

Institution: University of St Andrews



Unit of assessment: UoA 01: Clinical Medicine

1. Unit context and structure, research and impact strategy

1.1 Unit context

Emerging from a forty-year hiatus, the University of St Andrews' School of Medicine (SoM) was re-established in 2002. Since then we have been working with other world-leading research groups in the University to develop a collaborative, focused, and agile environment that enables internationally leading clinical research again. We recognise that, as a relatively small and geographically isolated institution, we need to concentrate our research in our core successful areas and exploit interdisciplinary opportunities within and external to the University. Clinical Medicine is an increasingly broad and interdisciplinary subject area, and we maintain excellence by playing to our strengths. In the first half of 2017 the expanding we established a divisional structure to replace the single administrative entity which had served the school well in its first 15 years. These divisions work in established areas of research strength, facilitating increased collaboration within the SoM and other Schools with cognate interests. Most of these are co-located at the North Haugh Science Campus in St Andrews which has facilitated the formation of eight interdisciplinary research entities in strategic areas (see Figure 1) and described in greater detail in section 3.2.

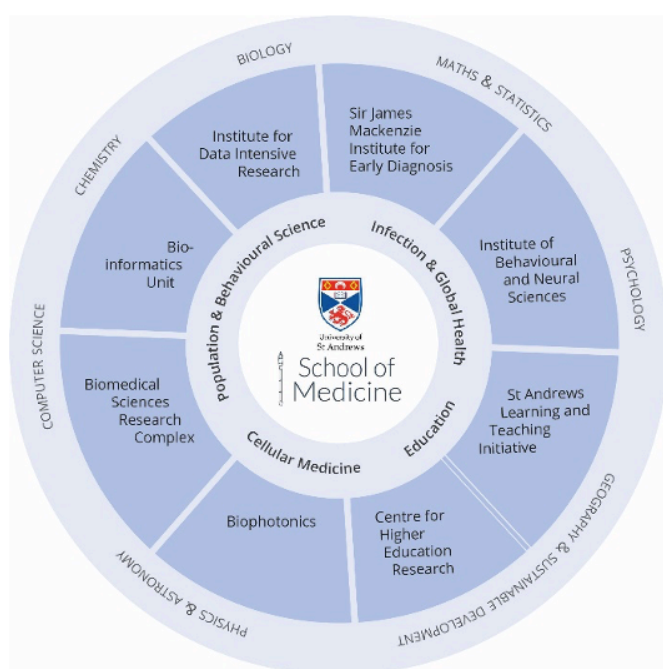


Figure 1: Interdisciplinary Research

We also have extensive links with academic partners nationally and internationally, with the NHS locally and nationally and with a wide range of industrial partners. Although a variety of pre-clinical and clinical research is undertaken in these interdisciplinary institutes, centres and units, the principal focus in the current REF period has been to increase the quality and focus of clinical research, culminating in the opening of the **Sir James Mackenzie Institute for Early Diagnosis in 2019**, which brought together research groups based within the SoM and seven other schools. Our agility and resilience have been exemplified during 2020 through the rapid development of new projects or repurposed work on more than fifty Coronavirus related research projects across the translational spectrum which is described in greater detail in section 1.3.

Unit Structure

The Medical School has a research capacity of 27.9 Category A staff and 1 independent Category B staff working in three divisions:

- **Infection and Global Health** (6.9 FTE Cat. A staff)
- **Cellular Medicine** (13.6 FTE Cat. A staff)
- **Population and Behavioural Science** (8.4 FTE Cat. A staff)

1.5 further FTE are being returned in UoA1 one from Computer Science (**Kelsey**) and a joint appointment with Mathematics & Statistics (**Lynch**). We have a fourth Research Division in Education but their staff are not being returned within this UoA.

Each Division, described in greater detail below, is formed from coherent research groups and has a Head (HoD), Deputy Head and dedicated administrative support. HoDs report to the Dean (**Crossman**), Director of Research (**Sullivan**) and Director of Impact (**Holden**). Continuing integration across the divisions is encouraged through school level meetings, seminars and training with an inclusive **Research and Impact Management group** that oversees delivery of the strategy, and adjudicates investment in priority areas by evaluating funding requests.

Infection & Global Health (IGH)

The Infection and Global Health Division (Head **Holden**) focuses on tuberculosis, pathogen genomics, antibiotic resistance, and innovation in diagnosis. It leads several international trials of novel regimens to shorten TB treatment and to address multiple drug resistance described in section 3.1. As the genomic leads for the Scottish Healthcare Associated Infection Prevention Institute (SHAIP) consortium, a near real-time sequencing (nRTS) facility in the School has been established, which has been used by NHS partners (NHS Grampian, Tayside, Fife), the Wellcome Sanger Institute and international collaborators, to detect outbreaks of healthcare associated infections across Scotland, and further afield. Building on this, Infection Group members have key roles in the implementation of sequencing into the Scottish Microbiology Reference Laboratories and NHS SARS-CoV-2 sequencing service, serving as advisors to Health Protection Scotland and helping build the business case, devising an end-to-end implementation process and overseeing its roll out within the laboratories. The Division's antimicrobial resistance work is diverse and interdisciplinary, from collaborations with the School of Chemistry to evaluate novel antimicrobial compounds, through to the development and use of novel technology to understand the biological and molecular mechanisms of resistance with partners in the School of Physics, to leading large scale teams in Africa, (HATUA consortium) marrying microbiology, genomics and social sciences to understand the burden and drivers of antimicrobial resistance (AMR) in UTI patients, and investigating the impact of COVID-19 on AMR (CARE consortium). The Division was recently funded by Global Challenges Research Fund (GCRF) to establish the St Andrews–Africa Research (StAAR) health network for interdisciplinary research in biomedical and social sciences. as a mutual partnership between University of St Andrews and research institutions in East Africa.

Building on our microbiology capability the division has developed ground-breaking technologies to address antibiotic resistance. The first, called SLIC has received several awards including a Longitude Prize Discovery Award and the Scottish Life Sciences Alliance Innovation of the Year Award. This can perform susceptibility tests in less than 30 minutes and diagnose urinary tract infection giving antibiotic sensitivities in 15 minutes. The University has spun-out a company following international investment valuing the company at \$20m. The second, the molecular bacterial load assay (MBLA) is a two-hour method to detect and identify Tuberculosis and enable treatment responses to be followed in real-time. This test is being made available for researchers and trialists through a spin-in company "vital Bacteria", which is being prepared for wider commercial exploitation through collaboration with LifeArc (formerly MRC Technology).

Global Health Researchers within the Division, develop and evaluate new diagnostic tools and techniques. This includes the Arclight ophthalmoscope a suite of low-cost tools being developed and evaluated for implementation in low- and middle-income countries (LMICs).

Cellular Medicine (CMed)

The Division of Cellular Medicine (Head **Pitt**) combines basic and clinical research with the goal of understanding the cellular and molecular basis of disease. The overarching aim of the Division is to innovate and improve current diagnosis and treatments to drive discovery in areas that are underserved by contemporary medicine. The Division currently comprises 13 PIs, of which 3 are active clinicians, one is a joint appointment with the School of Mathematics, and three are externally funded Research Fellows (Royal Society, Royal Society of Edinburgh and NHS Lothian). In recognition of their world-class research contribution, one research fellow (**Paracchini**) was elected a Fellow of the Royal Society of Edinburgh (2019) and was promoted to Reader, one Research Fellow was promoted to Senior Lecturer (**Pitt**) and the other Research Fellow was recently promoted to Lecturer (**Caie**). These promotions highlight the desire by the

Division and School to nurture the development of the next generation of future leaders with the support that the School has from the University.

