REF2021

Institution: The University of Edinburgh (UoE)

1. Context and mission

a) Mission

The University of Edinburgh (UoE) has existed to promote the public good since our foundation in 1583 as the UK's first civic university. Our mission is *to address tomorrow's greatest challenges: through our graduates, the knowledge we discover with our partners, and our values-led approach to teaching, research and innovation.*

b) Structure and size

UoE is a comprehensive, research-intensive institution. Our three Colleges (Figure 1) balance teaching, research and innovation: Arts, Humanities & Social Sciences (£315.9M turnover 2019-20, annual income growth rate 2014-20 [AGR] 6%); Science & Engineering (£301M turnover, 4.5% AGR); Medicine & Veterinary Medicine (£318.5M, 4.7% AGR). Relevant research is concentrated in Institutes and Centres, bringing together critical masses of researchers from a range of disciplines alongside partners from industry and the public sector to address major global challenges.

College of Arts Humanities and Social Sciences
- History Classics and Archaeology
- Law
- Literatures, Languages and Cultures
- Philosophy, Psychology and Language Sciences
- Social and Political Science
- Edinburgh College of Art
- Business
- Divinity
- Economics
- The Moray House School of Education and Sport
- Health in Social Science

College of Medicine and Veterinary Medicine
- Edinburgh Medical School
- Queen's Medical Research Institute
- Institute of Genetics and Molecular Medicine
- Institute for Regeneration and Repair
- Edinburgh Neuroscience
- Royal (Dick) School of Veterinary Studies
- Roslin Institute

College of Science and Engineering
- Biological Sciences
- Chemistry
- Engineering
- Geosciences
- Informatics
- Mathematics
- Physics and Astronomy
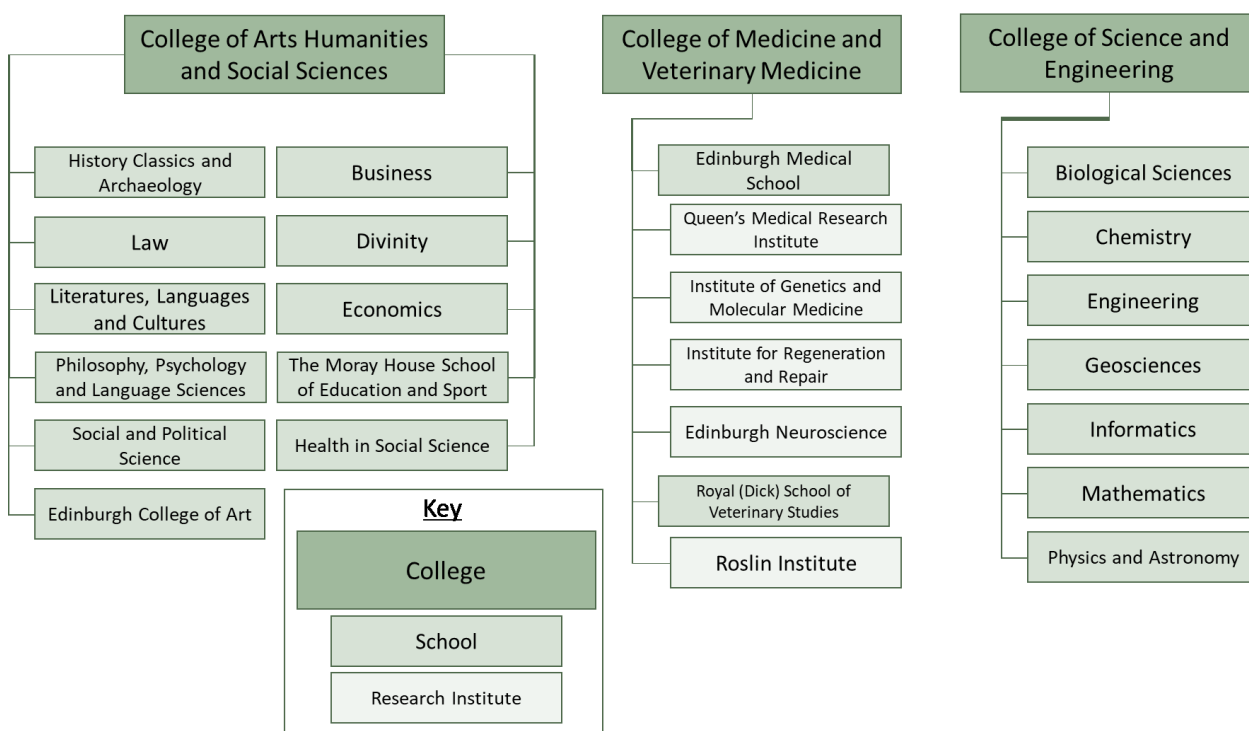
Key
- College
- School
- Research Institute

Figure 1: Colleges and Schools of the University

We host 5,423 PhD students (2020; up 28% on 2013) within our total 44,500 students (up 35% on 2013), of whom 4,900 are online postgraduate learners. 46% of on-campus students are non-UK nationals from 178 countries. Over 3 million learners from every country in the world have enrolled on our MOOCs.

