

Institution: University of Birmingham**1. Context and mission**

Founded in 1900, The University of Birmingham (UoB) is a civic, research-intensive University with a strong global footprint. Our goal is to use our strengths in research and education to find solutions to the big problems of our day, increasing well-being, social mobility and prosperity globally and locally.

The University comprises around 36,900 students (22,500 UG, 11,000 PGT; 3,400 PGR) and 8,500 staff, (2,700 academic staff, 1,560 REF-eligible). A founder member of the Russell Group and Universitas 21, we regularly rank among the top 100 in major international league tables.

We have one of the broadest disciplinary bases of any UK university, submitting to 28 UOAs in REF2021. Structurally, UoB is divided into 5 academic Colleges: Medical and Dental Sciences (MDS; Main Panel A (MPA)), Engineering and Physical Sciences (EPS; MPB), Life and Environmental Sciences (LES; MPs A, B and C), Social Sciences (CoSS; MPC) and Arts and Law (CAL; MPs D and C). The latter 4 Colleges are further divided into 4 to 7 Schools, the lowest level of budgetary academic unit. In 2015, MDS reorganised into an 8-Institute structure to reflect its key research priorities. Most disciplines are mature; Pharmacy is the only new area that we are submitting compared to previous REF/RAE exercises.

As a measure of research volume, UoB's annual number of research publications increased from 4,799 in 2014 to 5,734 in 2019 (Section 2), while our research income has increased from £112m to £151m (Section 4).

The University is located within the West Midlands, population 5.6m. The city of Birmingham, population 1.08m, has greater economic inequality than any other British city and high ethnic diversity (53% White British). The University engages with the city and region across the full breadth of our research portfolio, from health and environment, to energy, transport and leadership.

Our Dubai campus opened in 2017 (target 2,940 students by 2028) and a research stream is being developed - including recent funding from UAE Education Ministry. We also have strategic research partnerships and collaborations in Europe, India, China, Brazil, USA and Australia.

2. Strategy**2.1 Strategic Goals for Research and Impact**

The goals and actions for research and impact specified in our Strategic Framework 2015-2020 are to:

2.1.1 'Enhance the quality and reach of our research'

Investment in academic staff has been key:

- Recruitment to Research Fellowships to build critical mass (3.4.1)
- Launch of a Research Leaders' Programme, supporting selected mid-career academic staff to progress (3.4.4)
- Local (UoA-level) support to build an enhanced research culture '*that stimulates, nurtures and engenders drive, confidence and ambition*'
- Measures to enhance interdisciplinary collaboration and external partnership (2.3)

Research publications data indicate an increase in quality, disciplinary breadth and reach over the REF period, with significant increases in publication with international partners.

Table 1: Publications Data (SciVal 2020)

Measure	2014	2015	2016	2017	2018	2019	% change since 2014
Volume: Scholarly output	4,801	4,887	5,235	5,428	5,600	5,734	19.4%
Breadth: Subject areas covered	89.5%	92.8%	92.2%	91.9%	91.9%	93.7%	4.7%
Breadth: Academic-Corporate Collaboration	6.3%	6.4%	6.5%	6.2%	6.1%	6.2%	-1.6%
Breadth: International Collaboration	48.8%	50.3%	51.7%	50.6%	55.6%	56.9%	16.6%
Impact: Outputs in Top 10% citation Percentile	22.2%	22.9%	23.6%	21.4%	23.2%	24.2%	9.0%

2.1.2 ‘Invest strategically to create and strengthen areas of excellence’

Through our Dynamic Infrastructure Fund, we have invested strategically (ca. £30m) in 20 key research areas, including Gravitational Waves, Regional Economic Development, Human Brain Health, Quantum Technologies, Biomedical Imaging, Modern History, Thermal Energy, Superdiversity, Security. The University’s Foresight and Strategic Research Themes Group comprises members from a range of sectors and backgrounds, providing external context, advice and advocacy to steer investment and shape major funding bids. Strategic research partnerships in US, China, India, Australia, Europe have been built around key research areas, and we have implemented a £500m capital programme for research infrastructure focussing on them (4.2). These key areas have generated over £300m in new research awards in the REF period. The Queen’s Anniversary Prize awarded to our Centre for Rail Research and Education exemplifies external recognition of our strengths.