The Division of Cellular Medicine is tightly integrated with other Schools and Centres (Biomedical Sciences Research Complex, The Institute of Behavioural and Neural Science and the Centre of Biophotonics, across the University with collaborative projects, high impact outputs (Nature Communications, Nature Photonics, Nature Cell Biology, etc.) and shared PhD studentships. For example, collaborations with the Schools of Physics and Chemistry have developed a number of novel technologies including label-free photonic techniques to characterise immune cells in the blood, wide-field light-sheet imaging approaches that improve visualisations of complex neural tissue, development of nanolasers for deep tissue measurements of contractility in whole heart and live tissue slices, the use and development of Pulsed Electron-Electron Double Resonance approaches to determine protein structure (including that of membrane proteins), Mass Spectrometry and elastic resonator interference stress microscopy to detect mechanical forces at the pN scale. These are apparent in the use and development of quantitative proteomic approaches by several groups to answer clinically important questions, including the identification of prognostic and diagnostic biomarkers for disease (e.g. oesophageal cancer and Covid-19). Collaborative work utilising world leading lipidomic approaches to understand metabolic diseases is also ongoing with colleagues in Biology.

Collaborations between the Division and the School of Mathematics and Statistics have been strengthened by a joint appointment (**Lynch**) working in the application of high-throughput molecular technologies to address biological and clinical questions in cancer as part of the International Cancer Genome Consortium and PanProstate Cancer Group consortia. The Division has provided research projects for several MSc students from Mathematics and Statistics, and there are mutually beneficial interactions with PhD students from the Statistical Medicine and Molecular Biology research group.

The Division also works to strengthen clinical research through the development and use of novel technologies and establishing next-generation infrastructure. Examples of this are more fully described in Section 4.2.

Population & Behavioural Science (PBS)

This Division (Head **McCowan**) is focused on high quality research in the fields of health data science, trials and behavioural interventions delivered in the community and other health care settings. Through this work the Division aims to better understand and subsequently improve the health of populations, individual children, adolescents and adults. The methods we use include advanced health data science on routinely collected linked datasets and surveys, developing and evaluating public health and complex behavioural interventions and delivering community based clinical trials. Its membership includes eight PIs, nine post-doctoral fellows and six PhD students.

The Early Detection of Lung Cancer in Scotland trial of an autoantibody biomarker in 12,209 subjects (ECLS, **Sullivan**) is an exemplar of a complex clinical trials based in the community trial which uses advanced Electronic Medical Record and Data linkage Methods to identify potential trial subjects and ascertain end points using routinely collected data. Senior members of the group work within Health Data Research UK and **McCowan** leads the £1m MUR-UK national project, Measuring & Understanding Multimorbidity using Routine Data in the UK.

The Division has hosted the World Health Organisation (WHO) Collaborating Centre for International Child and Adolescent Health Policy since 2013 (**Humphris, Inchley, Currie**) and the Health Behaviour in School-aged Children (HBSC) International Research Network, which is an international study devised and conducted by a network of 428 members from 50 countries in partnership with the World Health Organisation.

Health Psychology PIs within this division undertake world-leading research on management of Fears of Cancer Recurrence (**Humphris, Ozakinci, van Beusekom**), smoking cessation and tobacco control policy evaluation (**Currie, Ozakinci**) obesity (**Cecil, Williams, Currie**) and physical activity (**Ozakinci**).

Using diverse approaches and methodologies, such as neuroimaging, neurocognition, big data, linked data and clinical characteristics, the addiction medicine research portfolio (led by **Baldacchino**) is able to analyse very rich data with colleagues from Scottish Universities, the global ENIGMA Addiction group and other international consortia to identify biosignatures –a set of biomarkers– that, when applied to individuals and populations, will produce better diagnosis, endophenotypes as well as tailored interventions for better outcomes in the field of opioid, tobacco and alcohol dependencies.

The group also contributes to major ophthalmology trials such as, the Efficacy and safety of cross-linking in children with Keratoconus (KERALINK) Phase 2 clinical trial, the Randomised Comparison of Femtosecond Laser Assisted vs Manual Phacoemulsification Cataract Surgery Trial (FACT) and the Treatment of Advanced Glaucoma Study (TAGS). The latter is a multi-centre randomised controlled trial comparing primary medical treatment with primary augmented trabeculectomy for people with newly diagnosed advanced glaucoma (all **Burr**).

1.2 Achievement of Strategic Aims

Our strategic approach has emphasised growth in original, rigorous and impactful research integrated, wherever possible, across the divisions and with research in other Schools in the Science Faculty and the School of Geography and Sustainable Development. The University has recognised the value of our collaborative approach and its strategy for 2018-2023 has made **Health, Infectious Disease and Wellbeing** one of the five priority areas for investment in interdisciplinary research.

Strategic growth

Our research strategy in the current REF period has been to grow clinical research with new appointments in General Practice (**Sullivan & Hernandez-Santiago**), Psychiatry (**Baldacchino**) and Ophthalmology (**Blaikie**). These have been complemented by investment in non-clinical senior positions in Health Data Science (**McCowan**) and Public Health (**Williams**).

In **REF2014 16FTE** were submitted to UoA1. We have increased the number of staff returned to **30.4FTE**—almost double the previous submission. The annual number of our publications has increased from 111 a year in the last REF period to 220 annually in the most recent full year and the quality of our outputs has also significantly improved. **60.3% of our annual publications are in the top 10% of cited journals and 33.7% are in the top 10% of cited papers (SciVal data)**. 55% of our publications have international authorship demonstrating the global reach of our research. Our impact cases demonstrate how our integrated strategies and selective research investment support high quality research.

1.3 Research & Impact strategy

Our Research and Impact Management committee is chaired by the Directors of Research and Impact, respectively and are assisted by the School's Research Support Lead. It includes a range of divisional representatives and two early career researchers (composition designed to span our research centres). The team assists and encourages staff in developing the impact of their research, reviews impact case studies from all parts of the School and coordinates with the University's Research and Innovation Services.

The Child & Adolescent Health Research Unit is the **WHO Collaborating Centre for Child & Adolescent Health**. Its work is used in several international policy initiatives. Our Infection & Global Health Research (IGH) group facilitates research in developing countries and members have significant impact through their work on the effects on Tuberculosis and Antimicrobial Resistance and novel eye examination tools. Members of all divisions work closely with governmental departments and regulators worldwide to address specific issues.

Since the **COVID-19 pandemic started**, Prof. Gillespie and Dr Cevik have provided scientific input to the Chief Medical Officer for Scotland on COVID-19 and they serve as members of the New and Emerging Respiratory Virus Threats Advisory Group (NERVTAG)- an expert committee of the UK Department of Health. Prof. Holden took up a more substantive secondment in Public Health Scotland and has been responsible of the integration of SARS-CoV-2 genomics into the UK public health response. This Department of Health and Social Care funded consortium is working in partnership with the NHS, the four devolved UK Public Health Agencies and NHS Track and Trace to sequence SARS-CoV-2 genomes as part of the UK COVID-19 response and Prof. Holden serves as a member of the steering group. Prof Holden has been the strategic lead for the development and implementation of an NHS SARS-CoV-2 sequencing service for Scotland for COVID-19 outbreak detection and incident investigation (see Institution-Level Environment Statement, ILES, 1). Additional funding from NIHR (Powis, Holden), UKRI (Pitt), SFC (Stewart, Paracchini, Humphris) and CSO (McCowan, Bowness) have enabled a range of projects across the translational spectrum from the detection and sequencing of SARS-CoV-2 derived HLA-I bound antigenic peptides, development of anti-virals to modelling of the spread of disease within and across households.