Our 5,351 FTE academic staff from 93 countries include 2,566 FTE independent researchers; all are returned here. This is an **increase of 46.3%** on 1,753 (21.8% increase on 2,105 eligible) FTE returned to REF2014.

c) Local context and partnerships

With 15,400 employees and a turnover of £1.2B (2019-20), UoE is an anchor of Edinburgh's regional economy. In 2017, we generated **£3.5B GVA for the UK economy** (£5.2B globally) and supported 46,000 non-university UK jobs. Our staff and students established an average of 65 companies/year (2014-20). Our companies thrive with 81% still trading two decades later.

The University's key local role catalysed the £1.3B Edinburgh and South-East Scotland City Region Deal ('City Deal', 2018-27; section 2). Within this, **UoE received £237M from UK and Scottish Governments**, leveraged with UoE and partner investments to £661M, to deliver data-driven innovation (DDI).

Beyond Scotland, we are a founding member of the Russell Group, the League of European Research Universities, Universitas-21, UNICA, U7+, and the Coimbra Group.

d) History

Our notable scholars have included statistician Thomas Bayes, philosopher David Hume, physicist James Clerk Maxwell, chemist Christina Miller, engineer Alexander Graham Bell, founder of geology James Hutton, authors Arthur Conan Doyle and Robert Louis Stevenson, anaesthetics innovator James Young Simpson, geneticist Charlotte Auerbach, founder of epigenetics Conrad Waddington and cloning pioneer Ian Wilmut.

Since 2013, Edinburgh alumni and researchers have received **7 Nobel prizes** in Physics (Peter Higgs, 2013), Chemistry (Fraser Stoddart, 2016; Richard Henderson, 2017), Physiology or Medicine (Edvard Moser and May-Britt Moser, 2014; Michael Rosbash, 2017) and Peace (Daniel Högsta, 2017).

2. Strategy

a) Research strategy

In 2018's *Strategy 2030*, we reiterated our long-standing commitment to *'research without boundaries'*, enabled by our interdisciplinary academic structure. The Strategy supports our researchers to: develop cross-sector and cross-discipline research and innovation to deliver impactful solutions to global and local issues, notably the UN's sustainable development goals; engage with digital and data-driven approaches in addressing future challenges; and become catalysts for new business and public-sector programmes that deliver benefit to societies around the world. This strategy is underpinned by an overarching ethos of respect and integrity, where academic researchers collaborate on equal terms with industry and public sector colleagues within fit-for-purpose open facilities.

We support research scholarship in all its forms from lone researchers to major teams. We develop institutes to address major challenges. During 2014-20, we hosted the UK's largest MRC-University Unit (Human Genetics), 4 MRC Centres (Inflammation Research, Regenerative Medicine, Cognitive Aging and Cognitive Epidemiology, Reproductive Health), a BBSRC Institute (Roslin), a Wellcome Centre (Cell Biology), a Wellcome Centre in Development (Biomedicine, Self and Society), UKRI's Strength in Places-funded Global Open Finance Centre of Excellence, EPSRC's UK national supercomputer (ARCHER2), the national computational facility for particle physics and astronomy (DiRAC), and the national data storage facility (UKRDF).

b) Data-Driven Innovation

Data is at the heart of our strategy. We are a powerful force in informatics. We created the world's second artificial intelligence (AI) department (1963) and, since 1990, have hosted and run the UK's national supercomputer (now ARCHER2, £82M, EPSRC, 2020-25). The trusted use and impact of data is key to our strategy.

The establishment of the data-driven innovation (DDI) programme through City Deal has been key to delivery. From its genesis in the UoE-led 2016 Science and Innovation Audit, UoE has been a driving force in a partnership of three Edinburgh-based universities and 6 local councils. Within UoE, DDI is developing substantial new infrastructure to deliver research, innovation, industry engagement and skilling at scale within our 'porous university' concept of academic researchers, student talent and industry/public sector partners working shoulder-to-shoulder in open facilities to deliver solutions to global challenges.

DDI research and innovation spans ten sectors reflecting key regional activities: health & care; AI/robotics, data science; space & satellite; financial services; fintech; agritech; creative technologies; public sector technology; tourism & festivals. These focus our delivery of research advances and their translation into health, wealth and social benefits.

We established five thematic 'Hubs'. All are active academically, albeit some infrastructure is under construction.