2.1.3 ‘Expand the impact of our research’

- We have invested, and leveraged investment, in facilities that enable external engagement and impact (4.3) and in teams supporting intellectual property development (UoB Enterprise), business engagement, research impact and public engagement.
- The Industry Professorial Fellows scheme (3.4.1) was established to stimulate and link basic research to translation.
- Impact culture has been strengthened by training the next generation via ECR networks (3.3) and the ‘Medici’ academic entrepreneurship programme; increasing the number of School-level industry advisory groups; embedding impact in recognition and reward (3.4.6); initiating annual University Prizes and a central fund for impact; encouraging leadership through School and College Impact Leads, and

appointing a DPVC (Research Impact) and a DPVC (Regional Engagement); communicating impact through e.g., the 'Birmingham Heroes campaigns' in 2018/19, including features at Euston Station.

- We developed key external partnerships to enable impact, e.g. establishing Birmingham Health Partners (BHP), an alliance between UoB and two NHS Foundation Trusts bringing healthcare innovations to clinical application at pace and scale; sponsoring CBI annual conference in 2017, 2018; Membership of Business in the Community network.

Two success indicators have been the growth of new research awards from industry (£6m in 2015-16 to £24m in 2019-20), and the growth of the University's HEIF allocation (determined by metrics including IP income, business, consultancy, regeneration, SME support).

2.1.4 'Increase levels of external investment in our research and our share of competitively-won research income'

In 2016 we set ambitious 10-year targets for 10% annual research-income growth (to £300m by 2026); new research awards have grown by an average of 12% a year since 2015 (4.1.1).

2.1.5 'Work with other universities to increase influence and impact'

We are founder members of Midlands Innovation (MI), a collaborative network of eight research-intensive universities. Two key MI projects led by UoB are the £5m Commercialisation of Research Accelerator (MICRA), funded by Research England; and the Energy Research Accelerator (ERA) research hub, (Director: Freer, UoB), with ~£180m of Innovate UK, University and industry funding. Since 2018, MICRA has trained 1,200 academics and leveraged £65m of additional funding across the eight universities, while ERA has created 23 major new research and innovation facilities in energy technologies across the network.

Through our strategic partnership with Nottingham University, we jointly invested £10m in 'COMPARE' (2016-21), assembling leading researchers and facilities to develop novel methods for visualising single membrane proteins, with application to prevention and treatment of cardiovascular disease and cancer. We are partners of the Turing Institute (since 2018), Faraday Institution, and Rosalind Franklin Institute, working with leading universities to advance data science, electrochemical energy storage and life sciences technologies.

2.1.6 'Develop strategic partnerships with business, public sector and third sector organisations'

We have received major ISCF awards to address national priorities with industry partners in, e.g., robotics and batteries, and established new national facilities including the National Buried Infrastructure Facility and the Centre of Excellence in Digital Rail Systems (Section 4). The Birmingham Stories National Literacy Hub is a collaborative initiative with the National Literacy Trust (their first hub partnering a university) aiming to improve literacy among KS3 students and adults by embedding UoB research into the NLT's programs and interventions.

2.1.7 'Collaborate to shape priorities and activities to increase opportunity and well-being in the region'

Strong links are established with the West Midlands Combined Authority (WMCA) through our joint WM-REDI economic development institute (£4.9m from Research England's Development Fund), and through membership of the WMCA Innovation Board; and the

Royal Shakespeare Company through our Shakespeare Institute at Stratford. We have secured £30.2m ERDF funds to work on R&D challenges involving approximately 1,500 SMEs across Energy, Rail, Manufacturing, Quantum Technology, Materials and Health Technologies, and a further £7m from the LEP's Local Growth Fund to establish the Birmingham Energy Innovation Centre. Located in Tyseley Energy Park, the centre will demonstrate new low-carbon technologies, contributing to Birmingham's reduced CO₂ targets by 2030.

