

Institution: University of Exeter
Unit of Assessment: 05 Biological Sciences
<p><u>Section 1. Unit context and structure, research and impact strategy</u></p> <p>Major strategic investments in staff and infrastructure and a commitment to excellence has driven the growth and quality of our UoA5 return in the current REF cycle. Key statistics include:</p> <ul style="list-style-type: none"> • Growth of the Unit from 54 to 103 faculty since 2014. • Appointment of 23 Independent Senior and 37 Junior Research Fellows. • Establishment of the £52M Living Systems Institute that supports interdisciplinary research between the life and physical sciences to understand and engineer complex biological systems. • Establishment of the £13.5M MRC Centre for Medical Mycology: The only UK Centre dedicated to Medical Mycology Research and Training. • Ten ERC Principal Investigators (PIs). • DTPs from all Research Councils that support Bioscience research (BBSRC, NERC, MRC, EPSRC, ESRC). • Annual research income per FTE has increased by 33% between 2014 and 2020. • Appointment of two UoA5-facing Fellows of the Royal Society (Gow and Smith). • Excellence in the international rankings for research impact. The Unit was ranked 11th in the world and 1st in the UK in the most recent Life and Earth Sciences Leiden Ranking (2015-2018), based on the proportion of outputs in the top 10% in the field. The Unit was ranked 7th in the world for Ecology (a core discipline aligned to our UoA5) in 2020 in the Shanghai World Ranking. • Published 2,736 peer reviewed papers (mean 27.6/FTE) with 58986 citations (mean 21.5/paper) since 2014. • Excellent faculty with 16 ranked in the top 2% of their disciplines by citation and related metrics (Stanford/Scopus analysis, 2019). <p>1.1. Research and Impact Aims and Strategy</p> <p>Substantially strengthening our faculty. We have increased the number of faculty in our research themes from 54 to 103, capitalizing on our existing areas of excellence. Our philosophy has been to build constellations of synergistic expertise, taking advantage of key partnerships. We have ensured immediate and sustained research excellence by providing extensive support for Independent Research Fellowship applicants to the University that includes 1-3 year “bridging fellowships”. This strategy has resulted in 23 Senior Research Fellowships and 37 Junior Fellowships since 2014. All of the Senior Fellows and five of Junior Fellows have accepted faculty positions at Exeter. These appointments complement our more senior research faculty, 16 of whom are named in the Stanford Top Two Percent. The recruitment of three Fellows of The Royal Society (Gow, Smith and G. Brown; the latter returned to UoA1) has provided further research leadership.</p> <p>Promoting inter-disciplinary research. We have invested heavily in cross-college research institutes and research networks (e.g. ExeterMarine, Microbiology, Antimicrobial Resistance Research) to enable staff to undertake seamless, integrated interdisciplinary research across all colleges, departments and campuses. The University’s flagship institute, the £52M Living System Institute (LSI), which opened in 2016, is fostering a step-change in the application of systems biology to health and disease in the UK. Thirteen UoA5 PIs have been recruited to the LSI (including Professor Austin Smith, FRS, as Director), together with PIs in mathematics, engineering, medicine and physics. Twenty members of UoA5, including 12 new faculty, are affiliated with our Environment and Sustainability Institute (ESI), which opened in 2013, where research integrates the biological, physical, and social sciences to with a view to achieving a global sustainable future. Two new cross-disciplinary buildings were recently opened on our Penryn campus: The Science and Engineering Research Support Facility (£5M) and the Stella</p>

Turk Building (£12M) integrate business with ecology and renewable energy research. Furthermore, we recently invested £13.5M in the MRC Centre of Medical Mycology (MRC CMM) that brings together biologists and clinicians to address the growing problem of fungal diseases of humans.

Developing synergy to promote impact. Impact activities represent a core theme in our academic workload models. The University and UKRI have provided support for impact activities, dedicated Impact Officers facilitate engagement with external shareholders, and Impact activities are overseen by Directors of Impact. This has led to seven industry/UKRI collaborative grants, six GCRF/Newton awards, the stakeholder-facing EU-funded Agri-tech Cornwall project (£1.2M), and successful spin-out companies (BioSystems Technology; ISCA Diagnostics; Attomarker). Research partnerships have been established with major stakeholders. For example, the Centre for Resilience in Environment, Water and Waste is a collaboration with industry, government and NGOs that is funded by a UKRPIF award from Research England (£10.5M) and South West Water (£21M). Sustainable Aquaculture Futures is a collaboration with the Centre for the Environment Fisheries and Aquaculture Science (CEFAS) and academic centres in India, Bangladesh, Malawi and Thailand. In collaboration with the University of Cape Town, the MRC CMM recently established, and now works with, the world's first research and training centre in a Low Middle Income Country (LMIC) devoted to combatting endemic fungal diseases (the AFGrica Medical Mycology Unit). Shell Biodomain has invested >£5M in biofuels research and has a Royal Society Entrepreneur in Residence at the University. The Zoological Society of London has a permanent outpost at the University, working closely with our marine ecologists on conservation projects.

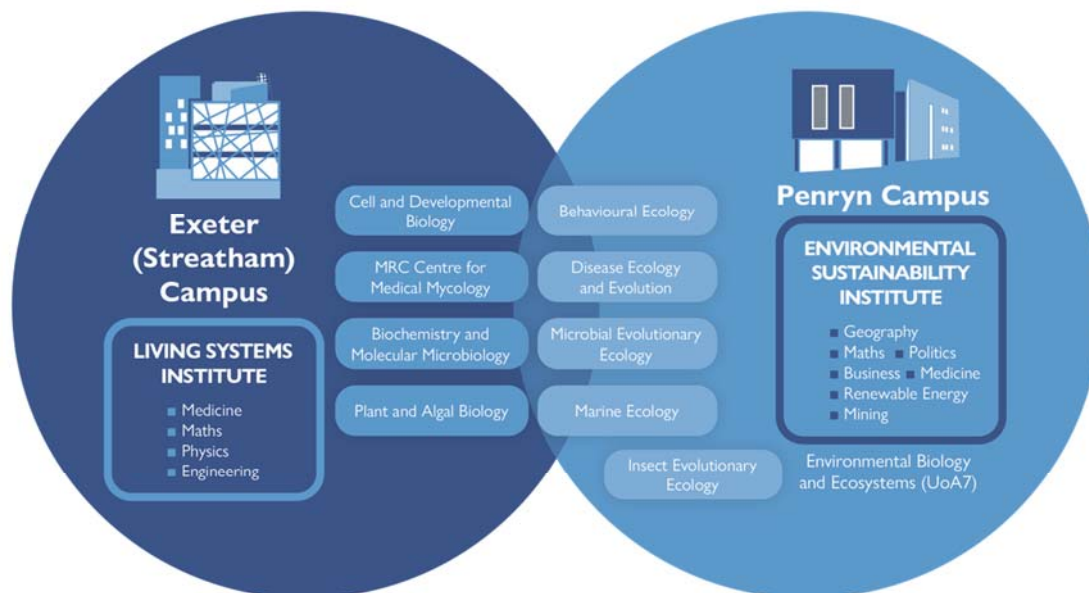
Facilitating inter-institutional collaboration. The UoA is a major beneficiary of the University's membership of the GW4 Alliance of Research-Intensive Universities (Exeter, Bristol, Bath & Cardiff), which operates inter-institutional DTPs funded by all the UKRI Research Councils. GW4 also integrates other external non-HEI partners and the NERC-funded FRESH Centre for Doctoral Training (CDT). This partnership underpins shared facilities used extensively by members of the UoA, such as the Wellcome-funded 'Regional CryoEM Facility' in Bristol and complementary imaging capabilities hosted by Exeter. Members of the UoA have played leading roles in establishing and benefiting from the University's formal collaborations with world-leading institutions that involve collaborative PhD programs and Postdoctoral Fellowships (e.g. University of Queensland, Chinese University of Hong Kong, Tsinghua University, University of British Columbia, Duke University, University of Cape Town).

1.2. Unit structure

The Biosciences UoA is part of the College of Life and Environmental Sciences (CLES) (ILES 1.5) and is the largest of Exeter's UoAs with 103 individuals (99 FTE members). UoA5 spans two departments on two campuses: 60 FTEs in Exeter, and 43 in Cornwall in the Centre for Ecology and Conservation. Senior university management is strongly represented in UoA5: Gow, DVC; Smith, LSI Director; Hosken, PVC for Cornwall; Wedell, CLES Associate Dean for Research. Members of our Biosciences Department who work in our *Environmental Biology* and *Ecosystems* themes (23 FTE) have been included in UoA7.

The generation of critical mass in specific research themes has been facilitated by maintaining a degree of campus research distinctiveness: Organismal and population biology in Cornwall, and cell biology, molecular biology and biochemistry in Exeter. The resultant international recognition has enhanced our continued recruitment (and retention) of top researchers. This strategy also underpinned the development of two distinct interdisciplinary units: the LSI and ESI. In Exeter, the LSI integrates physics, engineering, systems biology and medical research, driving numerous interdisciplinary and cross-college collaborations. In Penryn, the ESI drives research interactions involving geography, ecology, renewable energy, mining, environmental business, politics and law.

We have processes to facilitate cross-campus research synergies: Biannual faculty-wide research strategy retreats; research theme-based annual symposia (e.g. in Behavioural Ecology, Microbiology and Marine Biology); cross-campus seminar series; and University pump-priming of cross-campus research activities. We currently have >£5M of external grants funding cross-campus (and interdisciplinary) collaborations within UoA5.



Location and interaction of UoA5 research groupings (rectangular boxes) across the Penryn and Streatham Campuses. The two interdisciplinary institutes encompass the UoA5 research groups.

1.3. Research Themes

Our research theme boundaries are porous, and there is extensive collaboration both between and within themes. (*indicates new appointment since 2014).