1.4 Details of future strategic aims and goals

Planned new growth areas will be addressed by developing strategic and productive partnerships with colleagues in other schools and world-leading collaborators. Our goal over the next five years is to **double research productivity** by increasing postgraduate student numbers (e.g. in clinical and basic science Doctoral Training Programmes) and converting large project grants into programmes of research as well as leading more large, multi-institutional consortia. We are negotiating with a Chinese Ministry of Education Class A Double First-Class University about opening an Institute of Early Diagnosis linked with the Mackenzie Institute and with a Middle Eastern University over a joint Doctoral Training Program.

It is anticipated that the Scottish Government will shortly pass the necessary legislation to enable St Andrews to award a Primary Medical Qualification again. This will enable students on our graduate entry undergraduate medical course (ScotGEM), which started in 2018, to enter foundation year one in 2022. In turn, this will allow us to participate in the clinical academic track structures within Scotland: the Scottish Clinical Research Excellence Development Scheme (SCREDS). These include access to Academic Foundation posts, SCREDS lecturers, Clinical Doctoral Training Programmes and post-doctoral fellowship appointments.

In the current REF period, our existing Masters' in Medical Research and Health Psychology degrees have been joined by an MSc. in Digital Health (with the School of Computing) and we are planning an MSc. in Global Health and an MSc in Health Professions Education. Intermediate fellowships for Early Career Researchers have been created by the school and postholders will be supported to apply for externally funded senior UKRI and charity fellowships.

2. People

2.1 Staffing Strategy and Staff Development

Staffing Strategy

Staff numbers in the medical school have increased significantly as shown in Table 1 below during the current REF period with targeted growth in the numbers of early career staff and a higher proportion of research active staff. In order to attract and retain excellent clinical staff to support the expanding, more clinically-orientated school we have targeted strategic investment. Since 2014 we have started to expand the research-active staff complement within Clinical Medicine. The plans are based on three broad principles:

1. International excellence will only be gained in the context of a University the size of St Andrews by aligning the SoM's strategic ambitions with the existing strengths of our excellent Science Schools.

2. Academic appointments with a research component to their post are made to complement existing strengths and planned developments.

3. Our school is evolving through engagement with community-based medical practice.

Table1. Numbers and gender of staff in the medical school

	FTE		% Female	
	REF2014 01/08/2013	REF2021 31/07/2020	REF2014 01/08/2013	REF2021 31/07/2020
Professor	8.90	10.20	22.5%	7.8%
Reader	2.00	3.60	0.0%	16.7%
Sr Lecturer	5.40	11.90	37.0%	54.6%
Lecturer	7.00	13.20	42.9%	54.5%
Post-Doctoral Research Fellow	14.80	15.60	54.1%	53.2%
Other Research Fellow	2.00	4.00	50.0%	75.0%
Research Scientist	1.00	2.00	0.0%	50.0%
Total	41.10	60.50	38.9%	45.3%

Staff Development

Faculty

The Unit of Assessment is comprised of a productive mixture of early career staff and more senior researchers, which provides a vibrant research atmosphere and bodes well for our future. The staffing strategy aims to use our existing and emerging strengths to attract outstanding researchers who will complement and expand our expertise, and then support their development as world-class researchers. The success of this recruitment strategy is evidenced by the progression of staff recruited during the previous REF period and additionally, by the appointment of 26 Early Career Researchers from around the world. We also have excellent staff retention rates. We currently have an Industrial post-doctoral fellow (**Hammond**) and an MRC funded fellow with an Academy of Medical Sciences Springboard award (**Bowness**), an NHS Research Scotland Fellow (**Hernandez Santiago**) and an independent Early Career fellow on a transitional award (**van Beusekom**). We have plans for further appointments, in areas relevant to Early Diagnosis, and are aiming to recruit people at the interfaces of groupings to facilitate further collaboration.

Staff Induction

Following feedback from an internal review conducted in 2015, the school has created a bespoke induction process for both staff and PhD students. An information document is available to staff prior to their arrival in St Andrews. An induction schedule is drawn up for the new individual with introductory meetings and tasks pertinent to their position. They are also assigned a buddy, who is usually a peer with whom they will not work directly.

Staff development

At the University level this is co-ordinated by the **Organisational and Staff Development Service (OSDS)**.

Staff training courses and events. The University and Schools runs staff training sessions, which cover a range of research-related topics, such as how to obtain funding and how to write grant applications and peer reviewed publications. Our bioinformatics networking and training workshops are run twice and once a year respectively and are open to all schools. All supervisors of research students and staff are required to attend supervisor training events to receive updates on supervision best practices.

Annual review procedures. Each Principal Investigator (PI) has an annual review meeting with the Head of Division. All members of contract research staff undergo an annual progress meeting with their PI, which includes career planning.

Mentoring schemes. Probationary academic staff members are required to have a mentor, and all staff are encouraged to seek mentoring from colleagues in their own school or other schools.

Financial support for contract research staff. Staff are given a school-funded consumables budget based upon number of PhD students supervised, which can also be used for travel. In addition, all can apply for a travel award when presenting at conferences.

Impact Leave. PIs are encouraged to apply to the Head of School for leave to allow staff to focus on research or impact activities. Applications are collated and awarded following a transparent review process by senior academic staff members within the School (HoS, DoR, DoT and Director of EDI).

2.2 Support and Supervision of Early career researchers and research students

The school has a lively postgraduate community currently comprising 24 post-doctoral researchers (PDRAs) and 48 PhD students, 35 of whom are externally funded from a variety of funding bodies detailed below. The school has a robust and integrated research student culture with weekly Divisional research seminars and active participation in the North Haugh Campus seminar series (e.g. the Biological Sciences Research Complex involving researchers from Medicine, Biology, Chemistry and Physics). Postgraduate Research students and post-docs are actively engaged in these activities, and this forms an integral part of their training. PIs within the Divisions contribute to external training programmes building the research base nationally and internationally (e.g. Physiological Society, European Molecular Biology Organization., the Scottish Universities Physics Alliance).

Postgraduate students have monthly lunchtime meetings where they have an opportunity to give short presentations on their work to their peers. All postgraduate (including taught) students and medical demonstrators are invited to attend these meetings. The Divisions also all run weekly research in progress meetings where postgraduate students present their work alongside other staff.

Student experience is assessed annually, and the 2019 results show that a large majority of postgraduate students (80%-100%) are highly satisfied with their programme.

Funding

Postgraduate student numbers: Our current cohort of 48 research postgraduates is diverse, originating from 21 different countries, and were admitted with excellent first degrees and masters' qualifications. Competition for funded places is very strong. This cohort comprises individuals working towards a PhD. **At 01/01/14 we had 21.5FTE** of PhD students (20 full time and 3 part time) on **01/01/20 we have 40FTE** 75% of which are externally funded. Each PI has PhD students and 0.24 PhD students graduate annually for each FTE submitted to REF.