2.1.8 'Strengthen relationships with key international partners and foster new ones to enhance reach and relevance globally'

We have established secure, long-term, strategic relationships globally for research collaboration and influence:

- University of Illinois Urbana-Champaign: Our BRIDGE partnership involves 80 academics across all five UoB Colleges. Research collaboration has led to increasing output of jointly authored papers: 142 in 2017 (FWCI of 6.43). Five three-year BRIDGE research fellows have completed their fellowship and transferred into academic positions. (3.4.1).
- University of Melbourne: Over 50 active research links across all disciplines, and the £2m Priestley Joint PhD Scholarships programme for life sciences and engineering, established 2016. 199 jointly-authored papers were published in 2019, FWCI of 8.01.

To secure strong relationships in Europe, post-Brexit, we have signed strategic partnerships with Trinity College Dublin (bio-engineering, digital humanities and clinical trials) and University of Amsterdam, the latter to share best practice in equality, diversity and inclusion. The launch of the European consortium EUniWell in 2019 involving UoB has resulted in a €5m Erasmus+ award to support wellbeing-related collaboration.

Our China Institute has facilitated new partnership development, including a ¥6m microparticles initiative with Jiangsu Industry Technology Research, and increased collaborations leveraged through bases in Guangzhou and Nanjing, with enhanced outputs and grant capture. Our India Institute has improved visibility and profile, significantly increasing joint publications with Indian partners in the top 10% of highly-cited outputs, and stimulating greater grant capture and formal agreements to develop major collaborations, notably with Haryana State Government. Our 10-year engagement in Brazil has yielded resilient, impactful partnerships, notably through the UoB-FAPESP fund that created a pipeline for external grants, including a £2M MRC/Newton/FAPESP award for the UK-Brazil Joint Centre for Arbovirus with Sao Paulo University. A strategic partnership with Waseda University in Japan features collaboration from Shakespeare to Robotics.

2.2 Research Integrity and Open Research

We are committed to maintaining high standards of scholarly and scientific integrity in our research, with policy development led by the Research, Governance, Ethics and Integrity Committee, chaired by the PVC (R&KT), and supported by the RGEI office (8 FTE). We adhere to the 5 commitments of the UK National Concordat, setting expectations and a governance framework in our Code of Practice for Research. We publish an annual [Research Integrity Statement](#) outlining our processes, and integrity features in PGR courses and staff inductions, including bespoke discipline-based activities and online training for researchers and distance learners. The Clinical Research Compliance Team (6.4 FTE) delivers proactive, expert support for research involving human participants that is subject to external regulatory standards, ensuring responsibilities under the UK Policy

Framework for Health and Social Care Research are undertaken effectively and efficiently with appropriate ethical review.

We are increasingly prioritising Open Research (OR), which in turn facilitates testing of reproducibility, and are a signatory of DORA. The Open Research Board focuses on developing initiatives beyond compliance to reap the benefits of OR.

The Scholarly Communications team supports our open data repository (4.5) accessed via the Pure CRIS system, manages the University's Gold Open Access funds and provides guidance on Green Open Access. The Library Research Support Team runs workshops and online courses on OR, and when negotiating journal subscriptions, we prioritise Open Access provisions within licence agreements.

2.3 Interdisciplinary research

2.3.1 We aim to support, recognise and reward interdisciplinary research. The Institute for Advanced Studies (IAS) and Institute for Global Innovation (IGI) together provide a framework for developing interdisciplinary research from idea generation to securing funding and output production. Additionally, there are numerous interdisciplinary centres (see [research centres](#)) at local level.

2.3.2 The IAS facilitates 'bottom-up' interdisciplinary networking through workshops and talks, international visiting fellowships, funding and engagement with end users. Support from IAS led to the development of the Institute for Mental Health, National Centre for Nuclear Robotics and the Centre for Human Brain Health.

2.3.3 The IGI, launched in 2018, takes a challenge-led, mission-driven approach to interdisciplinary research, aiming to inspire, facilitate and deliver research addressing pressing global challenges. Harnessing the breadth of UoB research, it has raised nearly £20m in research funding, including £5.7m from the GCRF, and promotes four main themes: Gender Inequality, Resilient Cities, Water Challenges and Transnational Crime, alongside emerging themes. The IGI enables scholars from multiple disciplines, financially and logistically, to generate holistic responses to challenges and connect with scholars and stakeholders in LMICs, ensuring diverse global perspectives are incorporated into our research culture.