Microbial Evolutionary Ecology (*Beardmore, Bergmiller**, *Buckling, Chait**, *Gudelj, Raymond**, *van Houte**, *Westra**). This new cross-campus theme addresses how microbes adapt within microevolutionary time scales to physical and biotic environments, and the consequences this has for health, biotechnology and ecosystems. Our research integrates mathematical modeling with experimental dissection, ranging from single cells to complex communities. Key research areas include: The evolution of antibiotic resistance (Gudelj, Beardmore [recent EPSRC Innovation Fellow], Bergmiller, Chait); the natural roles of CRISPR-Cas systems in bacteria (van Houte [BBSRC Future Leaders Fellow], Westra [NERC Independent Research Fellow; ERC]); the evolutionary ecology of biogas production and bioremediation (Buckling); and the evolution of microbial biocontrol agents (Raymond). Much of this work is translational and part-funded by industry (e.g. BBSRC IPAs with AB Agri (Buckling) and Dow AgriScience (Raymond)), and a £100k contract between Bayer and Raymond). This theme has funding from NERC, BBSRC, Wellcome, AXA Research Fund, Leverhulme Trust, ERDF and the ERC (Westra, Gudelj).

Medical Research Council Centre for Medical Mycology (MRC CMM) (*Bates, Bignell*, Brand*, Al Brown*, Coelho*, Farrer*, Gow*, Mukaremera*, Thornton, D. Wilson**). The MRC CMM is one of the most ambitious strategic investments in the world for tackling the threat to human health caused by fungal disease. The centre relocated from Aberdeen in 2019, with MRC funding renewed in 2021. The Centre integrates researchers from multiple fields of expertise (cell, molecular and infection biology, immunology, genetics, bioinformatics, clinical and translational sciences) to increase our understanding of fungal pathogens and antifungal immunity, and to identify new ways to diagnose, prevent and treat fungal diseases. The Centre is increasing global research and clinical capacity in medical mycology through bespoke research and training programmes for medical and biosciences students, clinicians and early career researchers. In addition to the MRC, which co-funds the £13.5M Centre with the University, funding is primarily from the Wellcome Trust: Senior Investigator Awards (Brown G [UoA1], Gow), two collaborative awards (Gow), two Senior Fellowships (Brand, Wilson) and a seed award (Farrer). The MRC CMM has an adjunct team based at the University of Cape Town that extends their research and training to areas of endemic disease in Africa. Diagnostics for fungal diseases, and bench-to-bedside translation of pathogen-specific antibodies and diagnostic kits are produced through a UoE spin-out company, ISCA Diagnostics, founded by Thornton (funding from EU and Innovate UK), as described in one of our Impact Case studies. Work in Gow's laboratory when in Aberdeen led to a spin-out - MycoBiologics, which is based on the use of therapeutic and diagnostic antibodies for fungal diseases.

Cell and Developmental Biology (*Costello*, Dawe, Jekely*, Kudoh, Pagliara, Schrader, Scholpp*, Smith*, Steinberg, Wakefield, E. Williams**). This theme exploits advanced imaging techniques in a range of cell types to investigate organelle dynamics, intracellular trafficking, fungal growth, neurobiology and stem cell development. Key research areas include: The neural circuitry underlying behaviour in the marine annelid *Platynereis* (Jekely [Wellcome Investigator Award]), Williams [BBSRC David Philips Fellow]; the roles of intercellular contact via actin-based filopodia in Wnt-based signalling and zebra fish developmental biology (Scholpp, Kudoh); the role of peroxisomes in disease (Schrader, Costello [UKRI Future Leaders Fellow]), the role of microtubules in spindle function (Wakefield); motor proteins of fungal pathogens (Steinberg); cellular phenotypic responses to antibiotic stress (Pagliara [recent Leverhulme Early Career Fellow]). Our recently appointed LSI Director, Smith (FRS, MRC Professorship, ERC and MRC programme grant holder) is internationally recognised for work on the developmental trajectory of pluripotent stem cells. Innovative bioimaging techniques (super-resolution microscopy and Coherent Raman Scattering (CRS) microscopy) are fostered via LSI-associated colleagues in Physics. This theme has additional funding from BBSRC and Leverhulme Trust.

Biochemistry and Molecular Microbiology (*Bono*, Brown A, Butler, Daum*, Gold*, Harmer, Littlechild, Michell, Perry*, Phillips*, Porter, Shaw, Titball, West*, Wood, Yang*). This broad research theme has greatly expanded in its scope since the opening of the LSI. Protein structure research using X-ray crystallography (Littlechild, Harmer) focused on biocatalysis has been strengthened by new appointments. CryoEM is being used to investigate the structure and function of the bacterial type IV pilus, mitochondrial protein complexes and archeal surface proteins (Gold, Daum, ERC Starting). Phillips (UKRI FLF) uses hydrogen-deuterium exchange mass spectrometry and computational approaches to study the assembly and dynamics of protein complexes. Transcriptional and translational regulation are investigated by West [Wellcome Investigator Award] and Bono. Exeter's strength in bacterial pathogenesis, treatments and vaccine candidates is now empowered by a Class 3 pathogen containment facility (Titball, Porter, Brown, Butler, Michell and Harmer). Titball is developing standardised alternatives to vertebrate models for the life sciences through his spinout company, BioSystems Technology (one of our impact case studies). This applied focus extends to the development of novel medical diagnostics via chemical biology (Wood, Perry, Shaw), and the exploitation of enzymes for the synthesis of valuable compounds (Harmer and Littlechild). Physics-based colleagues in LSI strengthen our inter-disciplinary approach to biochemistry (e.g. label-free optical single molecule nanosensors; and quantum phenomena in biological systems involving transient radical pairs). The theme has funding from the MRC, BBSRC, Wellcome, EPSRC, as well as Innovate UK and extensive industry funding (e.g. Unilever and Glaxo Smith Kline).

Plant and Algal Biology (*Allen*, Ames*, Bebber, Deeks, Eyles*, Gurr, Helliwell*, Kumar*, Love, Smirnoff*). This theme addresses key issues of food security, climate change and plant-pathogen interactions. Our studies of plant-pathogen interactions (especially those with fungal pathogens) range from the cellular and molecular responses of plants (Ames, Deeks, Kumar, Eyles [UKRI FLF], Gurr) to the macroecology of crop disease in response to climate change [Bebber, Gurr]. Impact from the latter work is being realised by a RCUK-funded £1.2M collaboration with the UN FAO World Banana Forum to maintain banana production and supply chains, and our focus on fungal pathogens has naturally resulted in strong links with the newly established MRC CMM. Kumar and Smirnoff focus on plant-environment interactions, particularly temperature and light, while Smirnoff and Helliwell [NERC IRF] are dissecting metabolism (especially vitamin metabolism) and the role of reactive oxygen species in plants and algae. (Helliwell holds a joint appointment with the Marine Biological Association.) Algal molecular biology and biochemistry is focused on biotechnology, biofuels (>£5M investment from Shell) and bioremediation (Love, Allen; the latter a joint appointment with Plymouth Marine Laboratories). The theme is funded by the BBSRC, UK Global Food Security initiative, EU Horizon 2020, Industry (Shell, Syngenta, DuPont, Mycosciences), charitable bodies (CIFAR) and the Scottish Government. Love's work on algal biofuels is an Impact Case Study.

Marine Ecology (*Barrios-O'Neill*, Broderick, Ellis*, Lowe*, Metcalfe*, Monier*, Sherley*, Temperton*, R. Wilson*). This is new cross-campus theme focusing on marine ecology across all scales of biological complexity. The theme is embedded in the broader University-wide priority of marine research and includes academics from the biological, physical and social sciences (ExeterMarine). Temperton, Monier (Royal Society University Research Fellow) and Lowe use genomic techniques, including single cell genomics, to explore the molecular and phenotypic adaptation of microbes (viruses, bacteria, protists) to each other, and the implications for biogeochemical cycles. Barrios-O'Neill (Leverhulme ECF) investigates how biotic interactions between marine invertebrates impact their population dynamics. Broderick, Sherley (Pew Fellow) and Metcalfe exploit GPS technologies to determine the spatial ecology of at-risk species to predict and implement optimal conservation strategies. The impactful nature of this research is reflected in two impact case studies on the establishment of new Marine Protection Areas (Broderick, Sherley). Ellis (NERC Industrial Innovation Fellow) investigates the consequences of climate change on fish physiology to improve the efficiency of aquaculture. The theme is also funded by the BBSRC, Royal Society, NERC and Darwin Initiative.

Disease Ecology & Evolution (*Bonneaud, Boots, Harrison*, Lighten*, Longdon*, McDonald, Studholme, Tschirren*, B. Williams*). This cross-campus theme combines theoretical, statistical, experimental, genetic and genomic approaches to understand the interplay between evolution, ecology and epidemiology of parasitic diseases. A key focus is to understand underlying causes of disease emergence. This includes work on the genetics and ecology of host shifts in insects, including bee viruses (Longdon [Wellcome Trust Henry Dale Fellow], Boots), bacterial pathogens of wild vertebrates (Bonneaud, Harrison, Tschirren, McDonald), crop pathogens (Studholme), macroevolutionary radiations of eukaryotic single celled parasites (Williams [recently completed Royal Society URF], and disease susceptibility in aquaculture (Lighten [BBSRC FLF]). Integrating the effects of microbiomes is also integral to much of this work (Harrison, Tschirren, Studholme, Lighten). The theme is primarily funded by BBSRC, NERC, and the Wellcome Trust. Studholme is a core member of an interdisciplinary Horizon2020 project to minimize diseases of bananas, and McDonald's work on bovine tuberculosis is highly interdisciplinary (he has ESRC funding with social scientists in the ESI) and has had an important impact on government policy on vaccine use and biosecurity, resulting in an Impact Case Study. This work was facilitated by a NERC Knowledge Exchange Fellow (Robertson).