- Bayes Centre in data science (£45M, opened 2018)
- Roslin Innovation Centre in agritech (£31M, opened 2017)
- Edinburgh Futures Institute in data for financial services, creative industries and public services (£140M, opening 2023)
- Usher Institute in healthcare data (£68M, opening 2023)

- The National Robotarium (£23M with Heriot-Watt, opening 2023).

The success of our strategy is exemplified by the Bayes Centre's achievements. Within two years of opening, it raised over £90M in external inward investments, started 15 high-growth companies, gained £38M in research grants and generated over 400 new jobs.

c)   Research Partnerships

Our strategy is to develop a limited number of deep, durable partnerships nationally and globally, addressing specific themes via world-leading conjoint research and PG training. Evidencing this collaborative success, 78% of our research outputs 2014-20 were co-authored with partners, of which 72% with non-UK universities, 8% with industry.

(i) UK

In REF2014 we made more joint submissions than any other HEI. Five continue for REF2021; three with City Deal partner Heriot-Watt (the Maxwell Institute in Mathematics, Edinburgh Research Partnership in Engineering in Engineering, Edinburgh Strategic Alliance in Architecture), one each with Scotland's Rural College (Agriculture & Veterinary) and St Andrews (EaStCHEM in Chemistry). These partnerships include close co-working, congruent research strategies, co-ordinated senior appointments, co-supervision of PhDs, joint grants and myriad co-authorships.

Within the REF period we became a **founding partner in major UK research consortia** including the Alan Turing Institute (2015), MRC-UK Dementia Research Institute (2016), Health Data Research UK (2017) and Rosalind Franklin Institute (2018).

(ii) International

We have strategic institutional partnerships with universities across the globe, building on shared disciplines and missions. Selected on the basis of the quality of joint research, our global partners are the universities of Amsterdam, Copenhagen, Helsinki, Leiden, KU Leuven, University College Dublin, Harvard, McGill, Stanford, Toronto, Vanderbilt, Sydney, Makerere, Witwatersrand, Hong Kong, Shanghai Jiao-Tong and Zhejiang. With Leiden we have one of the largest global accumulations of expertise in African studies. We are founders of **Una Europa**, an alliance of eight European research-intensives focusing on research on cultural heritage, data science/AI, European studies, one health and sustainability.

d)   Tackling grand challenges

Our commitment to UN SDGs is demonstrated by conspicuous success with the Global Challenges Research Fund **(GCRF), winning 98 grants** (£60.7M; 2016-20), including leading the £20M GCRF Multi-Hazard Urban Disaster Risk Transitions Hub (£13.9M UoE, 2018; SDG11). With £2.4M GCRF funding (2017) we established the International Veterinary Vaccinology Network, initiating an African schools' outreach programme enabling local women scientists to take science to schools (SDG4&5), short-listed for the Nature/Estée Lauder Research Awards for Inspiring and Innovating Science. Our research on exoskeletons and prostheses restored movement and employment to people with disabilities/injuries in LMICs (SDG1&3) and work on machine translation for low resource languages helped disseminate information to marginalised communities (SDG10). We used image analysis to prevent potential tiger attacks, enabling co-existence of wildlife conservation zones and subsistence farmers in rural India (SDG15), and machine learning to underpin a new fast method to detect bacteria in human lungs using fibred confocal

fluorescence microscopy (SDG3).

e)   Public and policy engagement

Our research touches diverse communities from local primary schools and cultural institutions to communities in low-and-middle-income countries. Our *Strategy for Supporting Public Engagement (PE) with Research*, reaffirmed commitment to the National Coordinating Centre for Public Engagement Manifesto. UoE's 150 staff PE Forum developed a suite of PE professional development courses (>200 attendees/year).

We work closely with cultural institutions including the National Museums Scotland and National Galleries of Scotland. Our research has informed major exhibitions, including National Galleries' Inspiring Impressionism: Daubigny, Monet, Van Gogh (450,000 attendees, 2016) and National Museum's Robots (61,000 attendees, 2019).

We are a key partner of the Edinburgh International and Fringe festivals. Our researchers have run 236 shows since 2014 under the *Cabaret of Dangerous Ideas* banner (9,697 attendees), engaging the public on climate change, intellectual property in the digital age and crime & punishment.

UoE works hand-in-glove with NHS Lothian, with major academic campuses co-located with hospitals. We employ 368 clinical academics with honorary or part-time NHS appointments (162 consultants, 144 sub-consultant doctors, 11 clinical psychologists, 51 nurses). This supports local healthcare and facilitates translation of our research. Our work optimised delivery of care after out-of-hospital cardiac arrest, optimising the "chain of survival" and leading its Strategy Delivery Group, involving all Scotland's emergency services, Scottish Government, third sector, NHS and academic partners.

