world leading research and to provide an intellectually stimulating learning environment that benefits culture, society and the economy."* Our position in a large University provides extensive international links and encourages imaginative multidisciplinary collaborations, supported by a dedicated project coordinator within the Research Support Office alongside colleagues in the Finance Office, Computing Services, a Research Governance team, other College-wide facilities, and by the Robertson Centre for Biostatistics. External support is provided by NHS Greater Glasgow and Clyde (NHSGGC) and national agencies, e.g. NHS R&D, NHS Primary Care Research Network, and NHS Diabetes Managed Care and Research Networks.

A strong ethos of research integrity underpins all activities, ensuring ethical and NHS R&D approvals and information governance protocols (via NHS Scotland Public Benefit Privacy Panel PBPP, data sharing agreements, and local data security protocols) are in place. Three UoA3 staff are on the MVLS Ethics panel.

Research directors and committees within Dentistry, Human Nutrition, and Nursing enhance research vitality and sustainability, assuring quality by providing oversight of strategy in relation to funding projections, internal review of grants and outputs, and operational governance. We support researchers and postgraduate student groups through research seminars and journal clubs. Wider UoA3-wide cross-discipline strategic events have united our disciplines in collaborative projects, e.g. linking research in oral and intestinal microbiomes for two grant awards unravelling the role of fungal microbiota in paediatric Crohn's disease [**Ramage, Combet, Gerasimidis**].

**Partnership with Research Institutes:** In addition to the partnerships outlined in Section 1, we have partnered with the Health Economics Unit [IHW] to i) provided evidence of NHS cost-savings through preventive spending for child oral health, now widely adopted by Scottish Government and internationally [**Macpherson, McMahan, Conway**]; ii) initiated research on price policy regulation for cancer prevention via a Cancer Research UK seed-funding grant [**Conway**] and iii) demonstrated cost-effectiveness of the DiRECT intervention for remission of type-2 diabetes, projected into routine real-life NHS settings [**Lean**]. Our partnership with the ILL Institute, has elucidated links between periodontal disease and systemic health, identifying common immunological mechanisms and novel therapeutic targets [**Culshaw**]. Joint PhD studentships, post-doctorate positions and the first dentist in Scotland to be awarded an MRC CRTF are examples of those involved. Furthermore, with ICAMS, we have highlighted the role of periodontal disease as a risk factor for cardiovascular disease [**Guzik**]. The multidisciplinary BINGO Group facilitates interactions among those with interests in Bacteriology, Immunology, Nutrition, Gastroenterology and Omics [**Gerasimidis, Edwards, Ramage, ILL, Engineering, NHS**].

**Interface with the NHS:** Glasgow offers an outstanding healthcare research environment which brings together basic and clinical research excellence, in partnership with the UK's largest NHS Health Board, allowing new clinical research facilities to embed research at the heart of Europe's largest acute hospital campus. Strong collaboration with the Scottish Primary Care Research Network provides particular strength in real-life research, e.g. DiRECT [**Lean**].

### Dentistry Infrastructure

GDCRF, established in 2016 within Scotland's largest NHS/University Dental Hospital (>80,000 outpatient appointments per year), has dramatically improved our capacity for clinical studies. Initial capital funding of £225K provided two fully equipped dental surgeries, a separate interview room, NHSGGC R&D funded 1FTE research dental nurse and 0.5FTE dental hygienist for two years, which has been continued following review.

## Unit-level environment template (REF5b)

GDCRF facilitates patient recruitment for clinical research and has enabled collaborations with industry, academia (Valencia Microbiome Research Centre and University of Sao Paulo) and the NHS. It hosts RCTs evaluating instrumentation approaches to periodontitis and denture cleaning methods; facilitating successful funding applications, including £475,000 with: MRC CRTF, BBSRC iCASE, EU, and NIHR, and £245,000 with industry. It has led to Glasgow's inclusion in Clinical Studies Groups (e.g. Prospect) and NIHR consortia applications including the Newcastle-led ENHANC-D vaping smoking cessation trial.