Studentship funding sources: During the REF period the School has received PhD studentship funding from a wide range of sources, including the MRC, ESRC, EDCTP, Commonwealth Scholarships, CSO and the University of St Andrews Scholarships scheme. The School has obtained PhD studentship funding from industrial partners including as part of the Industrial Centre for Artificial Intelligence Research in Digital Diagnostics (iCAIRD) (Bering, Canon, Deep Cognito Ltd, Glencoe Software, Intersystems and Kheiron Medical Technologies). PhD scholarships also have been provided by charitable organisations, often in collaboration with the charity themselves, including the BHF, Tenovus, Carnegie Trust, Melville Trust and Cunningham Trust. Our students have received funding from government and charitable organisations in Chile, China, Columbia, Indonesia, India, Japan, Kuwait, Lithuania, Norway and Turkey. The School directly funds 8 PhD studentships each year from its annual budget.

Table 2 PhD funding sources

Year	BEIS Research Councils (The Royal Society, British Academy and The Royal Society of Edinburgh)	UK-based charities	UK Government, industry and other UK sources	EU	Non-EU
2013/14	21%	14%	43%	20%	2%
2014/15	23%	11%	45%	21%	0%
2015/16	20%	19%	50%	8%	3%
2016/17	17%	21%	49%	11%	1%
2017/18	18%	23%	46%	10%	3%
2018/19	19%	21%	45%	11%	3%
2019/20	11%	11%	29%	49%	0.5%

Supervision, training and student engagement:

Student representatives sit on the School Council, Postgraduate Committee, Research Committee, EDI Committee and Staff-Student Consultative Committee. The **Centre for Educational Enhancement and Development (CEED)** provides exceptional support for students through mentoring, professional development training (Passport to Research Futures; designed around Vitae's Researcher Development Framework), Patient and Public Involvement (facilitated by SoM's Community Advisory Council and Design St Andrews network), and professional support. All PhD students are assigned a Second Supervisor (sometimes across schools and sometimes a 3rd supervisor to enable more junior post-doctoral staff to develop their skills), who is responsible for monitoring student progress and providing academic support. Student progress is monitored via reports at the end of the first year to determine progression to the second year by the monitoring committee comprising of a convenor and tutor, which review the student and supervisors' written reports and meet thereafter. All information is made available for students in the School's Postgraduate Handbook and students can access their own annual reports in Module Management System (MMS) and discuss these with their supervisors.

Within the School we provide access to a comprehensive Postgraduate Training Programme, which consists of subject-specific, professional skills courses and other training events. Each year, postgraduates give a 30-minute Work in Progress (WiP) talk and produce a poster for the Postgraduate Research Session in the School. Specific training programmes for individual students are agreed annually with supervisors, and students keep a record of all their training activities in a Postgraduate Logbook. The School's Postgraduate Statistics Advisor is available and holds drop-in sessions to support statistical training. All postgraduate research students are provided with a desk and workstation, and supervisors receive funding to support basic research expenses, including UK conference attendance and visits to external laboratories. The School's Research Student Travel Fund provides support for attendance at international conferences. Students are encouraged to attend the School Seminars and a lunch is provided free of charge at each of these to facilitate interaction with speakers. Students are also invited to attend other meals with the speakers, with student costs supplemented from the School budget. Postgraduates also participate in the annual research meeting of the school. As part of the school-based Virtual Learning Environment (Galen) timetabling system for taught students, there is an e-portfolio area which each of these postgraduate students has access to in order to record their work and achievements. 60% postgraduate students go on to full time employment 20% to part-time employment and 20% to further study.

2.3 How we promote and Support Equality, Diversity and Inclusion (EDI)

In recognition of its ongoing commitment to EDI, the SoM has appointed a Director of EDI (ILES, 3.1) whose status is equivalent to the Directors of Teaching and Research. This post supports the vital work and a strategy to deliver on our School's vision is currently under development. The School currently holds an Athena SWAN Bronze award and delivery of our 2016 Athena SWAN action plan and ambition for accreditation informs part of our overall EDI strategy. A

School Athena SWAN began to meet in November 2019 to prepare for an award application in November 2021. The School follows all recommended guidance in the University Code of Practice, and we offer leave to researchers with parenting or other special circumstances. Our School is highly supportive of staff with a diversity of needs and requirements. We encourage informal flexible and remote working when feasible (over 70% of our research staff report that they work flexible hours). We support both reduced hours and annualised hours contracts when feasible. We have recently formalised our flexible working policy in the School Handbook and have included case studies of staff who have benefitted from flexible working on our EDI pages.

Some of our initiatives 2014-2020 have included:

- Development of a comprehensive and transparent workload model to balance workload across research, teaching and administrative load for all staff.
- Annual verification that there are no inherent gender, age or other biases introduced inadvertently by School policies
- Continued revision of the structure of the workload model to maximise transparency, fairness and utility.
- Development of undergraduate tutorials dealing with unconscious bias and disability issues.
- 50% of seminar programme speakers are women
- Development of a checklist for advertising material to ensure as wide as possible a pool of applicants is notified and that we equally encourage applicants of all backgrounds.
- An Unconscious bias training refresher prior to interviewing prospective undergraduate students.
- Support for junior researchers in grant applications in terms of review and feedback, and providing recent exemplars of successful grant submissions
- Increased support for those taking leave, in terms of consultation, potential formal support (e.g., assistance for experimental work during leave), and reduced teaching load upon return from leave.
- Regular engagement at institutional level in terms of suggestions for policy revision and improvement. We have provided comprehensive feedback on family-friendly policies and support available for staff taking leave (see examples below).
- Our **Gateway to Medicine** is a one-year programme intended to promote the uptake of higher education, specifically the study of medicine, among those groups that are traditionally underrepresented at university. The Gateway provides the opportunity for pupils resident in Scotland who have completed S5 at school to study at first-year undergraduate level. Those who pass the course and meet the other requirements for progression will transfer into the six-year **Medicine A100** course.

In order to not disadvantage staff on reduced hours, we have initiated school core hours of 9.15am–2.45pm (based on school hours for local primary schools). All departmental meetings and seminars are held within these times. Social gatherings are mostly held during working hours (e.g. reception to welcome new students, graduation party, poster session for 3rd year students). We have a few staff for whom disabilities makes sitting in theatre-style venues particularly difficult. We have introduced live streaming of high-profile lectures and other training material which we have expanded when Covid restrictions were imposed and have received very favourable feedback on this.

Support for those taking or returning from leave

We have initiated a more formal support structure for those taking leave, with consultation meetings with the director of EDI and with the Director of Research and the Head of School. The former ensures that staff are aware of opportunities (e.g., the University Caring Fund is available to support staff with caring responsibilities associated with attending events as part of their role). The latter evaluates any support from the School that would help minimise any career impact of taking leave (e.g. phased return to work, technical support requirements, supervision and continuance of research while on leave).

Career Pathways for Staff

In 2017, the School strengthened mentorship and established a gender-balanced panel to provide support on promotion applications and promotions procedures. Much of this activity has continued or has been adapted for online delivery. Positive results of these actions are now emerging. We have seen much-improved submission and success rates in the promotion process. In 2020, we initiated an annual promotions workshop to increase understanding and encourage appropriate representative engagement with the promotions process.