Insect Evolutionary Ecology (*Bass*, Field*, ffrench-Constant, Hayward*, Hosken, Hunt, Ma*, Royle, Tregenza, Wedell, Wotton**). This theme, which focuses on understanding how both micro- and macro-evolutionary processes shapes the lives of insects, spans a wide range of disciplines and both fundamental and applied topics. These include: The evolution of resistance to natural and synthetic insecticides (Bass, ffrench-Constant); the genetic basis of migration

(Wotton [Royal Society URF]); behavioural plasticity in the context of parental care and sexual selection (Royle); sexual selection and sexual conflict in insect adaptation (Tregenza, Hunt, Hosken, Wedell); the evolution of insect eusociality (Field); macroevolution of arthropod organ systems (Ma [NERC IRF]); and the role of transposable elements in insect evolution (Hayward [BBSRC David Phillips Fellow]). Genomics/transcriptomics and post-genomic functional approaches are frequently used to study molecular evolution through to function. The theme is also funded by the BBSRC, NERC, ERC (Bass and Field), ESIF, the Leverhulme Trust and industry. Impact is evidenced by a BBSRC IPA on predicting pesticide resistance in Aphids (PI Bass, with Bayer). Bass's work on safeguarding bee health by understanding the molecular determinants of bee sensitivity to insecticides is an impact case study.

Behavioural Ecology (*Blount, Boogert*, Cant, Currie, Dall, Fraser*, Hockings*, Kelley*, Kuijper*, Lamba, Mesoudi*, Postma*, Russell, Stevens, Thornton, Troscianko*, Weadick*, A. Wilson, Young*). This cross-campus theme addresses the interplay between ecological context and behaviour from an evolutionary perspective. Alongside members in the Insect Evolutionary Ecology theme and colleagues submitted to UoA4 (Psychology), this theme represents one of the largest groups of behavioural ecologists in the world. Exeter has more publications in the two leading behaviour journals (*Animal Behaviour*, *Behavioural Ecology*) in the last 10 years than any other University in the world (WoS 2020). Empirical approaches range from highly controlled laboratory experiments to molecular and observational studies of wild populations. The theme is highly computational, with mathematical modelling (Dall, Kuijper [recent Leverhulme ECF]) and advanced statistical approaches playing central roles in much of our research (Postma, Wilson). Social behaviour is a key theme throughout the group. For example, when and why do animals (and genes) cooperate rather than compete (Boogert, Cant [Royal Society Merit Award holder], Russell, Young, Blount, Kuijper, Dall), and how do organisms learn from each other? (Boogert [Royal Society Dorothy Hodgkin Fellow], Hockings, Russell, Thornton) Parallel questions are addressed for human populations (Currie, Lamba [Royal Society URF], Mesoudi). Group members investigate the genetics of behaviour, applying quantitative genetic (Postma, Wilson) and population genomic (Fraser, Weadick [Royal Society Dorothy Hodgkin Fellow]) approaches. We also possess a critical mass of sensory ecologists, working on sensory perception and its manipulation (warning signals, mimicry, aposematism and camouflage: Stevens, Kelley [Dorothy Hodgkin Fellow], Troscianko [NERC IRF], Blount). Some of Stevens' applied work on camouflage has been funded by a BBSRC IPA (with QinetiQ) and direct industry funding (Rentokil). The group has diverse grant income from the BBSRC, Royal Society, NERC, Leverhulme Trust, HFSP, ESRC and ERC (Fraser).

1.4. Research ethics and integrity

A commitment to the Concordat to Support Research Integrity (ILES 2.9) underpin all our systems and structures. All research in the unit is assessed by the Bioscience Ethics Committee (see section 2.1). Expert assessment from the Ethics Committee ensures research is conducted to the highest standards of integrity. Over and above mandatory University-wide training for researchers in Equality, Diversity & Inclusivity (EDI), research and data integrity and security and in ethics (ILES 3.3 & 3.6), these principles are discussed in all staff meetings and workshops, and key information is provided on a clearly signposted Sharepoint site. The commitment of our unit to research integrity is emphasised by Postma and Tregenza uncovering irregularities in published data sets generated by an established professor that has led to the retraction of ten publications to date. We are fully committed to furthering Open Access and open research initiatives, with many of the UoA editors of OA only journal and active members of Peerage of Science.

1.5. Covid-19 Research

Several Bioscience academics are involved in the COG-UK consortium to sequence SARS-CoV-2 isolates (Michell, Temperton, Studholme). Shaw's spin-out company, Attomarker, is developing a rapid and sensitive triple antibody test using a hand-held blood-testing device and a C-19-influenza dual testing platform. Harmer is working with Smarti Environmental Systems

(supported by £75k Innovate UK funding) to develop an enzyme infused anti-Covid surface spray.

1.6 Future Unit Research & Impact Strategy

Following our ambitious expansion in the last 7 years, and the medium-term constraints imposed by the pandemic, we will focus on consolidating our current themes, primarily by mentoring existing staff to support their career development. We will also continue to attract and support Independent Fellows, make key strategic appointments, increase inter-institutional collaboration. This will result in increase in research income and PGR number. We will further integrate our research and education to maximise our contribution to the development of research scientists and leaders. We also aim to expand two specific areas:

Marine Ecology. Two faculty were recruited to this area in 2019 (submitted to UoA7), and we will recruit additional faculty to further enhance research integration within this theme and ExeterMarine as a whole. Growth areas include fisheries management and conservation, and climate change impacts. Algal research on the effects of climate change on ocean productivity will be expanded through further collaborations with the Marine Biological Association, Plymouth Marine Laboratory, University of Queensland, Chinese University of Hong Kong and Duke University.

Microbiology. We currently have 33 microbiology PIs across our research themes linked by our Microbiology and Antimicrobial Resistance (AMR) Research Networks. Furthermore, we are uniquely positioned to apply our diverse expertise in physics, mathematics, engineering, 'omics, evolution and ecology to address key challenges in biotechnology, bioremediation, environmental change, infection and AMR (a university-wide priority area). We will develop our expertise in innovative applied microbiology by planned investment in a £16M extension to the ESI by 2024 which will provide laboratory space for an additional 8 groups.

Section 2. People

The Bioscience departments in Exeter and Cornwall that make up UoA5 operate in very similar ways, and, unless otherwise stated, "the department" refers to an activity that occurs on both Campuses. The principles set out in DORA (ILES 2.8) and the Researcher Development Concordat (ILES 2.9) are integral to how our UoA5 operates.

2.1. Staff

The unit consists of 34 Professors (6 female), 17 Associate Professors (3 female), 22 Senior Lecturers (6 female), 10 Lecturers (2 female), and 20 Senior Research Fellows currently funded by external Fellowships (8 female). We have a priority to improve our gender bias (77% male) and recent appointments made to Senior Research Fellows (60% male), and future appointments will continue to prioritise female applicants whenever possible. There are 141 Postdoctoral Research Fellows (69 Female) and 59 research technicians (29 Female). All staff and PGR students (the latter detailed below) enjoy the full benefits of departmental resources.

Each campus has its own Senior Leadership Team, including Head of Department (HoD) and Director of Research (DoR). The two HoDs meet weekly to ensure maximal research and organisational synergies across campuses, while DoRs interact through monthly Research Strategy Group meetings. The HoDs meet regularly with their core set of Directors, drawn from permanent faculty (Directors of Research, Inclusivity, Early Career Research [ECR], and Postgraduate Research [PGR]) to discuss key issues. Faculty meetings, to which all Departmental staff and PGR students are invited, occur monthly. Staff Away Days take place annually to discuss education and research strategies. HoD and Directors of ECR and PGR hold termly meetings with whole cohorts of ECR and PGR, respectively, to listen to and subsequently implement wider views of these groups. The department has a Research/Impact Committee, Education Committee, Ethics Committee and Inclusivity Committee, each of which meets monthly to discuss relevant strategy. Ad hoc workshops are held which provide open fora

for all departmental members to discuss key topics, including EDI, work-life balance, parents and carers network, climate and environment emergency, and PGR supervision. These activities have resulted in significant improvements to working policy, including scheduling key meetings within the timeframe of the school day. Regular family-friendly social activities are organised by a social committee (made up of representatives of all career stages). Online social activities have been maintained during the pandemic. Optional exit interviews for the 15 faculty on permanent contracts who left Biosciences since 2014 unanimously cited the supportive environment offered at Biosciences, and only three have moved to positions at other UK Universities. Ten faculty have moved abroad, with Brexit named as a key factor, Jourdain has taken an industry role, and Talbot became Head of the Sainsbury Laboratory at Norwich (maintaining an honorary position at Exeter).

Contracts. All of our Education and Research (E&R) faculty posts have permanent contracts, with new starters linked to a probationary period. Senior Research Fellows have proleptic appointments, changing to E&R positions after Fellowships have finished, and all staff with more than 4 years of service are now on open ended contracts. All new appointments, bar one, have passed probation within 5 years.

Mentoring and training. All staff have access to the University's "One Step Beyond" mentoring scheme (ILES 3.6). All new appointees are allocated a mentor, as well as an Academic Lead to provide bespoke advice and help them establish their education and research programmes. Academic leads hold mandatory annual Performance and Development Review meetings with their mentored staff, and update meetings with their mentees through the year as appropriate. All new faculty are enrolled on the University's Postgraduate Certificate in Academic Practice apprenticeship scheme unless they have prior education qualifications or fellowship of the Higher Education Academy.

A large number of training workshops and activities are funded by the University and available to relevant staff. These include technical skills (e.g. microscopy, bioinformatics), grant writing, leadership and management skills (e.g. an EMBO Leadership Skills Workshop, co-funded by the Wellcome Trust and the University).

Extensive support is provided for grant and fellowship applications, in the form of informal ideas-pitching workshops, written feedback at different stages of grant preparation and interview practice where appropriate. This is managed through research committees. This support is in addition to parallel provisions coordinated by funder-specific university-level committees (ILES 4.2). Faculty regularly take part in mock grant funding panels in conjunction with GW4 partners (ILES 1.8). The success of our processes is informed from the Principal Investigators and Research Leaders Survey (PIRLS), and the Careers in Research Online Survey (CROS) (ILES 3.17), which were recently combined in Vitae's CEDARS survey and adjusted accordingly. We tune our policies in response to the feedback we receive from staff surveys and other consultations.