2.4 New Strategic Framework

Building on the success of the last 5 years, our draft Strategic Framework (2021-2025), sets 4 key research goals:

1. **Identify, review and invest in key research strengths:** initiate a robust review (with international input) of research strengths, and 5-year plans to develop 30-40 such areas; build strategic partnerships with other HEIs, nationally and internationally, around these strengths.
2. **Reduce barriers to interdisciplinary working:** establish the Interdisciplinary Data Sciences Institute; joint supervision of PhDs across disciplines; digital networking of researchers across UoB.
3. **Embed impact in our research:** review our assets – facilities, expertise, support teams – to maximise benefit; develop a culture of enterprise and innovation supported by an 'ideas factory'; maximise public engagement opportunities of our city-centre hub, 'The Exchange' (4.2.2).
4. **Continue to enhance our research culture and address EDI issues:** develop new academic-staff-development programmes; new research-integrity strategy; new university-wide academy to support ECRs.

We will ensure professional support and infrastructure underpin these priorities, with emphasis on co-ordination across professional services.

3. People

3.1 Strategy

We aspire to be a destination of choice for the best researchers – from postgraduates to professors. People and Culture is a theme in our new Strategic Framework, and places value on those who are at the heart of what we do. Our ambition is to continue developing a vibrant research culture that stimulates and nurtures, is inclusive, equal and diverse, and recognises the importance of staff development from recruitment and induction through to support, progression and retention.

3.2 Postgraduate researchers

With nearly 4,000 postgraduate researchers (PGR) (30% international), including 440 visiting students, we focus on creating a supportive infrastructure and a high-quality student experience. The Postgraduate Dean (position established 2018) develops strategy and leads enhancements of the offering for all postgraduate students, supported by a Director of Postgraduate Research. UoB commits to welcoming all postgraduates into our vibrant and supportive research culture through our Postgraduate Guarantee. The Westmere Hub, run by the University Graduate School (UGS), opened in 2015, providing a training and social space for all PGR students. The Hub hosts training to support PGRs' development across the Researcher Development Framework (e.g., academic skills, entrepreneurship, career management), whilst high-profile annual events disseminate PGR research widely within the University (Research Poster Conference, Images of Research, Three Minute Thesis). A cross-institutional community is facilitated by the PGR-led activities fund, and five PGRs are appointed as Westmere Scholars to support peer-led community building and researcher-development activities within the Hub, with key themes including wellbeing and inclusivity.

The UGS manages the PGR Annual Review process and leads quality assurance projects to understand the PGR experience and tackle any issues. This includes face-to-face training for new PGR supervisors (and those new to the University) and conducting surveys (e.g., Postgraduate Research Experience Survey, PGR Exit survey) to collect initial destinations data and details of PGR alumni to facilitate future career talks/mentoring.

Annually, we spend approximately £10m on PhD scholarships distributed by the Colleges, and have offered 10-15 Global Challenges PhD scholarships annually since 2016 with cross-College supervision.

3.3 Early Career Researchers (ECRs)

The University is committed to enhancing the development and careers of ECRs. A major route to achieving this is the Postdoctoral / Early-Researcher Career Development and Training (PERCAT) scheme for STEM Colleges and the Early Career and Research Staff Committee (ECARS) for non-STEM Colleges. With senior academic and ECR representation from Colleges, these tailor personal and career development to disciplinary needs. Regular activities developed by ECRs include seminars, training, research-funding and Fellowships workshops. We aim to foster a collective identity for ECRs, ensuring the postdoctoral voice is represented in formulating College strategy. These groups, in turn, feed into the University-level Researcher Development Steering Group, comprising senior academic and ECR representation from all Colleges and reporting directly to Research Committee.

Our *European HR Excellence in Research Award* was renewed in 2016 and 2020, recognising the work we do to support ECRs. We have conducted a gap analysis against the principles of the New Concordat leading to an action plan that also underpins our *HR Excellence in Research* actions. The ECR work-stream of the *Birmingham Academic Career Framework* project has embraced the Concordat principles and is recommending their adoption through a guidance code for research leaders. The *Careers in Research Online Survey (CROS)* and the *PIs and Research Leaders Survey (PIRLS)* are conducted biennially and an ensuing action plan is agreed. In 2019 we received positive (higher than national) responses, for ECRs feeling valued in publications, funding applications, and public engagement. The University supports the *National Postdoc Appreciation Week*.