Our leadership in criminology and social justice includes the *Edinburgh Study of Youth Transitions and Crime*, a longitudinal study of 4,300 young people who started secondary school in Edinburgh in 1998. This highlighted the detrimental impact of poverty on offending and criminal conviction, underlining the complex cyclical interplay between offending, justice system contact and poverty, influencing Scottish Government's Child Poverty Action Plan.

Our research has helped shape public policy and implementation globally and locally. Two UoE academics are members of the UK Government Scientific Advisory Group for Emergencies, 3 on the Scottish Government's COVID-19 Advisory Group. In recognition of our influence in communication, business and public policy we have won 4 ESRC Impact Prizes 2014-20.

f)   Partnering with industry

Since 2014, our strategy has targeted commercialisation and stronger relationships with industry. UoE has **interacted with 2,700 companies** 2016-20, approximately half SMEs. To enable growth, culture change was vital, exemplified by a rise in academic staff engaging with industry from ~500/year in 2014 to >900/year by 2020.

Early translation was facilitated by £10M impact accelerator funds (EPSRC, BBSRC, ESRC), annual competitive MRC confidence-in-concept/proximity-to-discovery funding (£7.7M 2014-20, 7 spin-outs, 72 industry partnerships) and a Wellcome translational partnership (£1.2M, 2018-20; renewed £2.4M 2020-23). The last supports 2 *entrepreneurs-in-residence* who have: engaged with 320 researchers on human health across our 3 colleges, increased involvement with bio-translation by 260%, supported 57 early projects, 68% led by ECRs and

49% involving NHS/industry collaboration. Over 3 years the projects generated 16 disclosures, 5 patent applications, 3 licences and leveraged £24.6M grant funding. We have 4 further entrepreneurs-in-residence across UoE.

Examples in this REF period include:

- partnering Babcock to develop *Fastblade*, a £4.1M facility at Rosyth dockyard, collaboratively transforming the local economy for a lower carbon future, developing new materials engineering for tidal turbines

- partnering with Legal & General (2019) who funded our largest-ever industrial award (£20M) to co-create the *Advanced Care Research Centre*. This brings together data sciences, robotics/AI, engineering, medicine, nursing, neurosciences and arts to deliver novel approaches to care in own home and care settings

- *Design Informatics*, which in 2014-20 supported 337 companies, developed 16 start-ups/spin-outs and won a £6.5M AHRC translational award

g) Open research

We were early adopters of Open Access (OA) publication policies, actively promoting its role in academic and societal impact. In 2014, we led a Jisc pathfinder project (with Heriot-Watt and St Andrews) to embed OA into academic practice. We contributed to and adopted LERU's Roadmap for Open Science (2018). Our Research Data Management Policy requires data to be FAIR (findable, accessible, interoperable, re-useable).

These OA strategies have been successful. In the 2020 CWTS Leiden Rankings we were ranked 8th in the world for the proportion of research papers (2015-18) available OA. **92% of UoE's outputs eligible for REF2021 are OA compliant**. 2019-20 saw 1.6 million downloads from our OA repositories (an increase of 33% from 2018) and over 43,500 individual titles accessed in 2019, a rise of 25% on 2018.

UoE is a world-leading centre for expertise in Research Data Management, home to both EDINA and the Digital Curation Centre which offer expertise in digital preservation, text and data mining, computational notebooks, geospatial analysis and consultancy on good research practice. We are a founder member of the Research Data Alliance, co-hosting their conferences. During the REF period, 2,736 research data items were shared through the University's OA research data repository, Edinburgh DataShare (>75,000 downloads).

h) Ethics, Integrity and Culture

UoE conducts research to the highest standards of integrity. Our leadership underpinned the philanthropic £5M Baillie-Gifford *Centre for Ethics of Data and AI* (2018), which addresses public and governmental trust in data science. Governance is provided by our Research Policy Group, reporting to the University Executive. We are signatories to the *San Francisco Declaration on Research Assessment* and the *UUK Concordat to Support Research Integrity*, underlined by our Responsible Research Metrics policy.

UoE co-founded the *UK Reproducibility Network*, a peer-led consortium to drive robust research findings, promote training and disseminate best practice. We published extensively on research reproducibility (Macleod, Lancet 2014; Nat Human Behav 2018). Our researchers are supported through the Infonetica Ethics Review Management system.