The Oral Sciences group has a comprehensive suite of multi-purpose laboratories capable of handling category-2 microbial pathogens. The laboratories house contemporary equipment for microbiological, immunological, tissue culture and molecular studies, supported by a dedicated technician and sterilisation and waste management systems. The location of the laboratories is directly above clinical floors and GDCRF facilitates handling and processing of clinical material on site.

The Community Oral Health group works within an NHS-approved secure data infrastructure, enabling research and data analysis, including direct access to the national remote 'Safe Haven' and individual records. We were a national pilot site for this infrastructure and a pathfinder site for cross-sectoral data linkage between health, education, and social care data sources. We host the project manager and provide major contributions to the Scottish Oral Health Research Collaboration.

### **Human Nutrition Infrastructure**

Since 2014, a key change in university infrastructure reunited the Human Nutrition staff and students, previously part located at Yorkhill Hospital (paediatrics), on a single site in the New Lister Building (NLB), an extended and completely refurbished facility on the Glasgow Royal Infirmary (GRI) campus. This move, to a site immediately adjacent to the NHS Clinical Research Facility and to the GRI/UofG Library, with direct access to Glasgow Royal Infirmary (including radiology imaging, and national reference centre for nutritional biochemistry) and the Princess Royal Maternity Hospital, has directly facilitated strategic planning and capacity for greater internal collaboration, and provides a refurbished space for visiting and international researchers.

The NLB facilities comprise state-of-the-art teaching and research suites, including:

- Human Metabolic Suite with treadmills, cycle-ergometers, indirect calorimetry systems, an Appetite Research Room and two Phlebotomy Rooms. The facility supports energy balance research via gold-standard measurements of energy expenditure and energy substrate (fat and carbohydrate) utilisation during resting and exercise, and measurements of cardiorespiratory fitness.
- Dedicated laboratories for microscopy, molecular biology, cell culture and biochemical analyses form part of the analytical biochemistry platform central to two research themes: **diet & gut microbiome and diet & metabolism**, demanding targeted quantification of small compounds (phenolic acids, short chain fatty acids).
- Multidisciplinary clinical research in Human Nutrition is enabled by the embedded clinical research infrastructure at GRI, with the adjacent NHS Clinical Research Facility, physical activity and gait research laboratory, on-site MRI suite, and support from the Scottish NHS Primary Care Research Network for recruitment and access to primary care staff and patients. Collaborative research between UoA3 and NHS staff has attracted three commercial pharmaceutical trials (Novo Nordisk) since 2014, whose incomes support unfunded nutritional clinical studies by postgraduate students, to follow up the Diabetes UK-funded Diabetes Remission Clinical trial (DiRECT) with mechanistic and qualitative studies [**Lean**, ICAMS].

SUERC brings world-leading capabilities in the application of isotopic techniques in life sciences. Uniting UoA3 complementary skills in nutrition, dietetics, physiology, biochemistry, with application and measurement of stable and radiogenic isotopes, epidemiology, microbiology, and clinical medicine, has driven the development of shared research interests and collaborations on fermentable dietary fibre, polyphenols, and muscle protein metabolism.

## Unit-level environment template (REF5b)

### ***Nursing Infrastructure***

Our Nursing group has developed valuable links with hospitals, hospices, care homes and third sector organisations to facilitate engagement with clinical teams and access to health records. Strong research relationships are established with the NHS Clinical Research Facility (shared academic clinical staff), Scottish Stroke Improvement Team and Clinical/Policy Leads for Stroke organisations.

### ***Infrastructure to optimise UoA3 research impact***

A shared ethos of impact generation is driven via our Impact Champion [**Sherriff**], providing access to University-wide impact networks. The University Research Impact Manager works with individual research groups to support knowledge exchange activities and pipeline development to maximise impact. Impact is discussed at staff and student committees, and we have a bespoke electronic logging system for capturing impact-related activities to support impact-generation.