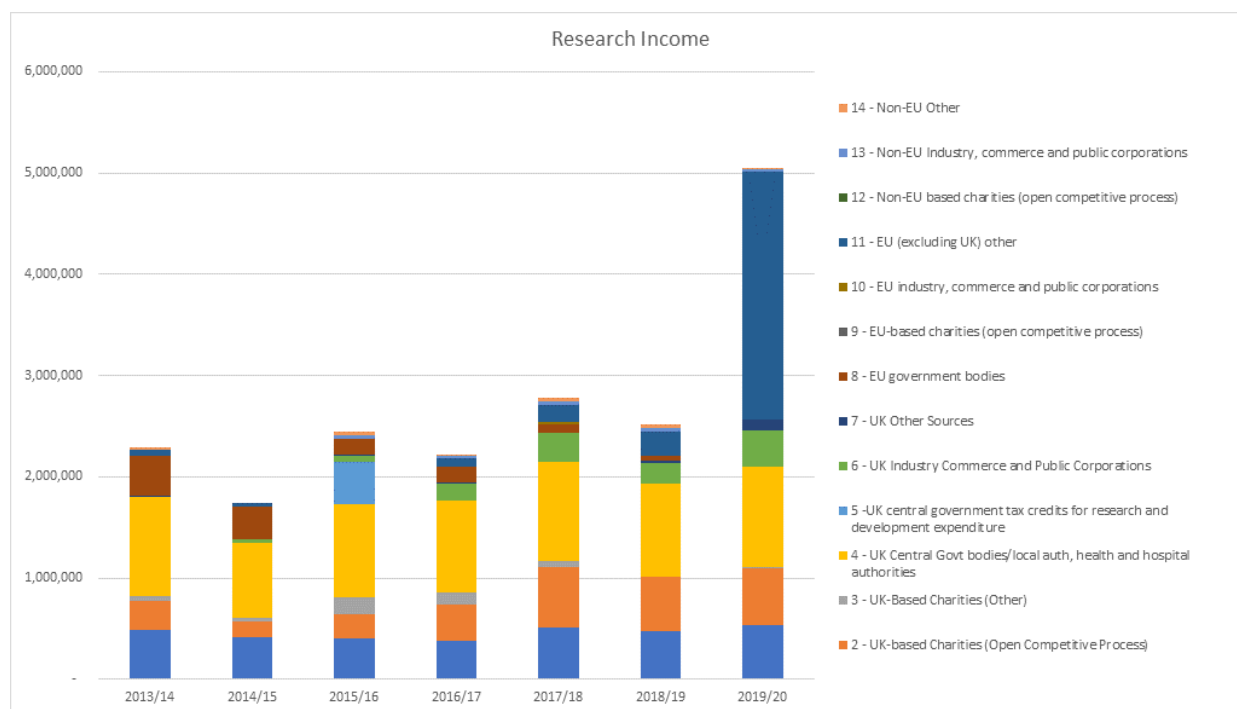
3. Income, infrastructure and facilities

3.1 Income

Grant income

Our grant income in this REF period has more than trebled from £6.8m in REF 2014 to £24.3M compared to the REF2014 period. The annual grant income figures are shown in Figure 2 and an analysis of the grant sources in Ref 4B shows that our research council income has grown by 11.3% charities' income has almost doubled and there has been a recent major growth in recent EU funding.

Figure 2 Annual Grant Income

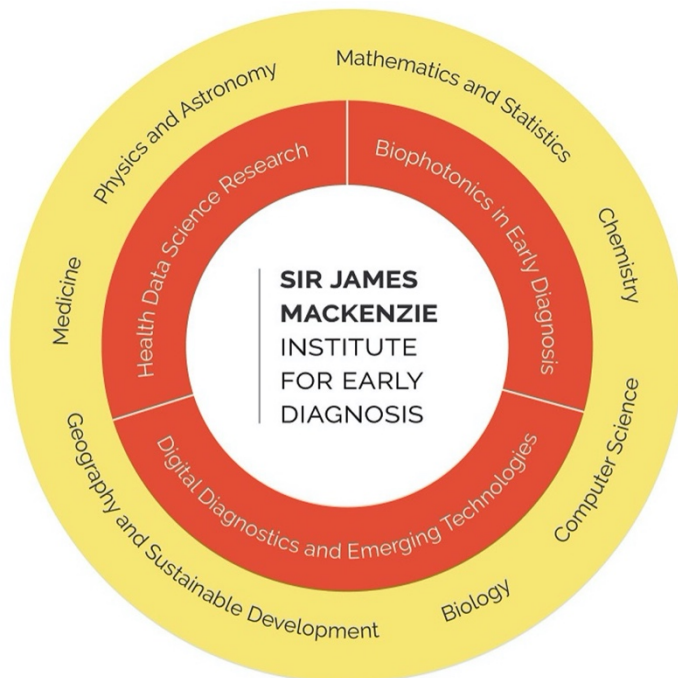


Our income data includes funding allocated to St Andrews for **world leading collaborations** on projects where spending is spread across multiple organisations. Examples include: Simplified Short Treatments for Tuberculosis, (PanACEA 2 Pan-African Consortium for the Evaluation of Anti-tuberculosis Agents, €16.5M, SimpliciTB Consortium European Developing Countries clinical Trials Partnership (EDCTP): €12M; Food Security & Health in East Africa EPSRC £1.1M, Harnessing natural product diversity to combat multidrug-resistant pathogens (£1.5M SA UK Newton Fund Antibiotic Accelerator Initiative) (all **Gillespie**); the Holistic Approach Towards Unravelling Antibiotic Resistance in East Africa, HATUA Consortium: MRC: £3M, SHAIPI CSO, £4.2M, CARE: COVID-19 and Antimicrobial Resistance in East-Africa—impact and response, NIHR, £900k (all **Holden**), The Industrial Centre for Artificial Intelligence Research in Digital Diagnostics (iCAIRD: £15M **Harrison**); The Early Child Protection work with families at risk Project (ERICA), EU 2020: €450K; Assessing prescription opioid overdose risk (POOR) via a

quality improvement process led by NHS Fife Pharmacy and scoping the feasibility of a specific overdose prevention intervention delivered by Community Pharmacists. Functional and structural neuroimaging and neuropsychological consequences of chronic suboxone use (NEMO), Indivior, £275K; A systems approach to exploring syndemic health and social condition clustering among individuals who experience a drug-related death (DRD): Developmental work for co-produced intervention(s), (CSO) £277K (all **Baldacchino**), The Early detection of Lung Cancer Scotland (ECLS) trial £5M and the Scottish Health Research register (SHARE £1.2M) (both **Sullivan**), the CRUK Prostate International Genome Consortium Project (£1.7M **Lynch**) The Health, Behaviour in School Age Children Survey from NHS Scotland (£800K **Inchley**) and the Health Data Research UK National Multimorbidity Resource £1.1M (**McCowan**).

3.2 Infrastructure

One of the main research infrastructure initiatives during this REF period was the creation of the **Sir James Mackenzie Institute for Early Diagnosis**. The institute has three main research platforms: Health Data Science, Advanced Digital Diagnostics & Emerging Technologies and Biophotonics in Early Diagnosis.



The Institute offers an inspiring and supportive environment committed to fostering ideas, sharing of knowledge and skills with a focus on earlier diagnosis of human disease. Academic staff retain offices and laboratories in the schools to which they belong initially. Postgraduate and postdoctoral students within the schools involved have shared space that enables collaborative links to develop. Its objectives are to develop, test and implement research programmes which have the capacity to achieve substantial improvements to early diagnosis in four clinical areas: Infection, Cancer, Cardiovascular Disease and Mental health

We are also heavily involved in interdisciplinary research in several interdisciplinary communities of

researchers in St Andrews which have been in existence prior to the current REF period.