In 2019/20, we surveyed 1,400 researchers and professional staff to benchmark UoE

research culture, based on the UK-wide Wellcome questionnaire. The survey engendered targeted approaches to career development and disability further to improve our culture.

i)   Future strategy

Since 2019 our research strategy has coalesced around five overarching research and innovation themes, reflecting the UN Sustainable Development Goals, influenced by our Scottish context. Underpinned by data-driven innovation and linked to the DDI hubs, these operate across our Colleges and disciplines:

- Future health and care

- One health and food security

- Societal and planetary sustainability

- Culture and creative economies

- Living and working digitally

3. **People**

   a) **Staff Wellbeing and Development**

   UoE's Strategy 2030 emphasises support for the wellbeing and development of research students and staff. Leadership is provided through the Institute for Academic Development (IAD). IAD's 40FTE provide support for teaching, learning, researcher development and staff wellbeing, through workshops, online resources, networks and face-to-face advice. IAD delivers our *Code of Practice for the Management and Career Development of Researchers*. This aligns with the HR Excellence in Research Award, held by UoE since 2010. Our Action Plan builds on our commitment to the *Concordat to Support the Career Development of Researchers*, supporting researcher learning and development. Our 'Mentoring Connections' programme, available to all staff (697 connections made 2014-20) is facilitated through our *Platform One* digital community.

   UoE's flexible working and family-friendly policies support staff wellbeing and work-life balance whatever their personal circumstances. Success is reflected in the number of part-time academic roles, 44% of our workforce. Since 2016, we have proactively reduced fixed-term contracts, with only 3.4% of academic teaching staff employed on limited-term 'guaranteed hours' contracts. Fixed-term staff access our Talent Register (152 registrations 2019-20) facilitating intramural redeployment. On joining, staff have immediate access to Shared Parental Leave and Occupational Maternity Pay, the latter increased by two weeks in 2019. We provide coaching for all returning from parental leave.

   b) **Career support for researchers**

   All new academic staff have bespoke induction programmes and online training courses, detailed in REF5bs. Staff and PGR students have annual reviews, focussed on the four academic facets (teaching, research, innovation, leadership). Reviews provide career support, discussions on promotion and wider development through Vitae's Researcher Development Framework.

   Early career researchers (ECRs) are critical to the future and sustainability of our research. In 2013, we introduced **prestigious 5-year tenure-track Chancellor's Fellowships**, supporting >300 ECRs at the point of independence into permanent positions across all disciplines. This highly international cohort (60% non-UK) are already becoming our research leaders of the future: Chancellor's Fellows appointed in this REF period have led as PIs on 257 projects (£54.8M), contributed as Co-Is on 103 projects (£23M), and produced >2,000 outputs. Over 90% assessed to date have gained a permanent post.

   Specific schemes to support ECRs include the Wellcome-funded *Edinburgh Clinical Academic Training* (ECAT) scheme (£10.2M) and the *Edinburgh Scientific Academic Track Scheme* (ESAT). ECAT supported 72 clinical lecturers through a PhD to a guaranteed postdoctoral lectureship (2013-20). ESAT Fellows have received a funded fellowship (Chancellor's Fellow or externally-funded). The Scheme provides support and guidance to enable the Fellow to develop the knowledge, skills and experience to become a Lecturer/Senior Lecturer/Reader after the Fellowship.

   In 2018 UoE was awarded a MSCA Actions COFUND programme (*TRAIN@Ed*; €2.7M), which has given 21 postdoctoral researchers bespoke opportunities to engage with industry and a dedicated skills development programme designed to help Fellows establish a career in research.

   Our new 6-month Strategic Leadership in Research programme (UoE investment £400K,

2019-20) has skilled 48 exceptional mid-career colleagues to excel in challenge-led research environments. Participation has driven increased researchers' ambition and confidence in grant applications, with the average value of applications with programme participants as PI doubling from £300k before participation in the programme to £600k.

c)   PhD Students

We provide all our 5,423 PhD students (2020) with detailed support, training and supervision (at least 2 supervisors, formal thesis committees). The majority of our students undertake 3.5-4 year PhDs, with an initial phase dedicated to core skills, tasters and matching, before a full 3-year research period embellished with transferable and generic skilling through >200 courses run by IAD.

Our *Excellence in Doctoral Education and Career Development Programme* (2017) focuses on supervisor support and training, mentorship, wellbeing and professional development. Building on this, in 2020 we established an overarching, unified *Doctoral College*. This coordinates all programmes, reinforces standards and provides support for all PhD students.

We host 11 Centres for Doctoral Training (CDTs), including from EPSRC, MRC, BBSRC, Wellcome. Our CDTs have trained >3,500 PGR students in the REF period.

In partnership this REF period, we co-led the ESRC/SFC-funded Scottish Graduate School of Social Science and the AHRC/SFC-funded Scottish Graduate School for Arts and Humanities. These support the development of new interdisciplinary research leaders and practitioners, highlighting the breadth of PGR support available. We lead the East of Scotland BBSRC Doctoral Training Programme and the MRC DTP in Precision Medicine (with Glasgow and Karolinska).