Identification of research priorities and promotion of knowledge exchange activities are facilitated via partnership with key stakeholders including the health sector, policy makers, industry, patient and public groups and the third sector. These partnerships have been cemented with honorary contracts, PhD studentships, grant awards, and collaborative projects. Examples include:

- Close forward planning with Diabetes UK and clinical leads for diabetes in NHS England and Scotland has translated the DiRECT trial results rapidly into routine services, to achieve remissions of type-2 diabetes for as many people as possible.
- Our Child Oral Health research programme drove the adoption and evaluation of Childsmile across the globe through targeted delivery of international research symposia and hosted visits with overseas colleagues, facilitating the sharing of methods, good practice, and expertise.

Our shared understanding of the importance of Patient Public Involvement (PPI) in research is exemplified by our Nursing and Healthcare PPI Research Group [**Kidd, Johnston, Kotronoulas**]; leading the recently established (2018) Scottish Division of British Society of Periodontology Patient Forum [**Culshaw**]; and PPI groups within specific research projects, including STOP-COLITIS and CD-Treat [**Gerasimidis**]. At the recent European Congress on Obesity (n=2000) hosted in Glasgow [**Lean, Combat**], patient representatives were invited to chair scientific sessions, and we have contributed to three Patient Conferences for people living with diabetes [**Lean**].

## 4. Collaboration and contribution to the research base, economy and society

We support collaboration, interdisciplinary research, and internationalisation through regular discussion at research group meetings. UoA3 makes a significant contribution to the research base through such collaborations and via contributions to grant awarding bodies and learned societies. Largely focusing on major clinical and public health concerns, we also contribute to societal health benefits.

### **UK research collaborations include:**

- Leadership within the Scottish Oral Health Research Collaboration (SOHRC), drawing together Scotland's three Dental Schools, Edinburgh Dental Institute and NHS Education for Scotland on areas of common interest and strength to deliver high quality research that supports national needs. Joint research funding has supported: i) improving oral care systems for people in Care Homes [**Ross, Sherriff, Macpherson**], ii) investigating prevalence, incidence and determinants of oral HPV infection in dental settings [**Conway, Bagg**], iii) investigating partial removal of dentinal caries in permanent teeth [**Conway, Sherriff**], iv) trialling pulpotomy in permanent teeth [**Conway**], v) implementing a healthcare systems approach to deliver preventive interventions in primary dental care [**Ross, Macpherson, Conway**].
- NIHR-funded grant with Imperial College, investigating inulin propionate-ester as a natural stimulant of GLP-1 for body weight control [**Morrison, Lean, Preston**].



## Unit-level environment template (REF5b)

- Our successful DiRECT trial, achieving 46% type-2 diabetes remissions, has attracted new NIHR collaborative proposal with MRC Epidemiology Unit, Cambridge, Leeds, and Sheffield [**Lean, Combet, ICAMS**].
- Extensive collaborations with Mycology Groups - including staff and student exchanges, investigating the mechanisms of fungal biofilms via transcriptomics and proteomics (Manchester, Aberdeen, Exeter (Wellcome Trust) [**Ramage**], as a key partner in the flagship National Centre for Biofilms Innovation (Southampton) [**Ramage**].
- Co-specialty lead of Oral & Dental Research, NHS Research Scotland [**Conway**].
- Our stroke research links with several UK Universities [**Kidd**], funding by Stroke Association, NIHR, CSO.

**Our research is highly internationally collaborative**, and we encourage staff and student exchanges to foster research collaboration and engage partners who complement our skillsets.

Examples include:

- European vaccine surveillance projects, assessing reach and impact of vaccines in children [**Smith**].
- Head and neck cancer epidemiology with: International Agency for Research on Cancer, EU Horizon2020-funded HEADSpAcE study across Europe and South America, [**Conway, McMahon, Ross, Ramage**], and International Head and Neck Cancer Epidemiology (INHANCE) consortium, to understand risks and develop preventive strategies [**Conway**].
- Investigating role of microbiome on oral health via advanced genomic, bioinformatics, and metagenomics techniques: Centre for Advanced Research in Public Health, Valencia, Spain and Academic Center for Dentistry Amsterdam, Netherlands [**Ramage, Culshaw**].
- Membership of the European Stroke Alliance for Europe 'Life After Stroke' Scientific Committee [**Kidd**].
- International collaborative research on plant bioactives, fibre and health through industry (BBSRC CTP with Mondelez [**Edwards, Garcia**]), EU-funded COST consortium on inter-individual variability in plant bioactives metabolism, and Andalusian Institute of Agricultural and Fisheries Research (Spain) to define the impact of physical activity on polyphenolics bioavailability [**Combet**].
- Lead collaborative centre for evidence syntheses to inform forthcoming nutritional guidelines for the European Association for Study of Diabetes [**Lean, Combet**].

## Research collaborations with LMICs:

- Collaborating with International Atomic Energy Agency (IAEA) supporting LMIC research capacity, SUERC is building isotopic tools and providing technical expertise to investigate *H pylori* prevalence [**Preston**], new non-invasive tools to define environmental enteric dysfunction in LMIC children [**Morrison**], and refining protein requirements in children with undernutrition and high pathogen burdens [**Preston**].
- International Consortium (HUNGer) involving Human Nutrition [**Edwards**] and SUERC [**Morrison, Preston**] is developing legume-based interventions to tackle undernutrition in Asia and Africa (MRC seed-fund).
- With St John's Research Institute, Bengaluru, **Preston** has pioneered novel methodology to measure plant protein digestibility, specifically legumes and cereals (Indian Government, Wellcome Trust, BMGF and Tata Foundation).
- Investigating diet and lifestyle in sub-populations with unusually high diabetes prevalence [**Edwards**], with ICAMS, IHW, and Malawi Epidemiology and Intervention Research Unit.
- Collaboration with University of Malawi (Borrow Foundation) on child oral health interventions [**Macpherson, Conway, Bagg**].
- Mycology and immunology research collaboration with Sao Paulo Research Foundation, Brazil (FAPESP SPRINT) [**Ramage, Culshaw**].
- Collaborating with Ministry of Health, Chile, to evaluate child oral health improvement programmes [**McMahon, Conway, Macpherson**].
- Via SOHRC, phenotyping craniofacial morphology of infants born with Zika virus infection and exploring its impact on brain abnormalities with Brazilian researchers [**Ayoub**].



## Unit-level environment template (REF5b)

### Contribution to the Research Base

Significant contributions are made through involvement in research funding and publication processes. We also have important roles within the professions, on clinical guideline development groups, serve as advisors to many public sector agencies and charities, and work with WHO in knowledge exchange and developing health strategies in LMICs.

### Contribution to grant funding panels and reviews

Chief Scientist Office Clinical Fellowships Panel [**Culshaw**]; EPSRC, Wellcome Trust and National Institute for Academic Anaesthesia [**Ayoub**]; Marie Curie Grants Committee [**Johnston**]; British Council Newton Fund [**Combet**]; MRC Peru fund [**Edwards**]. Chairs of NIHR Trial Steering Committees [**Conway, Lean, Macpherson**]. French National Cancer Institute INCa Grant Panel [**Combet**]; The Academy of Finland [**Edwards** 2015, 2020; **Lean** (chair) 2016, 2021]; Research Council of Norway Major Infrastructure Grant panel [**Lean**, 2018]. Commonwealth Scholarship Commission Academic Adviser Panel 2015-2021 [**Lean**]. Member of REF2021 SP3 [**Macpherson**]; Royal Society of Edinburgh Nominations panels [**Lean, Macpherson**]; MRC Unit Quinquennial Review panel [**Lean**].

### Participation in peer review

All REF-returned staff peer-review for journals and act as external examiners at undergraduate, masters and PhD levels. Journal editor/editorial board involvement includes: Frontiers in Microbiology [**Morrison**], Critical Reviews in Microbiology [**Gerasimidis, Ramage** – Editor in Chief], Journal of Dental Research [**Culshaw**], Archives of Disease in Childhood [**Sherriff**], Oral Oncology [**Conway**], International Journal of Oral & Maxillofacial Surgery [**Ayoub**], BMJ Simulation and Technology Enhanced Learning [**Ross**], Pharmacoepidemiology & Drug Safety [**McMahon**], PLOS One [**Kotronoulas**], BMC Nursing [**Johnston**], British Journal of Nutrition [**Combet**], Maternal and Child Nutrition [**Wright**], Nutrition Research Reviews [**Edwards**], Annals of Nutrition and Metabolism [**Gerasimidis**], International Journal of Obesity [**Lean**].