In 2012 **Paracchini** established, and has since led, the **St Andrews Bioinformatics Unit (StABU)** which supports the analysis of genetic and functional genomics data. The infrastructure was funded and supported through two consecutive Wellcome Trust Institutional Strategic Support Fund awards (total of £325K). The Unit is managed by a committee with representatives of the Schools of Medicine and Biology which include most of the user base. An economic plan based on grant recovery and sustainability charges has ensured the maintenance and expansion of the hardware and long-term sustainability with the appointment of a full-time dedicated bioinformatician). In addition to managing a dedicated cluster and supporting data analysis, StABU has further developed its scope and has now become a key asset for the St Andrews bioinformatics community, by providing a networking platform and training opportunities. Since its establishment, StABU has supported researchers spread across different Schools with 50 grant submissions leading to a total of £4.5M funding. Given the increasing demands in this area as well as in data-driven research across disciplines, the University has invested £325K in improving our High-Performance Computing capability by merging the existing bioinformatics cluster and a maths/chemistry cluster to enable new collaborative work. This improved capability provides key infrastructure to deliver world leading data science

research. In addition to support for current “big data” applications (e.g. simulation, bioinformatics), the new facility includes GPU nodes that will support image processing and machine learning approaches. We anticipate that the cross-school use of the facility will also foster cross-disciplinary and innovative ideas.

PIs across two of the SoM’s divisions (CMED and PBS) are active members of the **Institute of Behavioural and Neural Sciences (IBANS)**. IBANS is an interdisciplinary community of researchers interested in different aspects of behaviour and neuroscience bringing together a large community across different Schools. IBANS aligns with one of the key themes “Evolution, Behaviour, and Environment” underpinning the research strategy of the University of St Andrews. The steering committee, chaired by two co-Directors (currently **Paracchini** is serving in this role), is composed by PhD students and post-docs representatives of different Schools, including Medicine. IBANS hosts regular events featuring presentations by Early Career Researchers and high-profile external speakers, who are proposed and selected through a voting system that involves the IBANS membership. IBANS provides a platform for networking and regularly awards seed-corn funds to promote new cross-School collaborations.

The **Biomedical Sciences Research Complex (BSRC)** is an interdisciplinary centre for biomedical research with contributions from the Schools of Biology, Chemistry, Medicine, Physics and Astronomy. The BSRC’s main research themes are infection and immunity, biophysics, molecular medicine, and chemical biology. The BSRC is funded by a range of agencies including the Institutional Strategic Support Fund from the Wellcome Trust.

The BSRC brings together researchers to explore scientific strengths, share expertise, provide access to state-of-the art technologies and develop new collaborative opportunities to drive research to its full potential. Scientists associated with sixty research groups within the BSRC perform highly innovative, multi-disciplinary research in eleven broad areas of biomedical research including biophysics, molecular medicine, microbiology and structural biology. The complex houses core research facilities including advanced imaging suites (wide field fluorescence light microscope with deconvolution and a quantitative laser module to allow techniques like FRET, FLIP and FRAP, and multiple confocal imaging systems), pulsed electron-electron double resonance spectroscopy, and mass spectrometers to enable protein identification (MALDI MS & MSMS), intact protein mass (LCMS) and quantitative proteomics (SWATH and iTRAQ). The BSRC is a vibrant research environment holding weekly research seminars, annual research away days for PIs, cross-campus workshops in core research areas (bioinformatics, membrane biology, organelle cross talk, and cellular pathology), a University-leading commitment to supporting the careers of Women in Science and to outreach activities, and training opportunities for early career scientists including fellowship days and cross campus work-in-progress talks.

Centre for Biophotonics

Biophotonics research in St Andrews is internationally recognised and has critical mass in terms of funding and scientific collaboration with current grant funding this REF cycle in excess of £14M, and a string of high impact interdisciplinary publications (e.g. Nature Protocols, Nature Cell Biology, Nature Photonics, Nature Communications, Science Advances). Building upon a strong heritage of leading research in photonics, Biophotonics in St Andrews was formed in 2004 from initial grants from an EPSRC Bioplatfrom grant and a CRUK interdisciplinary grant which brought together researchers from Physics, Biology and Medicine. In the subsequent years, larger and more significant funds have been attained in open competition, and its significance was recognised by the University by building the Wolfson Laboratories in the Medical and Biological Sciences Building and undertaking a major refurbishment in Physics. In recent years Biophotonics in St Andrews has continued to develop from a core of laser physics to a broad portfolio spanning organic semiconductors, metamaterials, quantum optics, advanced imaging and metrology, and communications. Biophotonics in St Andrews was recently recognised as a core research strength by the University, and in order to capitalise on this research success a Centre of Biophotonics was launched in December 2019. The centre combines the skills of twenty-five principal investigators working across four Schools (Medicine,

Physics, Biology, Psychology & Neuroscience). Medical photonics is a key research platform of the Sir James Mackenzie Institute for Early Diagnosis.

3.3 Facilities to support Research

During this REF period, university investment has improved our research infrastructure and we have been successful in increasing numbers of large project awards and have obtained Infrastructure funding from the Wellcome Trust ISSF, BBSRC and a Royal Society Wolfson Laboratory Development. The Medical school moved to a new building in the heart of the Science campus in 2010 with a £45M investment to create purpose-built, and world leading facilities for the teaching of medicine and biomedical research. These facilities have been upgraded during the current REF period. For research, there are now two large (409m²) well-equipped shared laboratories which in total, provide bench space for 16 PIs. One of the laboratories is set up to work to Good Laboratory Practice standards. In addition, there are 4 dedicated tissue culture suites (each with 3 hoods/6 incubators), a microbiological lab and fermentation suite, a radioisotope lab, wash-up room and several rooms for shared equipment (microscopy, alarmed freezers, centrifuges etc.). There is a 320m² Biophotonics laboratory and a 44m² cell store archive for cryopreservation of cells and tissues. Some of the laboratory space in the building is shared with teams working in the Schools of Biology and Physics. Researchers in UoA1 collaborate with research teams across, and use facilities within, the North Haugh: notably, those in the Biomedical Sciences Research Complex, Physics and Astronomy, Computing Science, Mathematics and Statistics and Chemistry.

We have built up a world-leading digital pathology infrastructure including tissue processors, autostainers, whole-slide fluorescence and brightfield scanners, commercial and open-source automated image analysis software and NVIDIA servers optimised for large scale deep learning analysis. This core infrastructure supports advanced research projects in the Division's research strengths including human genomic bioinformatics, medical photonics, nanoscale quantitation, metal ion physiology, proteomics, digital pathology, quantitative image analysis and histopathology. We have been successful in obtaining a £1M investment for an Orbitrap mass spectrometer led by Sally Shirran in Biology. The bid involved 10 co-investigators from St Andrews and 1 from James Hutton Institute. We have also upgraded our Electron Paramagnetic Resonance Spectroscopy with a bid involving 8 co-investigators from St Andrews and colleagues from Dundee, Leeds, Durham, Birmingham, Oxford, Bristol.

Research Integrity

The Medical School participates fully in the University Research Integrity structures (ILES, 2.6). Our School Ethics Committees reports to the University Teaching and Research Ethics Committee (UTREC) and Animal Welfare and Ethics Committee (AWEC), working with the and the Ethics and Research Integrity Assurance Group to ensure that research integrity and ethics are embedded in research activity. The University has developed training programmes in research integrity. A part of the training of PhD students consists of a mandatory research integrity course.