Our PhD students go to positive destinations with over 96% surveyed in 2019 in employment or further study. Our Careers Service training events were attended by 833 PhD students/year and one-to-one career guidance sessions by 275/year (2014-20).

d)   Technicians

UoE's research environment is strengthened by the expertise, knowledge and skills of our >1,000 technicians. We established a Technician Support Steering Group in 2016 and signed the Technician Commitment (2017) supporting visibility, recognition, career development and sustainability through training and mentoring programmes. In 2020, the Science Council recognised UoE as an *Employer Champion*. Our action plan supports technicians to achieve visibility, recognition and career development through provision of clear, documented career pathways and increasing the sustainability of technical skills across UoE. We have delivered a bespoke career development programme with over 2,000 engagements with leadership, career and management training. Our Professional Registration Fund has supported 34 technicians to apply for professional registration with a professional body, 27 to date achieving awards. 54 of 108 staff celebrated for contributions to sustainability are technicians.

e)   Equality, Diversity and Inclusion

We are committed to creating and promoting a positive culture which celebrates diversity, challenges prejudice and ensures fairness. Our *Dignity and Respect* policy sets out the expectations placed on all members of the University. Staff involved in recruitment take

mandatory Unconscious Bias training. Leadership in EDI is provided through the *Equality, Diversity and Inclusion Committee* which reviews data on staff and student profiles across the protected characteristics. Each School has an Equality and Diversity Coordinator supporting the implementation of our *Equality and Diversity Strategy*. Our strategy and the initiatives outlined below have succeeded in improving the representativeness of our academic staff body: 37% of those returned to REF2021 are female, and 13% identify as BAME, up from 33% and 7% respectively in REF2014.

UoE renewed our **institutional Athena SWAN silver award** in 2018. We hold an additional 23 departmental awards: 1 gold (Roslin Institute), 11 silver, 11 bronze. Our academic profile is gender balanced: 49% women, 51% men in this REF period. 3% of staff reported as non-binary in 2020. Between 2013 and 2020, the proportion of professors who were women increased from 21% to 27%. We funded 356 places on the national Aurora programme supporting women seeking leadership roles, more than any other UK HEI (2014-20).

UoE now has no gender pay gap at any grade except 10, where the gap has reduced from 11.3% in 2015 to 6.5% 2020.

In 2014, IAD introduced a bi-annual 'Ingenious Women' leadership scheme; 120 women in research roles participated 2014-20. In 2018, we won £50K from SFC's 'Can Do Fund' to deliver analogous training nationally in collaboration with the University of Glasgow. The resulting *'Ingenious Women Scotland'* has supported over 100 women in STEM research from companies, public sector and 11 universities. 85% of attendees reported being more entrepreneurial and 90% more confident about taking risks after the programme. Follow-on networking events were open to female researchers from across Scotland; 460 attended led by 15 senior women role models in Edinburgh and elsewhere.

UoE also led a project supporting a gender-balanced working environment in higher education involving staff and students from different areas. The product of this is *Equal Bite: Gender Equality in Higher Education* (2017), available OA online.

UoE is a member of the AdvanceHE Race Equality Charter*,* Stonewall and Business Disability Forum. Our interdisciplinary hub for gender and sexualities studies, genderEd, brings together over 160 UoE academics with expert knowledge to address gender inequalities. It offers a toolkit and suite of resources for PIs to integrate gender equality into GCRF/ODA-focussed research, accessible to the whole HE sector.

The University recognises the importance of having Allies and LGBT+ Role Models across the institution and funds in-house training programmes for both, facilitated by Stonewall Scotland. In the 2019 Stonewall Workplace Equality Index, UoE rose to 121st (up 200 places since 2015). Our Staff Pride Network won Stonewall Scotland Network of the Year in 2018. It hosts monthly events across UoE. We have simplified HR processes for changes of name and gender details in staff records, removing the requirement of documentary evidence.

We are partners in three EPSRC *Inclusion Matters* (2018) projects (more than any other institution), developing new interventions to address lack of diversity in large grant leadership (Evidence BASE), improve access to STEM careers for researchers with disabilities (Disability in STEM Careers) and developing new models for collaboration and networking for researchers with caring responsibilities and mobility restrictions (Virtual In-Situ Networking).

UoE hosts a Disabled Staff Network for staff with disabilities and carers. We provide resources on accessible technology, carer support, disabled staff support, estates accessibility, fire safety, staff counselling, transport and parking. Our Staff Disability Officer provides one-to-one support to disabled staff and their managers. Our Disability Information

Officer aids with accessibility issues.