### International conference organisation

- Winning the competition to host the European Congress of Obesity (ECO2019) in Glasgow [**Lean, Combet**], increased visibility of UoF's obesity research and attracted new collaborations from among ~2000 international delegates.
- 2019 international child oral health improvement conference [**Macpherson, Conway**] with input from WHO global lead for oral health.
- Organised Eurobiofilms 2019, Glasgow, ~400 delegates [**Ramage**].

### Fellowships and Awards

UoA3 members have been recognised through fellowships and awards: Fellowship of Royal Society of Edinburgh [**Lean, Macpherson**], Fellowship of Royal College of Nursing [**Johnston**], Senior Clinical Research Fellowship – Scottish Research Excellence Development Scheme [**Culshaw**], Royal Society of Edinburgh Young Academy of Scotland Health theme lead 2017-2019; co-chair 2019-present [**Combet**], British Science Association Media Fellowship [**Combet**], Honorary Fellowship, Royal College of Paediatrics and Child Health [**Wright**], Tenovus Medal [**Lean**].

### Relationships with key research users and beneficiaries

All three UoA3 disciplines work closely with research users and beneficiaries including government agencies, NHS, and industry partners to identify priorities, disseminate research findings, influence policy, and maximise impacts.

Advisory committee membership includes: UK Scientific Advisory Committee on Nutrition, Maternal and Child Nutrition Subgroup [**Wright**], International Agency for Research on Cancer Advisory Group Cancer Inequalities [**Conway**], Scottish Partnership for Palliative Care and Scottish Palliative Care Research Forum [**Johnston**], Chair UNICEF UK Group on learning objectives on breastfeeding and infant feeding [**Wright**]; European Commission Joint Programming Initiative Healthy Diet for a Healthy Life (HDHL) Stakeholder Group [**Gerasimidis**], UK National Advisory Board on Human Factors in Dentistry [**Ross**].

## Unit-level environment template (REF5b)

### Examples of work with key research users:

#### **Government/NHS/UK Organisations**

- Revising influential evidence-based clinical guidelines for Scottish Intercollegiate Guidelines Network (SIGN), Diabetes UK [**Lean**].
- Public health microbiology pivotal roles as Director of the Bacterial Respiratory Infections Service, Scottish Microbiology Reference Laboratory, and chair of Scottish Antibiotic Stewardship in Dentistry group [**Smith**]
- Child oral health research feeds directly into Scottish Government and Public Health England [**Macpherson, Conway, Ross**].
- Head and neck cancer epidemiological research contributed to UK Joint Committee on Vaccination and Immunisation and government policy change to extend HPV vaccination to include boys, and chairing oral cancer guidelines group within PHE [**Conway**].

#### **International Organisations**

- Advisor to the Commonwealth Scholarships Programme and the WHO in knowledge exchange and developing health strategies in LMICs [**Lean**].
- Lead role in the European Association for the Study of Diabetes (EASD) dietary guidelines, and health policy advocacy (eg Price Waterhouse Cooper's 2020 study for New Zealand government diabetes policy) [**Lean**].
- Co-authorship of the Lancet series on global oral health and participation in the Lancet Oral Health Commission [**Macpherson**].
- Working with WHO on Global Oral Health Report, Noma Report and mOral Health Handbook [**Macpherson, Conway**]. Supporting Ministry of Health & Population of Malawi to develop and evaluate oral health strategy [Bagg, **Macpherson, Conway**].
- WHO International Agency for Research on Cancer Advisory Group on Cancer Inequalities [**Conway**].
- Founding members of the International Centre of Oral Health Inequalities Research and Policy [**Conway, Macpherson**].