The SoM is represented at the Institution's Research Data Management Advisory Group (RDMAG) which discuss research data management issues and opportunities. The RDMAG member acts as a liaison between the School and the RDM team facilitating collaborative projects such as the development of guidance on open data.

Open Research and Open Data

The University has arranged various membership agreements which support open access publishing. These have been chosen based on national negotiations, recommendations and consultation with academic staff, and because they represent good value and efficient use of funds. The overall compliance for publications published in the past 12 months, is 96% for those submitted in REF. Work is currently in progress to start developing a discipline-specific guidance document for the SoM covering datasets as well as papers. We make extensive use of preprints, Open Source Format and archiving in public repositories via the University's web-based

genomic knowledge into clinical practice and we have trained 288 senior clinical scientists from across the world.

Holden leads Wellcome Genome Campus Advanced Courses - Genomics and Epidemiological Surveillance of Bacterial Pathogens. This comprises 5-day workshops providing bioinformatics and whole genome sequencing training to researchers, clinical scientist and epidemiologists from across Latin America and SE Asia. Seven workshops have been run in this REF period.

The Health Psychology group run a MSc in Health Psychology for 10-12 Psychology graduates each year in their discipline with many graduates going on to practice as health or clinical psychologists in the NHS. Alternatively, they work within health care-centred research as research assistants. The popular course has run for over 10 years and has received multiple commendations from the British Psychological Society who visit every five years as the accreditation body.

Prizes Awarded

Crossman

Fellow of the Royal Society of Edinburgh 2020

Gillespie:

Fellow of the Royal Society of Edinburgh 2018

Scottish Life Sciences Award for Innovation of the Year 2018 for SLIC susceptibility

Shortlisted Times Higher Education Innovation of the Year for SLIC susceptibility 2017

Longitude Prize Discovery Award 2015 Inter-science Conference on Antibiotic Agents and

Chemotherapy of the American Society of Microbiology Program Committee Award for the best presentation in the area of Therapy and Prevention Washington September 2014

Paracchini

Fellow of the Royal Society of Edinburgh 2019

Sullivan:

University of Toronto, Department of Family & Community Medicine Outstanding Contribution to Family Medicine Research Award 2016

RCGP James Mackenzie lecturer 2015

Ian Stevenson Prize for Excellence in Public Engagement with Research. 2014

Blaikie

Victoria & Albert Museum, Dundee, Design Champion Award 2019

The Arclight ophthalmoscope was awarded a 'design champion' award for the innovative yet practical approach to design, August 2018

Hammond

Scottish Innovation of the Year 2018

Runner up- THE awards 2017

Discovery award 2016

Humphris

Research Giant Award 2019, University of Southern Queensland for distress recognition in doctor patient interaction

Major Projects

Harrison was appointed to NCRI's Cellular Molecular Pathology Initiative (CM-Path) in 2016 to bring together experts from pathology and other fields to build a stronger skills and resource base for the UK to undertake pathology research. The collaboration of NCRI Partners committed £635,000 to the initiative to boost the UK's research activity in cellular molecular pathology.

Sullivan Led the largest biomarker trial in Lung Cancer (ECLS) and was the foundation director of the University of Toronto Practice based Research network. He is a director of the, **Scottish Health Research Register (SHARE)**, which is a list of 300K people in Scotland, who have agreed to allow their electronic medical records to be accessed for research, and primary care data. This informs, supports and enables evaluation of the activities undertaken as a result of the NHS Fife, and NHS Scotland Clinical Strategy. SHARE has been franchised in North West London (NWL) as DISCOVER and in the USA a similar 'All of us' database has launched. He is also a site lead for the Scottish Health Data Research UK (HDRUK) node in St Andrews. From

2014-17 he was the inaugural Gordon F Cheesbrough Chair and foundation director of the University of Toronto's Practice based research Network (a £2M development)

Gillespie CI of PanACEA 2 Pan-African Consortium for the Evaluation of Anti-tuberculosis Agents (€16.5 million jointly with Martin Boeree, Michael Hoelscher and 12 African collaborators).

Holden is a senior advisor on the Scottish Universities Life Science Alliance (SULSA) and leads large collaborations on antimicrobial stewardship: AMR cross-research council initiative, GCRF-NIHR Principal-applicant 2018-21, £2.8m-HATUA, Global Effort on COVID-19 (GECO) Health Research NIHR Principal-applicant 2020-22, £900k-CARE: *COVID-19 and Antimicrobial Resistance in East-Africa—impact and response*; and SIRN-CSO HAI Research Consortium, co-applicant, £4.2m 2015-20 SHAIIP. He is also a co-investigator on Enabling optimal antimicrobial use in East Africa Global Research Challenges Fund investments in AMR (London School of Tropical Medicine and Hygiene; Glasgow, St Andrews; and Malawi Liverpool Wellcome Trust.

Baldacchino was seconded to the WHO Eastern Mediterranean Region as an advisor on Substance misuse in 2019 and is the Executive Board Member and Chair for the training and education Committee. He is the President of the International Society of Addiction Medicine (ISAM). He is also a founding member for the European Network for Training, Education and Research (ENTER)-Mental Health. He established (with Sullivan) a Learning Health System 'Enabling Learning NHS Care Systems utilising Electronic Medical Records' (ELectra) in Fife to underpin research and influence clinical care. It leverages existing local and national investments in information technology and digital health that are essential for the delivery of the NHS Scotland Clinical Strategy five-year plan, using the Scottish Community Health Index Number (CHI) as a linkage tool. The main datasets that are being used are from Information Services Division (ISD) and other national datasets, such as of the Scottish Health Research Registry (SHARE).

Burr is a co-investigator on four major grants in Eye Disease from NIHR: Screening for Diabetic Retinopathy. NIHR Policy Research programme £596,000. 1/4/2019 for 24 months; Efficacy and safety of cross-linking in children with Keratoconus. The KERALINK Phase 2 clinical trial *NIHR—Efficacy Mechanism and Evaluation (EME)* (14/23/18)—£774K Start date: 01/10/2015. Duration: 48 months; Randomised Comparison of Femtosecond Laser Assisted vs Manual Phacoemulsification Cataract Surgery: The FACT trial *NIHR—HTA* (13/04/46)—£1.4M Start date: 01/09/2014. Duration: 48 months; Treatment of Advanced Glaucoma Study (TAGS): A multi-centre randomised controlled trial comparing primary medical treatment with primary augmented trabeculectomy for people with newly diagnosed advanced glaucoma. *NIHR—HTA* 12/35/38—£2.0M Start date: 01/01/2014. Duration: 73 months.

NHS

During the current REF period the number of clinically active staff has increased from three to ten: Cardiology (**Crossman**) Psychiatry (**Baldacchino & Kent**), Psychology (**Humphris**), Microbiology (**Gillespie**), Infectious Disease (**Sloan**), Laboratory Medicine (**Harrison**) Ophthalmology (**Blaikie**), and General Practice (**Sullivan and Hernandez-Santiago**). Non-clinical staff make a significant contribution to the NHS via public health (**Holden, McCowan, Williams, Sabiiti, Crawford**). **Baldacchino** is NHS Fife Research, Development and Innovation Director.

Working with external partners in the NHS and Industry we are already seeing the impact of a learning health system in NHS Fife (**Sullivan, McCowan and Baldacchino**). This is a research environment linking data science and the evaluation of clinical innovations in a positive feedback loop, two current exemplars are in the promotion of exercise and more rational antimicrobial prescribing for Urinary Tract Infections. Discussions are under way to extend this to other areas of Scotland via the City Deals.