UoE's *Race Equality and Anti-Racist Sub-Committee* takes forward the University Race Equality and Anti-Racist Action Plan. Its action areas cover research, learning and teaching, improving Black, Asian and Minority Ethnic (BAME) student attainment and achievement, decolonising the curriculum, improving the diversity and representation of BAME students and staff, service improvement, addressing reparative justice to the promotion of an anti-racist campus culture. It includes key groups such as RACE:ED, a hub for research, impact and teaching on race, ethnicity and decoloniality studies, the Edinburgh Race Equality Network, the Student Association, BAME networks for students and staff and trade unions.

f)   Equality and Diversity in REF

Our REF Code of Practice covers all protected characteristics (2010 Equality Act) and has been rigorously applied across all submissions. All staff involved in decision making have undertaken the *Unconscious/conscious Bias as related to REF 2021* course, which covers the UoE inclusive approach to REF eligibility, potential biases in output selection and potential biases in impact case study selection, as well as responsible use of metrics. All members or attendees of UoE REF Boards and Groups have also undertaken our courses on the legal context to equality, diversity and inclusion in REF 2021 and Staff Circumstances in REF 2021.

4. Income, infrastructure and facilities

a) Research Support

Edinburgh Research Office (88 FTE) provides extensive support tailored to the specific needs of researchers. This includes horizon scanning for funding opportunities, funder relationship management, highlighting prospects, supporting pathways to impact, developing applications, research contracts and post-award grant management.

In 2019-20 alone, we supported 2,800 applications totalling £1,172B to 360 different funders in 34 countries. Success rates are high: 39.2% by count in 2014, 43.4% in 2020. UoE's research income has risen by 5.4%/year compound over the REF period.

This is facilitated by extensive internal peer-review for all applications, mock interviews for all fellowships and coordinated peer mentoring for new staff and those at career inflection points.

We provide specialist teams for major funding sources. The EU and International Team enabled UoE to submit 1,836 applications to Horizon 2020 over the REF period, with 358 awards totalling €230M. UoE won 31 Starter, 23 Consolidator and 20 Advanced ERC grants 2014-20. Our International Development Research Hub provides specialist support on bid development, network building and policy-into-practice enabling UoE to win £92.7M in ODA funding since 2016.

Our success in winning competitive fellowships is further demonstrated by 16 UKRI Future Leader Fellowships (2018-20) and 91 Wellcome fellowships, 2014-20.

b) Innovation

Researchers are comprehensively supported by *Edinburgh Innovations*, UoE's wholly-owned subsidiary (78 FTE), restructured in 2015 to focus on industry engagement. This strategy has engendered a step-up in attainment (Table 1).

METRIC	REF2014 TOTAL	REF2021 TOTAL
start-ups/spin-outs	77	372
Investment in spin-outs (£M)	31	118
Commercial licenses	748	1,949
Patents granted	140	330
Translational awards (£M)	74	109
Industrial research income (£M)	59	105
Consultancy (£M) / number projects	20 / 1,435	42 / 2,933

Table *1*: The increases in innovation data in the REF period.

UoE spin-outs employ over 1,700 staff and currently turnover >£350M. In addition, our start-ups garnered £247M investment 2014-20.

In consequence, UoE has risen from 15th (2015) to 4th (2020) in the UK Higher Education Business and Community Interaction Survey aggregate performance table. We have won £18.7M from the Industrial Strategy Challenge Fund. Our industrial collaborations are international; income is equally split between UK, European, US and Asian partners.

Recognising the barrier of insufficient venture funding in Scotland to develop our ecosystem,

we allocated £50M of University resources 2014-20 to invest in 32 spin-out/start-up companies, establishing our own £12M fund (Old College Capital), as well as attracting and co-investing in others including Epidarex (£102M), Evotec (£10M) and Mercia (£100M). Total investment 2014-20 into UoE start-ups and spin-outs was £365M. In consequence, during 2014-20, company formation has broadened from informatics (100 companies 2014-20) to encompass new areas including medicine, veterinary, chemistry, biology, physics, engineering, geosciences and creative arts.

c)   Library

The University of Edinburgh's library is one of the largest in the UK. Our research library has an annual turnover of £10M and employs 150 staff. We provide over 3.5 million books and 60 kilometres of Special Collections, Museum and Art Collections, along with >28,000 e-journals and 300,000 e-books. The Library supports researchers with publications, data outputs of research, storage of information about research. All collections are available online, crucial during the pandemic.

We are a leading member of Research Libraries UK, a consortium of the most significant research libraries in the UK and Ireland. We maintain close links with the adjacent National Library of Scotland and its world-class collections. In 2019, we acquired, via philanthropy and crowd funding, the Charles Lyell collection, 294 geological notebooks and >900 letters, some to Darwin. Hosting over 2 million visits/year, the Library incorporates publicly-available services such as the Centre for Research Collections and the University's historic Musical Instrument Collection (6,000 objects) and oversees UoE's Scottish Studies' archives and its 10 cultural heritage collections ranging from anatomy to zoology.