3.4 Academic Staff (Teaching and Research)

3.4.1 Recruitment strategy

The University has expanded REF-submitted staff FTE, from 1,141 (REF 2014) to 1,560 (REF 2021), via a sustained academic staff recruitment drive - at junior levels to grow careers, and senior levels to provide research leadership. Research-only staff numbers have also grown from 899 to 1,114 in the period, with staff originating from 78 countries. This recruitment, including the fellowship schemes given in Table 2, has selectively enhanced research strengths and critical mass in areas including Corpus Linguistics, Biomedical Imaging and Mathematical Biology.

Table 2: Fellowship schemes

Scheme	Number recruited in REF Period	Description
Birmingham Fellows	90	<ul style="list-style-type: none"> attracts early-career independent researchers to conduct original high-quality research five years protected research time Fellows graduate to Lecturer/Senior Lecturer at the end
BRIDGE Fellows	5	<ul style="list-style-type: none"> novel variation of Birmingham Fellows scheme including provision to spend one year at University of Illinois developing research collaborations
Professorial Research Fellowships	23	<ul style="list-style-type: none"> targeted at mid-career academics on a steep upward research trajectory three years protected research time
Industry Professorial Fellows	2	<ul style="list-style-type: none"> targeted at individuals in industry or working at the industry-university interface supports transition to academic sector to drive industry-university research collaborations
Interdisciplinary Professors	4	<ul style="list-style-type: none"> targeted at individuals in established Chair positions expected to lead and develop significant interdisciplinary research spanning two or more Schools, e.g., Computer Science and Law

3.4.2 Staff Inductions

Central Inductions for new staff provide an overview of the University's priorities and academic environment, and are delivered simultaneously to academic and professional services staff to encourage collaboration. Mandatory online training for new starters includes Equality and Diversity and Health and Safety.

3.4.3 PDRs and Study Leave

New academic staff have a probationary personal development planning (PPDP) period, and are allocated a PPDP mentor to help develop their initial academic objectives with their Head of School. Performance and Development Reviews (PDRs) are conducted annually and managed locally by Colleges and Schools. The University's HR Excellence Award action plan shows our commitment to a consistent approach to PDRs, recognising their centrality to career development, particularly for those from less represented backgrounds. Academic staff are entitled to apply for study leave (up to 1 semester per 7, with an enhanced scheme in CAL), an opportunity to develop research activities and for personal development.

3.4.4 Training and Development

A suite of leadership [training courses](#) is tailored to all academic career stages. This includes teaching ECRs to understand core leadership and management skills, and a Senior Leaders Programme for staff taking up greater formal leadership and managerial roles (e.g., College Director of Research), incorporating sessions on ED&I and 'leading in a diverse context'. The Research Leaders Programme, introduced 2016, offers mid-career academic staff training and support to lead large research programmes with multi-disciplinary collaborations (90 academic attendees to date).

The Aurora Leadership Programme, completed by 100 early-career female academics and new senior leaders, aims to develop skills and confidence to negotiate careers and build networks. The Aditi Leadership Programme for BAME academic and academic-related staff, completed by 58 colleagues, helps identify and address the barriers colleagues may face.

Our University-wide 'Developing as a Researcher' courses for all career stages include career planning, encouraging research integrity, grant writing sessions hosted by external academics and Journal Article writing. Our 'Influential Researcher' workshops focus on reaching audience and raising research profile, including sessions on collaboration and wellbeing.

3.4.5 Staff Support

The wellbeing of staff is central to creating an inclusive, thriving research environment. The Workplace Wellbeing team provides an Employee Advice and Listening Service to support staff in making informed decisions about work and personal issues, an Employee Disability Service offering practical guidance for disabled staff, and an Occupational Health Service to advise staff about how health (e.g., return to work after sickness) may affect work. Cross-University teams collaborate annually to provide a week of wellbeing-related activities, such as 'The Happiness Workshop', for academics. Additionally, we host a staff-wellbeing conference with Nottingham University; in 2019, over 30 HR practitioners and researchers from across the Midlands looked at how wellbeing initiatives work.