#### **Industry**

- European collaborations with ESPEN and ESPGHAN networks and industry, i) developing proprietary foods for medicinal purposes (Nestle Health Sciences; Nutricia-Danone), ii) establishing special interest groups within these organisations, increasing awareness of nutrition in sick children and developing guidelines for nutritional screening and assessment [**Gerasimidis**].
- Developing complex biofilm models and anti-biofilm strategies, with evidence informing recently published guidelines, and product reformulation with GSK, Unilever, Biocomposites and Gilead Sciences [**Ramage, Culshaw**]. Key Opinion Leader for GSK Oral Healthcare [**Ramage**] and Steering Group member of the Gilead Antifungal Information Network [**Ramage**].

#### **Contributions to the fight against COVID-19**

- Co-leading Glasgow centre of Oxford Phase III COVID-19 vaccine trial in healthcare staff [**Smith**].
- Leadership/co-ordination roles in developing guidance over recovery of dental services and oral health improvement programmes, with UK Chief Dental Officers, Scottish Government, Health Protection Scotland, Scottish Dental Clinical Effectiveness Programme [Bagg, **Macpherson, Conway**].
- Leading COVID-19 surveillance in dental settings [**Culshaw, Conway**], UK ONS Community Infection Survey Public Health Scotland lead [**Conway**].
- 'Silver' team member for rapid response to COVID-19: Chartered Institute of Ergonomics and Human Factors [**Ross**].
- Royal Society of Edinburgh Working Parties to advise Scottish Government over lasting societal changes invoked by COVID-19, and UK Government to reappraise the 4-Nations approaches [**Lean**].

#### **Patient and Public Involvement and Public Engagement (PPI)**

## Unit-level environment template (REF5b)

We have substantially increased emphasis on PPI in shaping and informing research in the community (care home residents, people with dementia, families from socio-economically disadvantaged areas, minority ethnic groups and care-experienced young people) and among NHS patients with cancer, stroke, and diabetes. All major clinical grant applications are co-designed with PPI, which continues within trial steering committees and beyond into dissemination and implementation beyond academia. UoA3 staff and students engage with the public through multiple creative routes, bespoke events, and media (mainstream and social), incentivised by designated internal funding and annual review processes.

- Our PPI group for palliative and end of life care research was selected by NIHR as a test-bed site for the INVOLVE standards for PPI, winning an NIHR exemplar award in 2019 [**Johnston**].
- Strong engagement with charities such as Diabetes UK, Breast Cancer Now, Melanoma Action and Support Scotland, to develop networks of members to act as PPI advisers [**Kotronoulos, Lean**].
- Established stroke care PPI groups, engaging with national stroke charities, serving on professional and patient representative committees e.g. the European Stroke Alliance for Europe Scientific Committee, the Alliance Self-Management Network and advising the Scottish Government Health Literacy Action Group [**Kidd**].
- Collaboration with Centre for Excellence for Children’s Care and Protection Group (Strathclyde University), care-experienced young people and voluntary groups, to disseminate research findings via social media, third sector and advocacy groups. Contributed to driving Government policy decision (2019) to introduce free dental treatment for care-experienced young people up to age 26 years [**McMahon, Macpherson, Conway**].
- Engagement with patient groups, including: Diabetes UK [**Lean**], National Rheumatoid Arthritis Society patient group and British Society of Periodontology (BSP) patient forum – the latter being involved in BSP adoption of national clinical guidelines [**Culshaw**].
- Innovative public engagement activities including: Pint of Science, Naked Scientists [**Ramage**], BBC Radio 4 More or Less [**Conway**], Meet the Expert at Glasgow Science Centre [**Culshaw, Ramage, Sherriff, Macpherson, Conway, Ross**], BBC’s “Trust Me I’m a Doctor” [**Combat**], Café Scientifique [**Lean, Edwards**] and “The Big Smile Big Band” engaged local schools in a mass participation event to establish the world’s biggest smile - a verified Guinness World Record.