ECR-specific support. All non-faculty ECRs have access to university mentoring schemes and promotions workshops, have academic leads who are not the same person as their PI or line manager, and take part in the mandatory annual Performance and Development Reviews.

The ECR Directors chair an ECR forum and update HoD and management groups on ECR issues on a weekly basis. ECR staff are invited to workshops, where they influence department decision making. ECRs and PGR have their own dedicated seminar series, taking place weekly, attended by peers and faculty. Feedback on these seminars is provided by peers and by faculty via anonymous feedback sheets. ECRs are supported by even more extensive Fellowship mentorship schemes than those described above, including access to professional presentation coaches. This complements a dedicated central training and development programme for ECRs (ILES 3.8 & 3.9) which includes bespoke training support and Careers Coaching. ECRs also feed into the University-wide ECR Liaison Forums (ILES 3.8), through which they have formal

strategic representation across the University on the Research and Impact Executive Group (RIEG) – our main R&I research committee.

Staff Reward and Recognition. The Department proactively implements the University's "Above & Beyond" scheme for reward and recognition. Anyone can nominate other members of staff for extraordinary contributions, while monetary awards (ranging from £50 to 10% of their annual salary) are fed through senior leadership groups. HoD, and members of relevant Learned Societies, regularly nominate faculty, ECRs and PGR for national and international prizes.

Promotions. The University has a clear set of career progression guidelines ("The Exeter Academic"; ILES 3.3), published online. There have been 41 promotions during the REF period, with female staff 15% more likely to have been promoted than males. Opportunities for promotion can be raised with the HoD directly at any time, but all academic staff are considered for promotion at a meeting of academic leads following the annual cycle of Performance and Development Review meetings. All academic candidates for promotion provide applications, and cases for support are written by the College Pro-Vice Chancellor with advice from HoDs. Internal promotion panels interview candidates for promotion to Associate Professor and Professor, and external references are sought. Promotion workshops are held in the department annually to answer questions and discuss progression criteria with all faculty. Promotion criteria are being revised in line with our commitment to the principles of DORA.

Exchanges and Networking. The University supports network building aligned with its Internationalisation and Impact priorities. Faculty can apply to annual funds for Inward and Outward mobility visit grants and can apply to HoDs for discretionary funding for networking workshops. There is dedicated funding available for networking with our international partner universities, and with key industry and government partners. Members of UoA5 have joint appointments with prestigious International Universities (e.g. Boots, Berkeley; Ma, Yunnan University) and other organisations (e.g. Allen, Plymouth Marine Laboratories; Helliwell, Marine Biological Association).

2.2. Research Students

The Postgraduate Research (PGR) community in Biosciences has more than doubled in size since the last REF. It comprises approximately 238 PhD and 60 MRes students, equating to a mean of 3.16 PGR per academic during the REF period (55% female). Twenty-five percent are non-UK students (39 EU, 37 international), and we have 5-10 visiting PGRs at any one time. During the REF period, >85% of PhD students completed within 4 years.

Our PGRs are a dynamic and engaged community, who self-organise to support each other by, for example, organising scientific events and social events. Many of our students have received prizes for talks and posters at international conferences (e.g. Tom Chaloner [Best junior speaker at The Rank Prize Funds Symposium on New Crop Protection], Paige Robinson [Best poster at a Wellcome Genome Centre conference] and Matt Scurlock [Best poster prize at a Bacterial Networks conference]) and undertake science communication to wider audiences (e.g. Emer Hickey is Chief of Staff for the London International Youth Science Forum; Paige Robinson undertook a Welsh Government science policy advisor fellowship placement in conjunction with NERC GW4+ DTP) as well as publishing high quality research papers. The PGR community is supported by the Directors of Postgraduate Research (DPGR), four deputy directors and three pastoral tutors on each campus. Many of our PGRs have obtained prestigious research fellowships (e.g. Marie Skłodowska Curie Fellowship (Sean Meaden), ETH ACE Fellowship (Siobhan O'Brien), Forest Fellowship (Sam Lymberly)).

Recruitment. Members of UoA5 have been very successful in securing PhD studentships through all the UKRI DTPs (NERC-GW4, SWBio-BBSRC, MRC-GW4, EPSRC-GW4, ESRC-GW4, MRC-CMM), CDTs (GW4 FRESH-NERC), other collaborative partnerships (CEFAS; Royal Dutch Shell PLC, 3 Marie Curie ITN programs (EvoCell, Insect Doctors and FunHoMic

[based in Aberdeen]]. With University match-funding (£5.1M), DTP studentships account for between 40-55% of our annual intake of PhD studentships, with the rest funded by supervisors' grant income, University-funded programs (2-3 LSI-funded studentships per year), University Scholarships (QuEx and Chancellor Scholarships; typically 1 of each per year) or international studentships, often additionally supported by competitive fee-waiver scholarships. ECR status of supervisors is a priority in selecting studentships to be advertised. PGR students are attracted via online advertising, and the recruitment process is managed by the Doctoral College (ILES 3.11). We interview all our student candidates using a gender-balanced panel before accepting them on a PhD degree programme. We have also set up a separate overseas interview panel with experience of supervising international students to improve the selection process. Interviewers must have completed training in recruitment and selection, and in equality, diversity and unconscious bias, offered by People Development at the University.

Student experience and research culture. During the current REF period, increased engagement by the PGR community has resulted in a number of student-led actions that have enhanced the research culture among PGR students and the overall student experience. This is evidenced by the Postgraduate Research Experience Survey (ILES 3.11). Following from the success of the Biosciences PGR student conference (BioCon) in 2015 and 2016, our PGRs now lead and organise an annual college-wide Student Conference (CLESCon). Students fund-raise to support all activities of the conference, including funds for invited speakers and prizes for posters and talks. These events have typically attracted ~150 delegates, comprised mainly of the PGR community including PGR students from all Life Science disciplines. Bioscience PGR students are also strongly engaged in the Biosciences Press Gang group. This group writes broad audience articles focused on topics of interest (including research publications, prizes, and research events) and communicates the science conducted in Biosciences with the wider community via articles for the web and press releases. PGR students typically give one talk per year in weekly seminar series attended by other PGRs, ECRs and academics, fostering a sense of research community and feedback. The PGR liaison forum (PGR LF; ILES 3.10) held at each campus allows PGR students to provide feedback to the department via PGR-elected representatives.

PGR students are encouraged to feed into department strategy via workshops and PGR forum meetings. PGR Representatives meet with the DPGR regularly to discuss engagement in departmental activities. PGR students also have access to a Pastoral Tutor, who feeds issues to the DPGR. The HoD uses discretionary funds to support workshops, run by research clusters, and PGR students are encouraged to submit ideas for, and run, such workshops. A recent example is "RISE: Research and Inclusion in Social Evolution", held in March 2020, which was attended by ~80 delegates. At all research seminars, PGR students are offered the second opportunity (after undergraduates) to ask questions of the speaker.

Supervision, training and development. We have implemented termly talks and discussions for students, led by the DPGR, and these sessions cover various aspects of PGR studies. The topics include: learning agreements; assessment and reports; preparing for thesis writing; preparing for vivas and interviews; managing time; managing expectations and relationships with supervisors and colleagues; and maintaining good mental health. A default co-supervision system has been implemented, where students receive meaningful supervision from more than one academic. All PGRs are also assigned a pastoral tutor, independent of their supervisors, who have proven very successful at mitigating potential student-supervisor conflicts. Progress meetings are held at 9 months (when students can upgrade from MPhil to PhD student status) and at 24-30 months. These require students to provide detailed research plans to ensure they have sufficient time to generate data for their PhD thesis and to identify potential problems. The Annual Monitoring Review (ILES 3.11) process involves an anonymous online form completed by student and supervisors, with any issues raised followed up by the DPGR. Data from these reviews suggest that supervision quality within the department has continued to improve during the REF period, with students displaying a high level of satisfaction. We also hold a yearly meeting with all deputy DPGRs to review the processes and share good practice.

In addition to the extensive general and academic training organised through the Doctoral College (ILES 3.12) and the various DTPs, regular departmental training events are offered in specialised areas in response to requests from the PGR community (e.g. advanced statistics, GPS and confocal microscopy). PGRs are encouraged to visit other national and international institutes and attend conferences/workshops for training and networking. Funding to support these activities is available using departmental discretionary funds if they are not available via their studentship/supervisor grant. PGR students are recruited as demonstrators for undergraduate lab sessions and enjoy full employment benefits on annualised contracts.

2.3. Research-led teaching. A key aim since the last REF has been to enhance the synergy between Research and Education. The Gold status achieved by Biosciences in the Teaching Excellence Framework (2019) partly reflects this. All E&R staff undertake teaching in their areas of expertise. This has been especially successful thanks to the Education & Scholarship Job Family (9 of 17 on permanent contracts), whose main focus is the management and delivery of our education strategy. We ensure that all UG and taught Masters students engage in independent research projects under academic supervision over a 6- and 9-month period, respectively. To ensure sufficient and engaged supervision, >95% of academics undertake UG and Masters supervision each year. UGs are also encouraged to apply for 3-month Research Internships (for which stipendiary funding is available during the holiday periods) that are embedded within research groups. This approach has resulted in at least 128 peer-reviewed publications co-authored by taught students, as well as international prizes. Notably, the Exeter International Genetically Engineered Machine (iGEM) UG teams were awarded Gold in 2017, 2018 and 2019.

2.4. Equality, Diversity & Inclusivity (EDI)

Wellbeing of Staff and Research Students. The department adheres to the University's processes for parental leave, flexible working and occupational health (ILES 3.14 - 3.17). Information on the department's Staff and PGR Sharepoint Gateway leads people to a wide variety of support organisations, health providers and recreational activities. When staff or PGR students report accessibility issues or declining health to their line managers, they are referred to Occupational Health Services who make recommendations to the department for mitigation. All such recommendations have been upheld by the department. Health issues understandably increased during the pandemic, and Occupational Health supported and facilitated all requests for home-working equipment and allowed all members of the department to use Covid-secure office space when requested.