In 2016, we created a DPVC (ED&I) role to provide leadership and drive progress on ED&I issues, and a network of College Equality Leads to support and embed change using local, subject-specific approaches. The central Equality Team oversees implementation

of ED&I strategy and *inter alia* provides ED&I information to support research funding bids, including participation of University academics in equality events. An important contribution is to support academic staff (particularly women) to use techniques to combat ‘trolling’.

Supported by an EPSRC "Inclusion Matters" award, we are conducting rigorous research into bias in making judgements of academic quality, and evaluating the effectiveness of trial interventions, such as ‘reverse mentoring’. Our staff networks are increasingly recognised as models of sector best practice, and include thriving LGBTQ+, BAME, Enabling, Women’s, and Parents’ and Carers’ networks, to ensure staff from under-represented groups are supported and visible. They work together to host ‘Branching Out’ events across campus, recognising intersectionality in the ED&I agenda.

Our successful 2019 Athena Swan Bronze-level award application demonstrated that our focus on developing female colleagues – through the introduction of institutional targets and recent promotions and recruitment activities - has significantly improved the proportion of senior female staff:

Table 3: percentage senior female academic staff

	2014	2020	Target
Professors	20	28	30
Grade 9	27	34	30

The University received a bronze-level award under the Race Equality Charter (REC) scheme in 2020. Analysis of staff data indicates issues in the recruitment and progression of some groups of BAME academic and Professional Services staff. A key initiative is delivering ‘Talking Confidently About Race’ workshops to all senior management teams, focussing on identifying and addressing bias, micro-aggressions, institutional racism and white privilege. We have also introduced institutional targets for BAME staff representation at each grade.

We engage with the Stonewall Workplace Index, aiming to enter the Top 100 Employers’ Index as a demonstrable sign of commitment to LGBTQ+ issues. We launched an LGBTQ+ Allies Scheme, open to all staff. In 2020, UoB hosted the LGBTQ+ STEMinar, an annual UK research conference celebrating the work of STEM researchers who identify as LGBTQ+.

All staff can request a flexible working pattern. Academic staff on research and teaching contracts returning from maternity, adoption or Shared Parental Leave are entitled to one term’s respite from teaching or administration duties to enable them to focus on research.

3.4.6 Promotions, Reward & Recognition

A focus in the REF period has been on embedding reward and recognition of Research Impact in processes at every career stage, including recruitment, PDR, and as a prioritised criterion in promotion. We have committed to valuing and rewarding impact in its broadest sense, appointing or promoting a number of Chairs in direct recognition of their excellence in Impact.

4. Income, infrastructure and facilities

4.1 Research Awards

Our strategic goal is to increase research awards and income by 10% per annum from 2016 to 2026 to enhance the volume, quality and impact of our research. Table 3 shows

a steady increase in income and awards over the second half of the REF period, on track to reach our 2026 goal.

Table 4: Research Awards and Total Research Income (HESA)

	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20
Awards (£000s)	123,573	143,683	136,948	170,197	204,300	215,475	220,343
Total Research Income (£000s)	111,769	126,395	135,465	124,031	134,237	150,620	140,266*

*(including - £11m 'COVID accounting adjustment')

To achieve such increases, we have expanded our research support ecosystem. Research Development teams (42.8FTE) are embedded in each of the Colleges, providing discipline-specific advice to PIs preparing funding bids. Central teams provide support for EU/International funding, engagement with industry/charity funders, grant set-up and post-award support. Our Business Engagement team, increased from 9 to 21 FTE since 2014, develops strategic academic-industry partnerships and has helped to increase industry research grants by over 200% between 2014 and 2020. Our Research Planning Team provides institutional support and guidance and training in Impact and REF, Open Access and Research information.

We support PIs to develop applications for multimillion-pound complex research and innovation projects (e.g., RPIF, ISCF, ESIF) through the Strategic Research Development team, typically co-ordinating a range of external partners/stakeholders and internal academic and professional services teams across the University. The Development and Alumni Relations Office encourages philanthropic support for research projects, including from Trusts and Foundations; the Birmingham in Action campaign, launched 2019, set stretching targets for philanthropic research awards to help tackle global challenges, such as youth mental health.

University of Birmingham Enterprise supports academics to take ideas to market, creating new businesses and social enterprises, providing enterprise training, access to investment, office and laboratory space and a full 'Knowledge Exchange' service. In 2019-20, 63% of researchers used these services.