Contribution to the sustainability of the discipline

Baldacchino is the President of the International Society of Addiction Medicine (ISAM)

Sullivan led a review of Academic Careers in General Practice in Scotland commissioned by Scotland's Board for Academic Medicine which reported in March 2020

Crawford is a member of the NIHR HTA General Committee.

Gillespie is an active fellow of the Royal College of Pathologists and a Council member 2010-16.

Ozakinci has been the chair of Health Psychology Scotland since February 2020.

The following are fellows of relevant Societies which are important for Clinical Medicine.

Royal Society of Edinburgh: **Sullivan, Crossman, Gillespie, Paracchini**

Royal College of Physicians (UK): **Crossman, Sullivan**

Royal College of Physicians (Edin): **Baldacchino, Crossman, Humphris, Gillespie**

Royal College of Physicians (Glas): **Sullivan**

Royal College of Psychiatrists (UK): **Baldacchino**

Royal College of General Practitioners: **Sullivan**

Royal Society of Biology: Paracchini, **Stewart**

Young Academy of Scotland: **Paracchini, Bowness, Ozakinci**

The 'Acid Fast Club' studying mycobacterial diseases –**Sloan & Bowness**.

The following have honorary positions at other Universities:

Baldacchino: Honorary Professor, Medical School, University of Dundee

Crossman: Chief Scientist (Health) Scottish Government and Chief Scientist Office

Sloan: "Professor in Residence" at Infectious Diseases Institute (IDI) at Makerere University in Kampala, Uganda IDI in January 2019

Stewart: Honorary Guest Professor at North West Plateau Institute of Biology, Chinese Academy of Sciences, Xining, China

Sullivan: Senior Research Fellow International Prevention Research Institute, Lyon

Professor Department of Family and Community Medicine & Dalla Lana School of Public Health, Univ. Toronto

Honorary Professor Medical School, University of Dundee

Humphris: Visiting Professor, School of Medicine, Central Southern University, China

McCowan: Honorary Professor at the Institute of Health & Wellbeing, University of Glasgow

Contributions to the Economy

These include the £15.8m artificial intelligence (AI) health research centre called iCAIRD (a pan-Scotland collaboration of 15 partners from across academia, the NHS, and industry led by **Harrison**). iCAIRD brings together researchers from the Schools of Computer Science and Medicine, with clinical (NHS Greater Glasgow and Clyde health board) and industry (Philips) partners, to develop AI algorithms capable of diagnosing gynaecological biopsies to translate the research into a pathologist's daily workflow. The Biophotonics suite with industrial partnerships (MSquared Lasers) allows access to bespoke and innovative imaging platforms including super-resolution microscopy (dSTORM), confocal, light sheet wide-field, multi-photon, micro-spectroscopic optical techniques, focussed ion beam scanning electron microscopy and correlated light and electron microscopy.

Externally, the School has strong links with Industrial partners including Nanostring, Definiens, Indica Labs, Marine Harvest/Mowi, and MSquared lasers. In the medical imaging sector, iCAIRD directly links with Philips (digital pathology), Canon (radiology) and Glencoe software (developing solutions to allow the digital images and AI algorithms to become open source and platform agnostic). All academic staff have engaged in productive collaborations during the REF period with a range of universities, nationally and internationally. These collaborations have led to successful international and collaborative funding (e.g. British Heart Foundation, Leverhulme Trust, Innovate UK, Japan Society for Promotion of Science, Chinese Academy of Science). This international perspective is an essential element of facilitating the development of world-wide scientific partnerships and membership on international consortia (Neurodys, Psychiatric Genomics).

Scottish Enterprise provided £388K for development of a high growth spin out company to manufacture and market rapid phenotypic susceptibility testing methodology (SLIC:**Gillespie**). In collaboration with the School of Mathematics and Statistics **Lynch** was awarded five 'Statisticians in the Pharmaceutical Industry' undergraduate prizes.

Contributions to Society

Crossman's appointment as Scotland's Chief Scientist (Health), Chair of the MRC/NIHR EME Board, which funds phase 2 clinical trials across the UK. He is a member of the MRC Translational research group. He is also currently a member of the BHF Chairs and Programme Grants committee. A reviewer of the NIHR Senior Investigator awards for the last 3 years and a REF2021 member of Main Panel A.

Gillespie chaired a Royal Society of Edinburgh Working Group on the supply of medicines on which **Sullivan** was a member of the MRC/NIHR EME Board and is now a REF 2021 UoA1 (Clinical Medicine) Panel Member and MRC Clinical Fellowships Panel. **Sullivan** has also contributed to an RSE Working Group on the future of Primary Care and a response to the Scottish Government's Digital Strategy.

Informing policy

We have taken an active approach to connect with the UK and Scottish Governments and the research councils (chairing three grant panels and members on another nine) to help inform policy and shape the research landscape. The Dean (**Crossman**) is Scotland's Chief Scientist for Medicine and several staff engage policymakers at a senior level e.g. during the COVID-19 pandemic (**Gillespie, Holden, Cevik**).

Public Engagement

Our commitment to the funding and development of activities for knowledge exchange and impact through the Knowledge Exchange and Impact fund is seen through our Staff dedication to engaging with the wider non-academic communities and organisations including **van Beusekom's** work on co-design (ILES, 2.3). In 2014 **Sullivan** won the Ian Stevenson Prize for Excellence in Public Engagement with Research in his role as Clinical Director of Scotland's Health Research Register (SHARE). In 2017 the school initiated and funded a Patient and Public Involvement group with NHS Fife. This Fife Community Advisory Committee meets as a group twice a year to discuss current and planned research on patients and members of the public. Members of the group, and their wider contacts, are involved with the design of research involving patients at project initiation stage and join research teams during the conduct, analysis and dissemination phases. Exemplar activities of our wider non-academic engagement with research include: involvement with Cell Block Science (2018 Herald Education Partnership Award), running since 2015, a partnership to promote STEM (science, technology, engineering and mathematics) in Scottish prison learning centres. A number of our researchers work with charities in the UK and abroad (e.g. Italy and Hong Kong) and contribute to events such as Café Scientifique, Charity roadshows, Parliamentary receptions and other stakeholder events. Following participation to the Royal Society Westminster Pairing Scheme, one of our number (**Parrachini**) contributed to the development of a mirror pairing scheme at the Scottish Parliament. The school has also hosted a research event for Scottish politicians on behalf of the British Heart Foundation.

The School has many staff and students involved in the delivery of Public Engagement at both national (Explorathon, Academics Go Wild, Young Archaeologist Club, Bioblitz, World of Work) and local (Primary School Science days, University's Science Discovery Day) levels. Staff and students are actively involved in the University's Access and Outreach initiatives including the First Chances Project and the Sutton Trust Summer School and REACH Scotland. Many members of staff are also involved in provision of cardiac resuscitation training to local communities.

We also work with communities in East Africa on antimicrobial stewardship in HATUA and have contributed to the National Academy of Sciences report on Rwanda's Human Resources for Health (HRH) Program to build the health education infrastructure and workforce necessary to create a high quality, sustainable healthcare system. We support regional and international education by providing online teaching resources which reach global audiences in the form of our infection group have developed two computer games with Abertay University' ("Sanitarium" and "Plague hospital"), which have gained international awards.