Strategies & Activities that support EDI. Our Inclusivity Committee is made up of volunteers representing all of the departments' job families. The Director of Inclusivity sits on the local Management Group, and reports to staff meetings on Inclusivity Issues. We also liaise with a University Equality & Diversity Advisor. Our priority is to ensure that those with protected characteristics experience no prejudice. Dignity and Respect Advisors have been trained to help all staff and PGRs report instances of harassment without fear of reprisal, and we have Speak Out Guardians as confidential points of contact on both campuses (ILES 3.15).

Biosciences in Cornwall improved its Athena Swan award from Bronze to Silver in 2015, and retained Silver following a 3-year review in 2018. Biosciences at Exeter was awarded a Bronze award in 2017. The pandemic prevented the planned 2020 application for a Silver award: we will apply again in 2021. We encourage female academics to enrol on the Aurora Leadership and Springboard personal development courses. Our reviews of recruitment and promotion procedures reassure us that we show no discrimination from the point of receipt of a job or studentship application. We celebrate scientist role models with protected characteristics, particularly female scientists, using dedicated webpages, posters, banners and talks to UG student cohorts. In December 2020 we held a student-led conference, "Celebrating Diversity in Science" in collaboration with the LGBTQ+ Staff Network and LGBTQI+ Society. We encourage

all members of Biosciences to engage with relevant anti-racism media, and members of the department celebrated Black History Month by producing short biographies of Black Life Sciences Researchers.

We further celebrate inclusivity using staff profiles describing the work-life balance and inclusivity challenges faced by faculty members. We have established a Parents and Carers Network that shares advice and support for staff and PGR with caring responsibilities, complementing the University's progressive parental leave and nursery provision (ILES 3.16). This has since been extended to staff and PGR in all disciplines.

EDI and Staff Recruitment. All job adverts are passed through a bias-checker by Human Resources, to ensure the language used is not discriminatory. Selection and interview panels include at least one female faculty. All selection and interview panel members are required to complete prior training in equality, diversity and unconscious bias and in recruitment and selection. All selection panel members are asked to double-check their shortlists to ensure they have given equal opportunity to applicants with protected characteristics. Our recruitment processes ensure that all applicants who meet the essential criteria, and self-diagnose as disabled, are invited to interview.

Support for Staff with Significant Research Responsibilities. The University has a workload model that accounts for education, grant writing, funded research, impact activities, leadership roles, departmental citizenship tutoring, PGR supervision and UG research project supervision (ILES 3.4). Target workloads are adjusted pro rata for part time staff. Annually, all staff who are >10% over-target are consulted by HoDs, to ensure that they understand their workload and are able to cope. Research Fellows are asked to act as tutors to small numbers of undergraduates, and to supervise UG and MSc research projects to gain teaching experience. As much as possible, a PI's scheduled teaching is concentrated into a single semester to maximise blocks of time dedicated to research. When research and management activities cause target workloads to be greatly exceeded, education workloads are adjusted downwards subject to the staff member's approval. We operate a "light landing" policy for new appointees, giving them up to one-third of normal education delivery commitments in their first year, up to two-thirds in their second year, and only moving to full education commitments in their third year after appointment. Notably, one colleague achieved promotion to professor and won a Zoological Society of London conservation prize while working part-time (Broderick).

Productivity of Researchers with protected characteristics. The department provides extensive internal peer review options for grants and publications, over and above mandatory requirements for those with protected characteristics (See Section 3.1). The Research Committee works with Research Services to ensure peers have advanced warning of impending grant applications. Through the peer review process, Research Committees have oversight of equality of opportunity to apply for grants. When grants are won, successful investigators hold discussions with DoRs and HoDs to ensure that their research needs are met by laboratory and field resources.

Flexible/Remote Working. The department fully supports applications to work flexibly, part-time or remotely. Where possible, adjustments are made to tutorial quotas and timing of education commitments, to allow staff to work flexibly. Teaching restriction applications are always accepted when justified, and teaching timetables are adjusted annually to cope with these applications. The department keeps a database of flexible working arrangements for all staff to consult to ensure that activities are scheduled for when they are available.

Conference/Seminar attendance for those with caring responsibilities & ill health. We have a database of childcare facilities at conferences and we disseminate this information through staff meetings and emailed announcements. We actively pair people up with willing colleagues attending the same conference, in cases where additional support is needed to travel to/from, and attend, a conference. We cover the childcare and travel and subsistence costs of accompanying children for invited seminar speakers.

Support for Staff Returning from Leave or Ill Health. Staff are consulted prior to long-term leave, to ensure they know what will be expected on their return. Wherever possible, a “light landing” is again provided, such that education commitments are significantly reduced for at least the first term following their return to work. We ensure that staff returning from parental leave have no teaching for the first semester following their return.

EDI during selection of REF Research Outputs and Impact Case Studies (ICSs). Members of the UoA self-nominated their key outputs (6-10) and ICSs for potential inclusion in the REF. Outputs were evaluated by a gender-balanced panel of 6 senior academics, including the two Directors of Research, and consensus scores reached following multiple meetings. Scoring was benchmarked against external expert reviews of approximately 10% of self-nominated outputs. The distribution of outputs across job titles, gender and protected characteristics was determined, and any deviations from a null model explored. It was ultimately not deemed necessary from an EDI perspective to change the output selection.

All potential ICS authors attended workshops run by academics and Impact Officers. Funding and mentorship – especially for ECRs - was provided to develop ICSs. The final selection of ICSs was determined by a gender-balanced panel of 4 academics, including the two Directors of Impact, and 4 Impact Officers. There was no evidence that gender, protected characteristics or ECR status influenced the selection of the 8 ICS from the initial 20 potential ICSs. All panel members involved in output and ICS selection panels took part in unconscious bias training workshops.

EDI during the COVID-19 Pandemic. Increased responsibilities during COVID-19, in addition to anxiety, had a significant and differential impact on individual productivity. All members of UoA5 were encouraged to report to HoDs if workloads were too much, and excess work distributed to colleagues who volunteered to help. A light-touch professional development review (PDR) and no-detriment career progression policy for vulnerable colleagues was instated. ECR well-being was regularly checked by their Supervisors/Mentors. Research restarts were phased, and all members of the department were encouraged to apply for priority research activities, with the selection criteria made transparent. Priority was given to the most time-limited work.

Section 3. Income, infrastructure and facilities

3.1. Research Income

Mean annual income during the census period was £12.3M, amounting to £124k per FTE. Our annual income has increased from £11.7M (2013/14) to £15.5M (2019/20) and income per FTE has increased from £118k (2013/14) to £156k (2019/20). Success rates (by grant value) grew from 18% (2014/15) to 31% (2018/19). Our funding came from UKRI (52%), the European Union (19%), Wellcome/Leverhulme Trusts (14%), industrial funders (7%) and smaller charities (8%). UoA5 has additionally been awarded £8.8M in UKRI PGR funding, matched by £5.1M from the University.

Key funding achievements:

- 23 Senior (5 years+) Fellowships: 5 Royal Society University Research Fellowships (Brand, Lamba, Monier, Wotton, Richards [left Exeter 2019]); 3 Royal Society Dorothy Hodgkin Fellowships (Kelley, Boogert, Weadick); 3 NERC Independent Research Fellowships (Ma, Helliwell, Troscianko); 2 BBSRC David Philips Fellowships (Hayward, Williams); 3 Sir Henry Dale Wellcome Trust/Royal Society Fellowships (Longdon, Wilson, Cook); 3 Wellcome Senior Research Fellowships (Wilson, Brand, West); 1 EPSRC Innovation Fellowship (Beardmore); 3 UKRI Future Leaders (Eyles, Costello, Philips).
- 37 Junior (<5 years) Fellowships: 2 BBSRC Future Leader Fellowships; 3 Leverhulme Early Career Fellowships; 1 Human Frontier Science Program Fellowship; 2 Royal

Commission for the Exhibition 1851 Fellowships; 1 Pew Fellowship; 1 NERC Industrial Innovation Fellowship; 1 MRC Skills Development Fellowship; 2 Newton Fellowships; 2 EMBO Long Term Fellowships; 1 British Academy Postdoctoral Fellowship; 20 Marie Skłodowska Curie Fellowships, 1 EPSRC Fellowship.

- 10 ERC PI grants: 4 Starting (Daum, Westra, Currie, Fraser); 3 Consolidator (Richards, Bass, Gudelj); 3 Advanced (Field, Smith, Talbot).
- 3 Wellcome Investigator Awards (Jekeley, Brown G, Gow); 2 Wellcome Collaborator Awards (Gow).

Strategies to maximise funding success. Our increased funding reflects an increased focus on mentoring and peer review of the large number of recently appointed ECRs, many of whom have won Independent Research Fellowships. We run biannual grant and fellowship hustings, where staff pitch initial ideas in a supportive environment and receive feedback on the content and the most appropriate funding sources. Faculty have worked to attract excellent external candidates, and in some cases short-term internally funded fellowships have been awarded to support applicants during the application process. Haywards, Monier and Richards were all awarded 1-year fellowships before being awarded senior fellowships by the BBSRC and Royal Society. The duration of these Bridging Fellowships has been extended by the MRC Centre for Medical Mycology, which has awarded two 3-year Fellowships since 2019. Independent Research Fellows receive extensive mentoring in both their research and progression towards permanent positions, and they are prioritised for DTP Studentships (See Section 2).

We employ extensive mentoring and peer review through local Research committees and University-wide Funder Advisory Networks (FANs; ILES 4.2). The model is akin to journal editorial boards, where members provide feedback and assign at least two other peer reviewers. For interdisciplinary grants, FAN chairs share proposals with other FANs, who undertake the same process. Every grant application is supported by a dedicated, experienced research administrator who helps the applicant with finances and personnel details, as well as ensuring compliance with funder requirements.