Our research communications team has recently prioritised examples of research impact: 53 impact cases were supported with communications and policy activity across the Colleges and 41 through high-profile [Heroes](#) and [Quest](#) campaigns. These campaigns feature diverse academics in terms of gender, ethnicity, sexual orientation and career stage, creating visible role models.

4.2 Major Capital Investment

In this REF period, we have invested substantial capital and leveraged external investment, in physical assets that provide a world-class environment for research and extend the breadth and depth of knowledge exchange and impact.

4.2.1 Core research facilities

Investments in the core research and education environment since 2014 include the £25.9m Business School Extension (opened 2019), a £83.7m new building for Engineering (2021), £ 16.3m refurbishment for Law/Music, £22.6m investment in the

School of Psychology, new £80m Molecular Sciences building (2023) as a principal research space for Chemistry and Environmental Sciences, and a £59.2m new Main Library (2016).

4.2.2 Knowledge Exchange investments

To enhance the University’s external engagement, knowledge exchange and impact strategy we have invested in:

Table 5: Knowledge Exchange Investments

Building	Investment (£)	Purpose
The Exchange (Opening 2021)	40.2m	<ul style="list-style-type: none"> • hub to bring local partners and community together to shape and transform the region, deliver public engagement programmes • housing the new RED-funded regional economic development institute, WM-REDI.
Edgbaston Park Hotel and Conference Centre	40.9m	<ul style="list-style-type: none"> • hosts research conferences, and knowledge exchange activities e.g., the 2019 Quantum Technologies Hub Phase 2 launch, involving national and international academics and companies
University of Birmingham School	22.6m (20m from DoE)	<ul style="list-style-type: none"> • the only UK-university-owned comprehensive school; engages strongly with university researchers, including the Jubilee Centre for Character and Virtues and School of Education
Birmingham Health Innovation Campus (Opening 2023)	15m	<ul style="list-style-type: none"> • harnessing academic and clinical partnerships establishing West Midlands as a leader in Life Sciences R&D • bringing together our research expertise in health data, medical technologies and clinical trials with NHS and industry partners
Tyseley Energy Park	3m	<ul style="list-style-type: none"> • working with the Birmingham City Council, LEP and WMCA to deliver large-scale sustainable solutions for energy, waste and transport for the city, including an innovation hub with £7m of LEP funding
IGI and IAS (Section 2)	995k	<ul style="list-style-type: none"> • newly-refurbished building on campus, facilitating Global Challenges research and interdisciplinary dialogue across Colleges and disciplines

4.2.3 Strategic research and innovation themes

Capital investments (£47m UoB, £136m external) to support specific research and innovation themes include:

Table 6: Capital Investments

Building	Investment (£)	Purpose
Centre for Human Brain Health (CHBH)	9.9m	<ul style="list-style-type: none"> a new-build housing functional magnetic imaging (fMRI) and magnetoencephalography (MEG) scanners
Digital Systems Integration Centre	18.6m (14.325 UKRPIF)	<ul style="list-style-type: none"> part of Birmingham-led UK Railway Research and Innovation Network
National Buried Infrastructure Facility	27.6m (21.6m EPSRC)	<ul style="list-style-type: none"> unique facility for research/training in buried infrastructure-ground interaction, soil stabilisation and improvement, geophysical sensing, and trenchless technologies; part of the UKCRIC national programme
Birmingham Environmental Research Facility	3.116m (1m Wolfson)	<ul style="list-style-type: none"> refurbishment of glasshouse, providing a controlled environment for plant sciences where conditions (eg CO₂ and pathogen levels) can be manipulated
Free Air Carbon Enrichment (2018)	15.7m (15m JABBS)	<ul style="list-style-type: none"> assesses the impact of rising CO₂ levels on whole forest ecosystems - the second such facility worldwide, unique in Northern Hemisphere Part of Birmingham Institute of Forest Research providing a step-change in UK interdisciplinary forest research
Institute of Translational Medicine	24m	<ul style="list-style-type: none"> promotes NHS-industry-academia interactions, accelerating development of healthcare innovations houses the £7m Healthcare Technologies Institute within a Class 2 containment area, equipped with the latest electro-mechanical testing machines for evaluating surgical implants, enabling work with surgeons and the healthcare industry
High Temperature Research Centre	60m (20m UKRPIF; 40m RR)	<ul style="list-style-type: none"> joint with Rolls-Royce; the unique processing capability for investment casting of aeroengine components, and design and simulation for advanced manufacturing, enables production-scale research delivering rapid high-quality product and process innovation