We host a state-of-the-art Makerspace supporting research with emerging technologies including; virtual reality, AR, 3D scanning, 3D printing, holography, advanced programming and analytics. Makerspace won the Times HE Library Team of the Year, 2020.

We use Open Journals Systems as a hosting platform for OA journals, giving free access to staff and students. We provide a comprehensive service to help researchers make their papers OA, including managing article-processing charge payments from UKRI and Charity OA Fund block grants. Our OA policy for monographs parallels REF's policy for journal articles.

Our research information system, Pure, acts as our repository enabling OA. Our OA data repository supports researchers with data management from planning to digital preservation. We received trusted digital repository certification in 2014, re-validated in 2020.

UoE's Research Data Service provides tools and support to enable researchers to manage their research data, including secure data storage on the University's archival storage platform (DataVault), which offers full encryption for sensitive data, creation of permanent identifiers for datasets and discoverability through links to records in Pure.

d)   Facilities

We host three important national facilities: the UK's national supercomputer (currently ARCHER2; £82M, 2020), the UK Research Data Facility (UKRDF; £8.1M) and the national computational facility for particle physics and astronomy (DiRAC; £22.8M). We also host major UKRI-University units such as the BBSRC-UoE Roslin Institute (£33M at QQR 2017), the UK Centre for Mammalian Synthetic Biology (BBSRC-EPSRC-MRC-UoE, £13.4M), the

MRC-UoE Human Genetics Unit (£59.8, 2018-2023), the Wellcome Centre for Cell Biology (£6.3M, 2017-23), and the Wellcome Centre for Biomedicine, Self and Society (£1.2M, 2017, extended in 2020).

We have cutting edge facilities across our disciplines. The EPSRC-funded (£12M, EPSRC) *FloWave* Ocean Energy Research Facility was launched in 2014 to emulate, at up to 1/20th scale, real sea conditions for wave, tidal, and offshore wind energy converters. We established the Edinburgh Genome Foundry, the world's largest automated DNA assembly platform (£4.8M, BBSRC, 2016).

As part of the DDI programme, within the Usher Institute we have formed the DataLoch. This repository of all routine health and social care data for the Edinburgh and South East Scotland region has been created with NHS Lothian, Borders and Fife, Health and Social Care Partnerships, patients and the public. It facilitates a data-driven approach to prevention, treatment, and health and care service provision, enabling high-quality and efficient care within a world-leading learning healthcare system.

Over the REF period, the University has made substantial investment (£24M) in the Centre for Sport and Exercise with its world-class standard sport and recreation facilities that are available for staff and student but also sports research and impact.

St. Cecilia's Hall, the UK's second oldest concert hall, underwent £6.5M redevelopment partly funded by Heritage Lottery and reopened in 2017. Open to the public and researchers, it houses the University's world-renowned musical instrument collection and is used for research, public engagement and outreach.

One of Scotland's leading public galleries of contemporary visual art, Talbot Rice Gallery is housed in the University's Old College. It is an outstanding centre for art and ideas. Through exhibitions, the Gallery is available for cross-institutional research and impact.

e)   Estates

Our Estates strategy prioritises an optimal, accessible estate to meet the future requirements of our students and staff. The UoE estate has a gross internal area of 864,000m^2. Since 2014, we have coalesced on 4 major campuses (Central, King's Buildings, BioQuarter, Easter Bush). Each hubs around modern student centres, with optimal-for-purpose research and innovation facilities enabling co-working across disciplines and industrial/public sector partnerships. In addition, we have substantial research facilities at the Western General and Royal Edinburgh Hospitals, and share facilities with STFC at the Royal Observatory Edinburgh, including the *Higgs Centre for Innovation.*

Adapting our facilities and estates to be accessible is a core focus. We spent £15M on access improvements (2016-20).

During the REF period we have committed **£560M from University resources and external awards to our research and innovation infrastructure**; note construction incomplete by early 2020 has been considerably delayed by COVID-19. Examples include:

- Roslin Innovation Centre (£31M, opened 2017)

- Bayes Centre (£45M, opened 2018)

- Law School (£35M, opened in 2019)

- Advanced Computer Facility Extension (£29M, opened 2020)

- Large Animal Research and Imaging Facility (£25M, opened 2020)

- Institute for Regeneration and Repair (£92M, due 2020, delayed 2022)

- New Biology (£136M, due 2021, delayed 2023)

- Edinburgh Futures Institute (£140M, due 2021, delayed 2023)

Figure 2: Clockwise: Law library, Roslin Innovation Centre, Genome Foundry, FloWave facility, Anne Rowling Regenerative Neurology Clinic, Bayes Centre