Internal Research investments. In addition to infrastructure investments described in the Building summary below, UoA5 received £390k for small pump-priming projects that prioritised interdisciplinary research during the census period. These awards (typically <£20k) were used to fund consumables and short-term staff contracts to generate pilot data to support large grant applications. This scheme was in addition to Start Up funding for new appointments.

3.2. Buildings infrastructure

UoA5 staff (along with UoA7-facing Bioscience colleagues) are located on both the Cornwall and Exeter Campuses. Some members are located within our physical interdisciplinary institutions: the Living Systems Institute (LSI) in Exeter and the Environmental Sustainability Institute (ESI) in Cornwall. Each laboratory area is managed by a dedicated Core Technical Manager.

Biosciences at Exeter is located primarily in the Geoffrey Pope Building (GPB) which provides 4817 m² of lab space, much of which is configured as BSL2/GM2 laboratories. In 2019, one floor of this building was refurbished (£13.5M) to accommodate the relocation of the MRC Centre for Medical Mycology (8 PIs plus 4 new PI appointments) from Aberdeen University. The GPB houses Core Facilities (Bioimaging, Sequencing, Mass Spectrometry, Cytometry, ARC – one of the largest and most modern aquarium facilities in Europe, glasshouses, controlled environment plant growth chambers and animal facilities). UoA5 colleagues are also located in the Living Systems Institute (LSI) adjoining GPB. This is an interdisciplinary institute founded in 2016 with a £52M investment. It brings together biology, medicine, physics, mathematics and engineering in one building. Currently, 27 research groups are applying integrated systems approaches to biology and medicine. An additional 550 m² of lab space in the Sir Henry Wellcome Centre for Biocatalysis, adjoining the GPB has undergone a £136k refurbishment (in 2017) to

accommodate the Bio-Economy Centre, housing Shell-funded biofuel research and space to accommodate industrial collaborators.

Biosciences at Penryn is located in four neighbouring buildings: the Daphne Du Maurier building (2004), the ESI, the recently built Science and Engineering Research Support Facility (2016, £5.5M) and the Stella Turk Building (2019, £12M). Together these buildings provide 2340 m² of laboratory space, with approximately 50% configured as BSL2/GM2. The buildings house key facilities including mass spectrometry, stable isotope facility, imaging, cytometry and controlled temperature (CT) rooms. The 12 CT rooms were expanded to 18 (> 50% of which are quarantined) in 2019, following a £250k investment from the Wolfson Foundation, match-funded by the University.

3.3. Research Facilities

Running costs are funded by the University, supplemented by cost recovery through grant-funding and external contracts.

The DNA Sequencing Facility supports a wide range of genomics, transcriptomics and epigenetics applications. The Facility houses Illumina HiSeq 2500, Illumina MiSeq, PacBio Sequel (for long reads) and nanopore sequencing (Oxford Nanopore Technologies Flongle, MinION Mk1B and PromethION24). In 2019 our HiSeq was replaced by the NovaSeq and a 10X Chromium instrument to enable single cell genomics and transcriptomics (£1M: 50% Wellcome trust; 50% University matched funding). The Facility employs a Senior Research Fellow, two bioinformaticians, two wet-lab technicians and a laboratory apprentice. Academic oversight is provided by a joint Biosciences/Medical School team. The Sequencing Facility is a major user of the University's high-performance computing facility.

High Performance Computing (HPC) is available through a University Facility (ISCA). It consists of a cluster (128 GB nodes) complemented by two large memory (3 TB) nodes, Xeon Phi accelerator nodes and GPU (Tesla K80) compute nodes. It also includes a cluster of higher memory nodes (256 GB), 3 TB nodes, and an Openstack environment for the management of virtualised resources. Recent investments of £750k from the World Class Laboratories fund and UoE investment in Research Software Engineers will facilitate bespoke ISCA-based developments.

Single Cell Analysis Facilities. Single cell experimental approaches are facilitated by the **Environmental Single Cell Genomics Facility [eSCG]**, which is funded jointly by the University and the Plymouth Marine Laboratories. The eSCG Facility is housed in a clean room (ISO 14644-1 ISO5), supported by a joint University/PML appointment, and funded by the NERC and the Wolfson Foundation. The eSCG Facility facilitates the direct isolation and characterisation of unicellular organisms and viruses from natural samples. It combines high performance and precision flow cytometry, microfluidics, liquid handling and molecular diagnostics (BioRad QX200 droplet digital PCR, Roche LightCycler480 real time PCR), uniquely offering unprecedented genomic resolution for oceanic microbial ecology and non-culturable microorganisms. The **Microfluidics Assembly Facility** provides a suite of equipment for fabricating end-use microfluidic devices for to empower research spanning molecular biophysics, single cell analysis, host-pathogen interactions and healthcare technologies focused on antimicrobial resistance. This Facility provides an important bridge for collaborations with physicists and engineers. The **Centre for Biomedical Modelling and Analysis** combines our expertise in quantitative disciplines (mathematics, computer science and physics) to enable breakthroughs in biomedical and clinical research. This includes the analysis of complex datasets such as dynamic interaction patterns emerging from millions of single-cell measurements.

The Cytomics Facility was established in 2019 with a £1.2M investment and is now a national registered facility. It houses instruments for flow cytometry-based cell sorting and imaging (Acoustic Flow Cytometer Attune NxT, Cytex Aurora Spectral Flow Cytometer, Imaging Flow

Cytometer Amnis ImageStreamX, BSLII Cell Sorter BD FACSAriaFusion and MultiPlex technology Luminex FlexMap3D) along with a data analysis suite. A Bigfoot BSLII Spectral Cell Sorter (Propellabs) with 6 lasers and 56 channels and built-in Class II containment will be installed in Jan 2021.

The Bioimaging Centre houses an array of light microscopes to support all key bioimaging techniques (e.g. FRAP, FLIM, FCS, photoactivation). We have confocal laser scanning microscopes (Leica TCS SP8, Leica TCS SP8, Zeiss LSM 880 with Airyscan FAST); Leica SP8X HyVoLution II system for super-resolution live cell imaging and cross correlation studies; an Olympus IX81 spinning disc system for fast live cell imaging; and an Olympus IX81 wide-field system with TIRF module. Live cell imaging was recently augmented with a Lattice Selective Plane Illumination Microscope (L-SPIM) (BBSRC ALERT2019, £650k). We have extensive electron microscopy capability (JEOL 1400 JEM transmission electron microscope; JEOL JSM 6390 LV and Zeiss GeminiSEM 500 scanning electron microscopes). The Centre is supported by an Experimental Officer, two technicians and a Finance Administrator. Additional bioimaging capability (provided via the LSI and ESI) includes super-resolution microscopy, multiphoton imaging and label-free techniques to probe physical and chemical structure (second harmonic generation and coherent anti-Stokes Raman scattering microscopy) and a Quanta 650F field emission gun scanning electron microscope (FEG-SEM) capable of imaging materials to a maximum of 10 nanometres resolution.

The CryoEM Facility for protein structure, based in the LSI, is a collaboration with the GW4 University consortium (£2.3M with £1 M from Wellcome). The Exeter Facility includes sample preparation and a 120 keV cryo-capable EM (FEI Tecnai 12) with automated data collection. Higher resolution imaging uses the 200 keV GW4 facility (FEI Talos Arctica) in Bristol. This is supported by extensive protein purification and crystallisation systems (e.g. Mosquito and Oryx liquid handling, RNA-protein crystallisation).

The Mass Spectrometry (MS) Facility houses two LC-MS systems (LC-triple quadrupole MS/MS and LC-QTOF MS/MS) along with a GC-QTOF MS/MS and HPLC with diode array, fluorescence and refractive index detectors. The Facility supports custom targeted small molecule analysis and untargeted metabolite profiling plus data analysis pipelines. Chemical analysis by MS is complemented by a 400 MHz NMR spectrometer (Bruker) and IR spectroscopy. An additional MS in the LSI is equipped with hydrogen-deuterium exchange for protein structure studies. Further analytical capability is provided by GC and LC-single quadrupole MS instruments.

The Stable Isotope Facility is equipped with two isotope ratio mass spectrometry (IRMS) instruments: a Sercon Integra 2 system and a Sercon 20-22 isotope IRMS. This Facility is used extensively to research animal diets and spatial ecology.

The Biological Services Unit (BSU) and Aquatic Resources Centre (ARC) provide controlled facilities for experimental animals. In the BSU, rodents (capacity 8000) are housed in IVC cages under optimal high health conditions. The Facility was expanded in 2020 to accommodate Cat2 containment facilities for research on fungal pathogens by the Centre for Medical Mycology with a capacity for ~700 mice. Over £12M has been invested in the ARC to provide high-spec teaching and research facilities. The ARC has 16 aquaria rooms, including the recent addition of a 3000-tank zebrafish unit, which houses a wide range of freshwater and marine species. The Facility is supported by a Wolfson Imaging Unit with specialist microscopes, video and imaging equipment, together with preparation and laboratory rooms that contain automated respirometry, dosing and gas control systems for sophisticated developmental, physiological and behavioural research. A computer-controlled water treatment plant with 12 recirculating and 7 flow-to-waste systems provide high quality water of the desired salinity and temperature. Each room has a dedicated building management system for air temperature control and independent day-night light cycles. A smaller freshwater and marine aquarium facility is dedicated to behavioural work, and another £200k marine aquarium will be refitted in 2021 (delayed due to the pandemic) to accommodate our expanding marine theme. **The Containment Level 3 (CL3) Facility** has 3

rooms (150 m³) served by a self-contained air handling system, held at negative pressure to handle ACDP level 3 microorganisms. Currently the Facility has consent to work on *Burkholderia pseudomallei* and *Coxiella burnetti* (ACGM level 3).

Plant growth facilities (Exeter) comprise 400 m² of heated and lighted glasshouse space (including 35 m² for GM and pathogen containment). In 2020, the controlled environment plant growth capacity was upgraded with 18 chambers specified for high light, CO₂ control and supplemental far red/UV illumination.