4.3 Libraries and museums

Our libraries are key to supporting research, holding over 1.8 million print and 500,000 online books, and over 85,000 print and online journals. The Library Research Suite includes a reserve amassing stock from previously disparate stores in a controlled environment. The Cadbury Research Library houses extensive special collections with rare books and manuscripts dating back to 1471, including 120,000 books and 3 million manuscripts available to researchers.

Our Research and Cultural Collections, one of the most varied University offerings in the UK, incorporates the Danford Collection of West African Art and Artefacts, the Archaeology Museum, the Historic Physics Instruments, the Historic Medical Artefacts and a Fine Art Collection (including outdoor sculpture). The Barber Institute of Fine Art holds one of the most outstanding and internationally-significant collections of Western Art assembled in the UK in the 20th Century.

Our Lapworth Museum of Geology (reopened 2016 following an award-winning £2.5m redevelopment) has >60,000 visitors/year. Designated as 'outstanding' by Arts Council England (ACE) and an ACE National Portfolio Organisation, it was shortlisted for Art Fund Museum of the Year 2017. This outstanding venue for researchers to engage the public houses around 300,000 internationally-renowned objects.

4.4 Enabling Technologies

We have invested £7.8m in our Enabling Technologies function during the REF period, providing a sustainable equipment base and technical expertise in key life-sciences areas such as Sequencing, Mass Spectrometry, Cell Sorting, Fluorescent Imaging, NMR, and Computational Biology, and a platform for engaging external users.

We provide match funding for equipment bids to research councils and other funders through a central fund, and made a one-off investment of £10m in 2016-17 to upgrade research equipment, principally in STEM disciplines. Our PVC (R&KT) established and chaired the Midlands Innovation Research Efficiency Group (2016-2018), developing policy and mechanisms for sharing facilities and equipment across the Midlands.

National-level facilities include the Henry Wellcome Building for Nuclear Magnetic Resonance, a £16m resource on campus providing access to six high-field NMR spectrometers, with funding competitively won from Wellcome and EPSRC. The UK's only 1 GHz liquid-phase spectrometer was delivered in 2020, providing scientists with insights into the molecular basis of human health, cancer progression and infectious diseases. Phenome Centre Birmingham, developed through an £8m MRC award and four scientific instrument companies, is a state-of-the-art metabolic phenotyping centre conducting small and large-scale studies in medical research and stratified medicine, from conception and experimental design through data acquisition and analysis, and biological interpretation.

The University uses external facilities to enable research and impact that cannot be conducted on campus. A 10-year agreement with Diamond Light Source includes lead responsibility for beamline I18 designed for corrosion studies. The US-based Laser Interferometer Gravitational-Wave Observatory (LIGO), is used by our Institute for Gravitational Wave Astronomy.

Our 300+ technical staff play a critical role in enabling researchers to deliver cutting-edge research. As a signatory of the national Technician Commitment we support the visibility, recognition, career development and sustainability of the technician community and in 2017 launched our Technical Academy to implement this commitment.

4.5 Research Computing

The Birmingham Environment for Academic Research (BEAR) supports researchers with high-performance computing and data storage facilities and expertise. Key services include BlueBEAR, a Linux-based, batch-processing HPC Cluster and BEAR AI, the largest IBM AI cluster in the UK. The Research Software Engineers team (3 FTE) has delivered 'Software Carpentry' since 2018, supporting researchers in delivering quality,

reproducible research through the adoption of accepted good practice. In 2018, we opened a £6m research data centre to meet the demands of a high power, dense research-computing infrastructure.

Our Open-Data strategy is supported by UBIRA ePrints, which currently contains 174 data set records, 94% openly accessible and 160 published in the REF period. The Library's [e-thesis repository](#) contains 7,703 theses (3924 in REF period, 86% open access) with 7.5 million downloads to date.