Field experiment facility. A dedicated research field and associated greenhouses permit the execution of controlled and highly reproducible experiments. These terrestrial mesocosms allow light spectra and intensity to be manipulated. The completion of aquatic mesocosms (£220k, University-funded) that allow manipulation of light and temperature has been delayed until 2021 because of the pandemic.

The Radar tracking facility. A vertical-Looking Radar is used to investigate the abundance and behaviour of insects flying at high altitudes. Harmonic radar enables individual tagged low-flying insects to be tracked continuously. Only two institutions in the UK and three in the world currently possess this technology.

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

4.1. Academic collaboration

Academic collaboration at all scales and across all disciplinary boundaries is central to our research philosophy. Within Exeter, regular university-wide events (e.g. biannual Exeter Marine meetings, annual Exbase and Microbiology meetings), as well as more focused events (e.g. University wide AMR meetings in 2019 and 2020) encourage interdisciplinary and cross-college collaboration between academics. Our interdisciplinary institutes (e.g. ESI, LSI) and Centres (e.g. MRC CMM) facilitate daily interactions across academic boundaries. All provide small pump-priming grants for interdisciplinary projects.

We actively support collaboration with other institutions. This is supported locally by our GW4 network, which provides pump-priming funding for travel and meetings within the network. Our UKRI DTPs are all linked to GW4, and multi-institutional supervision is an important part of our project ranking. Since 2014, we have established formal links with a number of top-ranking international institutions (e.g. University of Queensland, Chinese University of Hong Kong, Tsinghua University, University of British Columbia, Duke University, University of Cape Town, University of Lund, ETH Zurich, University of Geneva). Funding has been awarded to members of UoA5 for collaborative meetings, studentships or postdoctoral grants with all these institutions. In addition, we have provided competitive funding, open to all faculty, for global networking visits. This has led directly to formal international partnerships as well as 6 GCRF and Newton Awards (£1.6M, with partner institutions in Brazil, Ecuador, Kenya, Indonesia & Bangladesh).

We strongly support networking and the showcasing of our research and facilities by supporting academic workshops and conferences. The University also provides administrative support to organise such meetings and to identify sponsorship. Numerous national and international workshops and conferences have been hosted by the University, including: International Society for Behavioural Ecology 2016; European Meeting of PhD Students in Evolutionary Biology 2016; British Ecological Society 2019; AIDS-related Mycoses Workshop 2019; and Entomology 2020 (cancelled because of the pandemic).

4.2. Industrial, NGO and business collaboration

Our Impact, Innovation & Business (IIB) department actively supports stakeholder engagement. Twelve IIB officers work with UoA5 to promote stakeholder-academic collaboration by identifying relevant stakeholders and facilitating interactions. This is done through stakeholder workshops (examples include workshops on Geographic Information System and Anaerobic Digestion at

the Environment and Sustainability Institute in 2019) and inviting key stakeholders for one-to-one meetings. Stakeholder collaboration has been further supported by the UKRI (e.g. BBSRC and NERC Impact Acceleration Awards) and by University funding to support meetings and key proof of concept preliminary work. This combined activity has contributed to 7 BBSRC IPAs during the REF period (totalling £5.2M; 10% industry contribution from e.g. Bayer, DowBioscience, ABAgri). Members of UoA5 have received direct and CASE industry funding, including from Syngenta, AstraZeneca and Shell, which totals £12M. IIB officers and university solicitors now take the lead in financial and legal negotiations, thereby circumventing what was previously viewed as a barrier to industrial collaboration by academics.

To encourage interaction with stakeholders, we provided 20% impact engagement time in the workload model to all faculty in our first and largest institute (Environment and Sustainability Institute; ESI) from 2014-2016. This helped to establish many (>100) new partnerships and created the necessary networks for our successful UKRI (South West Partnership for Environmental and Economic Prosperity; SWEEP) and EU (ESIF Agri-tech Cornwall, TEVI) multi-million pound impact-focussed bids. Examples of UoA5 projects funded from these awards include research into edible insects and the use of novel auditory technology to scare starlings off farms.

Strategic Partnerships. We have established partnerships with a range of key stakeholders, to maximise impact through long-term collaborations. Many of these are CASE partners for DTP studentships, and co-applicants on grants. Key examples follow.

The Exeter Microbial Biofuels Group (EMBG) has partnered research into advanced biofuels with **Shell Biodomain**. EMBG research provided the evidence and rationale for Shell to alter their Biodomain strategy for biofuel production from the exploitation of natural, relatively inefficient microbial biocatalysts to developing more versatile microbial chassis using Synthetic Biology. The EMBG established a formal research framework agreement with Shell (>£5M) in 2017, which has supported 11 FT researcher positions, bolstered by regular exchanges of personnel, including a Royal Society Entrepreneur in Residence Fellow (Professor Rob Lee). This work represents one of our REF Impact Case Studies. Shell also funds 4 Exeter MSc students each year to research biofuels at this University.

The Cornwall campus is host to Marine and Freshwater Conservation research from the **Zoological Society of London (ZSL)**. This includes the Head of Unit, Prof Heather Koldewey, 2.0 FTE postdoctoral fellows, and visits from London- and overseas-based staff. This has led to Exeter staff becoming deeply embedded within, and receiving secure funding from, for example, the Bertarelli Programme in Marine Science programme around the large Marine Protected Area in the Chagos Archipelago (Broderick). The ZSL has also opened up their field-sites for graduate research projects. This is pump-priming research proposals and CASE-studentship work and supporting industry focused initiatives such as EXEMPLAR (EPSRC) and ENSURE (Exeter-Chinese University of Hong Kong Alliance).

The Centre for Resilience in Environment, Water and Waste (CREWW) was launched in 2020 and is a collaboration between the University, industry, government and NGOs. CREWW was established to address some of the most pressing environmental challenges of our time, namely how we can manage our precious natural water resources in ways which are sustainable and resilient in the face of climate change and population growth. CREWW is funded by co-investment from Research England UKRPIF (£10.5M) and **South West Water** (£21M).

Sustainable Aquaculture Futures (SAF) is a collaboration between the University and **Centre for the Environment Fisheries and Aquaculture Science (CEFAS)** (B. Williams, R. Wilson and Michell from UoA5 have lead roles). The aim of SAF is to integrate leading scientific expertise to ensure that the key challenges facing sustainable growth in the aquaculture industry are better understood, both in the UK and internationally. The University's partners in SAF include academic centres in India, Bangladesh, Malawi and Thailand.

The AFGrica Unit was recently established in Cape Town by the MRC Centre for Medical Mycology (MRC CMM) in collaboration with the **University of Cape Town**. The AFGrica Unit represents the world's first international research and training centre based in a LMIC that focusses on combatting the major health burdens imposed by endemic fungal diseases. The AFGrica Unit currently includes eight researchers led by Hoving (Wellcome Trust Intermediate Fellow in Public Health and Tropical Medicine) and Dangarembizi. Hoving and Dangarembizi are members of the MRC CMM and as honorary members of the University. The MRC-CMM has two UoE honorary chairs (Johnson & Borman) from the PHE Mycology Reference Laboratory in Bristol.

The University recently formalised a long-term partnership with the **National Trust**. The concept of developing 'landscape laboratories' is a key component of the Partnership's vision, to facilitate the National Trust's priority of implementing 'nature-based solutions' to climate change. The only other University partner of the Trust is the University of Oxford. The Trust is a key partner in our recent £12M NERC Changing the Environment Expression of Interest.

4.3. Spin out companies and patent applications

UoA5 academics have established multiple spin-out companies. **ISCA diagnostics** was founded in 2012 (Thornton) and is developing and delivering highly specific and selective reagents and test systems for the investigation and detection of pathogenic and allergenic fungi, and their allergens and enzymes. **BioSystems Technology Ltd.**, which was founded in 2015 (Titball), has developed a standardised insect model (TruLarv™) as an authentic alternative to mammalian models of pathogen infection and for anti-infective drug efficacy studies.

Attomarker was founded in 2008 (Shaw) and is valued at £25M. Attomarker, which developed a highly portable diagnostic device to conduct 30 multiplexed blood-tests within minutes (see Covid-19 related research), was winner of the OBN Life Sciences Industry 'One to Watch' award in 2019. Attomarker has commercialised formats for triple Covid-19 antigen tests and C-19-influenza dual detection.

Members of the UoA5 have **37 patent applications**, many in antimicrobials and equipment. Examples include a Covid-protective surface spray (Harmer), novel spectrophotometer (Beardmore), vortex (Allen) and bio-digital systems (Chait).

4.4. Impact in progress

In addition to our Impact Case studies, we have many ongoing impact activities. For example: **Algal Fuels**. In partnership with Algae Energy, Love devised a cost-effective, engineering solution for low-cost waste recycling and algal production. The system is currently at the TRL-6 (field prototype) stage.

Biogas. Amur energy, a subsidiary of Ab Agri, is working with Buckling (funded by BBSRC IPA) to conduct an industrial-scale controlled trial to evaluate the efficacy of microbial community coalescence to enhance biogas production.

Well-building in India. Lamba (funded by a Royal Society URF) is using data from social experiments to increase well building in rural Indian villages.

Insect bio-control. Raymond is applying experimental evolution techniques to increase the efficacy of microbial insecticides. Partners include Bayer, Corteva Agriscience and the Agriculture and Horticulture Development Board.

Racehorse performance and welfare. A. Wilson is applying quantitative genetics to predict racehorse performance and long-term welfare (currently supported by £250k from Innovate UK). Stevens is working with the racehorse industry to improve welfare in horse racing by enhancing the visibility of obstacles

Guinea Worm eradication. McDonald, funded by the Carter Centre, is working on Guinea Worm control in Africa, through practical interventions to break zoonotic transmission chains.

UK Marine Protection Areas (MPAs). Research on Basking Sharks by Exeter Marine Ecologists has resulted in the establishment of four new MPAs off the Scottish Coast.

4.5. Climate emergency

The University won the Guardian University Award for Sustainability in November 2020 for its white paper on dealing with the climate emergency. This included joining the Laboratory Efficiency Assessment Framework (LEAF), which promotes sustainability in energy use, procurement, and waste engagement. The microbiology laboratories in the ESI are one of the first laboratories in the UK to receive a silver LEAF award. Many members of the unit have pledged to cut their conference/seminar travel by 50% and avoid non-essential air travel.

4.6. Wider community engagement

Science in the Square is an annual outreach event that is free for families and attended by 2-3000 each year. The event includes interactive talks and displays and forms an integral part of Falmouth Week. It involves approximately 70 volunteers at all levels (UG to senior academics).

Science of the Sea is an annual event held at the National Maritime Museum in Cornwall. This includes approximately 20 volunteers to deliver interactive talks and displays for children and families.

Science of Christmas is an annual event held at the local arts society near the Penryn campus. This year we collaborated with local schools to enable every child in every year 3 class in surrounding schools (7 primary schools) to attend. As a result, approximately 90 children attended to listen to interactive talks linking science to Christmas.

Soapbox Science. Female ECRs have been active in Soapbox Science events.

How Science Works is a collaboration with a local secondary school (Penryn) to work with all feeder Primary schools (7 in total). Our UG students visit the primary schools and the secondary school over four weeks to help the year 5 children design and carry out a science investigation and then produce a poster of their results. All the primary schools then meet on campus for a conference, which includes presentations from a student and from the secondary school and viewing the posters from other schools. This programme occurs twice a year in the autumn and spring terms.

Exeter Scholars. We host 20-30 sixth form students on a residential summer school each year. We also have 30-40 students from the south-west visiting approximately monthly over 5 months to learn more about Biosciences degrees.

Student-led activities. Our students lead an annual Bioblitz for local families to visit Penryn campus. Generation Wild is a student society to get children engaged and inspired about nature and the environment through providing environmental education sessions.

In addition to these large projects, we also host multiple ad hoc visits throughout the year. We visit 9-10 schools per year and have a similar number of visits from schools on campus.

Creative Exchange. An open studio in the ESI, where local artists collaborate with scientists on outreach projects. Recent examples include a collaborative project between a ceramicist and microbiologist, highlighting mine waste contamination and bioremediation.

Eden Project. Our microbiologists have been heavily involved in establishing and contributing to the Eden Project's Wellcome Trust-funded long-term exhibition "Hidden Worlds".

FoAM. We have extensive collaborations with Penryn-based FoAM an science/arts/technology education charity co-founded by Exeter Faculty, Amber Griffiths, to facilitate outreach and engagement. For example, Longdon (Wellcome Henry Dale Fellow) developed a computer game, VirusCraft, with FoAM, to help explain virus host shifts.

MRC CMM. The Centre has been involved in numerous events and festivals including British Science Week, Explorathon (European Researchers' Night) and MRC festivals. The Centre established a two and a half year exhibition, 'the Kingdom of Fungi', with staffed events at the Aberdeen Science Centre, and took part in the Royal Society Summer Exhibition (2016) with an ambitious and well received exhibit, leading to the Centre Manager winning the University's Principal's Prize for Public Engagement. Overall, the CMM reached in excess of 45,000 people through engagement activities over the last five years. The group has also developed two educational gaming apps about fungal disease, which are available on all App stores.

The Living Systems Institute held its inaugural open night with ~500 attendees to showcase research activities to the public.

MOOC. Bebber leads “Future Foods: Sustainable Food Systems for the 21st Century”, a free 12-hour course open to the public. It has been given a 4.6/5 review from users.

Life Magazine. Undergraduates from our degree programmes collaborate with Falmouth University students to produce a monthly natural history magazine, *Life*, which is popular both on and off campus and serves as an outreach vehicle for research in the department.

Grand Challenge. Annually, faculty and students in the department collaborate, with representatives from the Biosciences sector and beyond, in a week-long immersive Grand Challenge on topics including Food Security, Obesity, Depression and the Climate and Environment Emergency.

4.7. PGR & ECR training

Biosciences has a key role in delivering training across three GW4 DTPs (NERC, MRC, BBSRC), and one CDT (NERC Fresh). Specific examples include courses in bioinformatics, advanced statistics and toxicology. This training is delivered to the student cohort across each GW4 DTP. UoA5 is involved in (EvoCell, Insect Doctors and FunHoMic [based in Aberdeen]). Members of UoA5 have been involved in national and international training workshops, for example: EMBO practical course on Imaging of Neural Development, 2014 (Scholpp); FEBS course on Alternative Infection Models 2020 (Al Brown), BES Analytical tools for Microbial Ecology 2019 (Harrison).

4.8. Additional Contributions to the Academic Community

Editorial positions. (Examples out of >150). Editor-in-chief: The Cell Surface (Gow), Histochemistry and Cell Biology (Schrader). Editors: Food Security (Gurr), ISME Journal (Buckling), Development (Smith), Annals of Botany, Plant Physiology, Journal of Experimental Botany (Smirnoff), CRISPR journal (Westra), Cellular Microbiology (Gow). Guest editorships: Philosophical Transactions of the Royal Society (Thornton x2, Westra, van Houte).

Research council and funding committee appointments. BBSRC: Council Member (Gurr); Panel member (Chair: Gurr, Brown; Harmer, Smirnoff, Brand, Littlechild, Steinberg); BBSRC pool of experts (Buckling, Bonneaud, Westra, Stevens). ESRC (Mesoudi). EPSRC (Beardmore). NERC core panel member (Chairs: Boots, Blount; Buckling, Hosken, Cant, Gudelj). MRC (Titball). UKRI FLF Peer Review College (Raymond, Buckling, Currie, Schrader). ERC (Buckling, Boots). Royal Society: Dorothy Hodgkin (Wedell, French-Constant); Newton International Fellowship (Blount, Brand); International Exchange (Bonneaud, Wedell); Research Grants (Brand, Wedell); Challenge Grants (Gow). NSF-EEID (Gudelj). ESF (Hosken). ASAB (Kelley). Philip Leverhulme Prize (Field). Mentorship Schemes: BBSRC Discovery (Lead: Young; Bass, A. Wilson); Royal Society URF/Dorothy Hodgkin (Buckling); NERC NBAF advisory board (Wedell); REF Panel (Gow, Hosken).

Seminars and Conferences. 96 conference/workshop organising committees and 36 session chairs. Members of the UoA have been invited to >500 talks at academic institutions, conferences and workshops, including: Association for Animal Behaviour Tinbergen Lecture (Wedell), Behaviour 2019 (Boogert), Resistance 2019 (Bass), GRC Immunology of Fungal Infections 2018 (Coelho), GRC Urbanisation, Water & Food Security (Ellis), International Sea Turtle Symposium 2015 (Broderick), GRC Fungal Immunology & Royal Society Discussion Meeting 2019 (Gow), American Academy of Microbiology 2017 (Gurr), International Thermophile Meeting 2017 (Littlechild), European Ornithologist's Union 2015 (Tschirren).

4.9. Additional Stakeholder Contributions

Vector-Bite RCN advisory board (Boots). Chair of Scientific Advisory Board and Council member, The Sainsbury Laboratory; CIFAR “Fungal kingdom: threats and opportunities” Advisory Board (Gow). Birmingham City Council Food advisor security / Waste (Gurr). Cell Therapy Catapult Academic Advisory Board; AstraZeneca, Stem Cell and Primary Cell Advisory Group; EMBL Council Working Group on Human Embryonic Stem Cells and Embryo Research

(Smith). Expert Reviewer – HM Government Office for Science: Future of the Sea (Broderick). Scottish Government Plant Health Advisory Board (Gurr). Member of the ACRE committee of DEFRA on biocontrol agents (Raymond).

4.10. Additional Marks of Esteem

Appointments in Learned Societies. (Examples out of 44). Fellow of the Royal Society (Gow, Smith, G Brown). President of the Microbiology Society, President of British Society for Medical Mycology; President of ISHAM, Fellowship of the European Academy of Medical Mycology (FECMM), 2019 (Gow). President of the International Society for Behavioural Ecology; President elect of European Society for Evolutionary Biology (Wedell). President of the Association for the Study of Animal Behaviour (from 2020, Hosken). Treasurer for the Society for Experimental Biology (Love). Royal Society Public engagement committee (Kelley). Vice-chair European Section of Applied Biocatalysis (Littlechild).

Awards and Prizes. Clarivate Analytics Highly cited researcher; Sir James Black Medal (Royal Society of Edinburgh); British Mycological Society President's medal; D.Sc. (Honorary), University of Kent, 2018 (Gow). Microbiology Society Fleming Medal; Phillip Leverhulme Prize in Zoology; Finalist for the Blavatnik Award for Young Scientist 2020 and 2021; Heineken Award (Westra). Royal Society Wolfson Merit Award holders (Wedell, Cant, Buckling). Otto Hahn Medal of the Max-Planck Society (Daum). ASAB Outstanding New Investigator Award (Kelley; Tregenza). The Palaeontological Association 2018 Hodson Award (Ma). McEwen Award for Innovation, International Society for Stem Cell Research (Smith). Zoological Society of London (ZSL) Scientific Medal (Buckling, Hosken, Stevens). ZSL Marsh Award for Marine and Freshwater Conservation 2019 (Broderick). Fungal Biology Research Award of the British Mycological Society (Steinberg). EMBO Young Investigator Award (West). Genetic Society (UK) Mary Lyon Prize (A. Wilson). Finalist in the 2014 BBSRC Innovator of the Year Award for the production of retail-grade diesel in bacteria (Love). Members have been on a range of national and international award committees. Recent sabbatical awards include 1- year fellowships at Wissenschaftskolleg zu Berlin (Cant, Lamba).

In summary, our strategic investments in staff and facilities, and the processes we have in place to create a nurturing and dynamic research culture have achieved our goal of making the UoA both a national and international centre of research excellence across the biological sciences.