

Institution: University of Strathclyde

Unit of Assessment: 8

1. Unit context and structure, research and impact strategy

The Department of Pure and Applied Chemistry (PAC) has a long-standing tradition of combining fundamental with translational research to produce focussed areas of impact. The Department fully embraces Strathclyde's founding mission as a '*place of useful learning*' and the research carried out within the Department reflects this commitment.

Table 1. Alignment of PAC Research Sections with the Institutional Strategic Research themes

Strathclyde Strategic Research Themes	PAC Research Sections Contributing to Themes		
Energy	Materials and Computational Chemistry	Catalysis and Synthesis	
Advanced Manufacturing and Materials	Materials and Computational Chemistry	Bionanotechnology and Analytical Chemistry	
Measurement Science and Enabling Technologies	Bionanotechnology and Analytical Chemistry	Medicinal Chemistry and Chemical Biology	
Health and Well-Being	Bionanotechnology and Analytical Chemistry	Catalysis and Synthesis	Medicinal Chemistry and Chemical Biology

Structure

During the current REF period, PAC re-organised its operational structure into distinct Research and Teaching Schools. Within this REF submission, all submitted staff are members of the Research School which is organised into four research sections that overlap with four of the seven strategic research themes of the University (Table 1, also see Institutional Statement). The research sections were developed by identifying the existing strengths within the Department and targeting recruitment into these areas to both strengthen and expand them. Consequently, the research sections within the Department are relatively evenly balanced in terms of their number of academic staff and their experience profiles (Figure 1). Each research section is led by a Head of Section (HoS) who sits on the Research and Knowledge Exchange Committee which is responsible for creating and fulfilling the academic strategy. This committee is chaired by the Director of Research (DoR) and also includes the Head of Department (HoD), Deputy HoD, the Director of Knowledge Exchange (DoKE) and the postgraduate research (PGR) Coordinator.

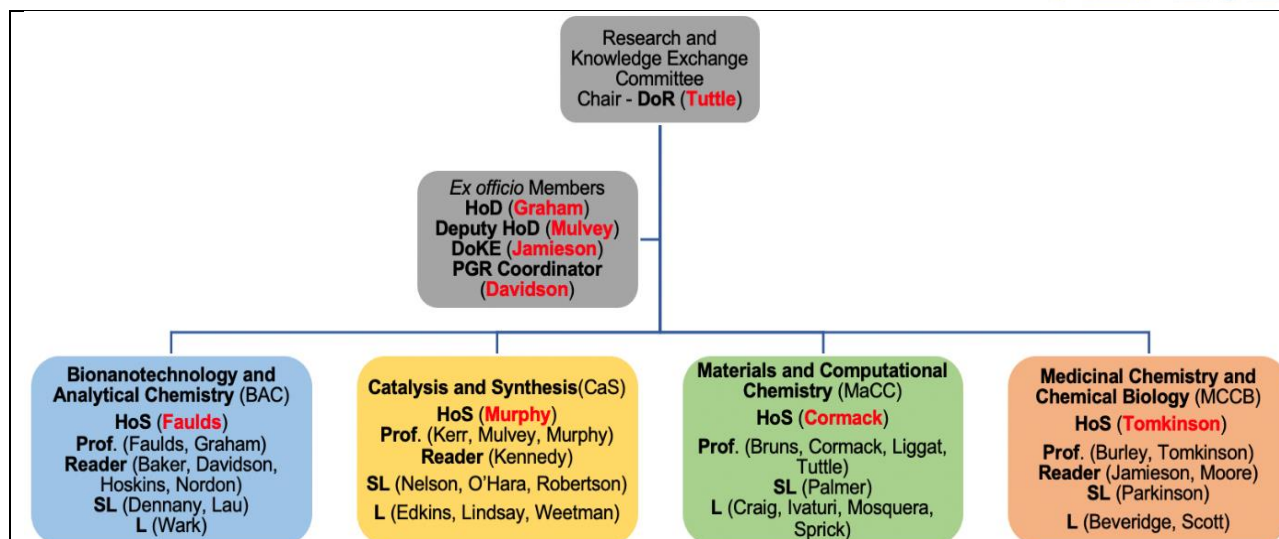


Figure 1. Organisation of Research Sections in PAC and Membership of the Research and Knowledge Exchange Committee.

The recruitment policy for the Department is strongly informed and influenced by the University's research strategy and how best to grow and complement areas of strength (see Section 2). This focus on the existing research strengths of the Department and the strong alignment with institutional aims and investment led to the decoupling of PAC from the former WestCHEM grouping for this REF submission.

In RAE2008 and REF2014, PAC submitted as one of the two components of the joint research school WestCHEM. The overarching goal of the WestCHEM partnership was to deliver accelerated growth to the chemical sciences in the West of Scotland. To this end, the partnership was a success with a significant number of new staff appointed, resulting in WestCHEM submitting 66.2 FTE in REF2014 compared to 51.4 FTE in RAE2008. This increase in staff was also mirrored by a substantial increase in the funding profile of the partner schools, with the research spend doubling from RAE2008 (£4.4M per annum) to REF2014 (£9.1M per annum).

Since 2015, the investment strategies of the WestCHEM partner institutions have diverged in accordance with the goals stated in REF2014: Glasgow – to retain core strengths of a broad-based university; and Strathclyde – to increase industrial translation of research, aligned with the University's mission. Having achieved WestCHEM's goal of accelerated growth at the conclusion of the last REF period, the strategic focus became the vitality and sustainability of PAC as an independent research school. In the current REF period, the Department benefitted substantially from Strathclyde's investment into research aligned with economic growth and societal need to enable impact, which is exemplified in major projects such as the Technology and Innovation Centre (TIC). Thus, the dissolution of WestCHEM reflects the emergence of distinct strengths within the institutions and is testament to the success of the original investment intentions.

Strategy

To enable the translation of ground-breaking research into technology that has a meaningful impact on society, PAC has embraced Strathclyde's triple helix approach of "innovation, collaboration, and new knowledge discovery". In the context of the Department's research strategy, collaboration was identified as a key principle that can drive innovation and promote new knowledge discovery.

Over the last five years, PAC identified new collaborative partnerships that enabled the diversification of the funding base and provided a direct means to translate the research outcomes from the Department into useful applications. A flagship example of this type of collaborative research is the GSK-Strathclyde research partnership which has trained 165 postgraduate researchers (PGRs) as of 09/20, based both at GSK and Strathclyde. The success of this programme (detailed in the related impact case study) has inspired additional Doctorate@Work schemes established with companies such as DSTL, Mondelez and RedX Pharma. These schemes directly impact the R&D strategies of the companies involved through in-house training of their staff and exposure to cutting-edge research that is carried out within the Department. The Department has also established international networks with academics and industry through the European ITN scheme during the REF period (Moore – PARAGON, Skabara – EXCILIGHT, Nordon – ModLife, Cormack – BioCapture, Bruns – PlaMatSu). Key partnerships within CDTs (OPTIMA, Medical Devices and Health Technology, bioX) have provided similar prominent opportunities at a national level and the Department has successfully driven a distinct strategy to enhance engagement with local (Scottish) companies through KTPs.

The strategic shift in approach that the Department has undertaken during this REF period has altered the balance of research funding won by PAC. As discussed in more detail in Section 3, our current funding profile is less than 50% dependent on RCUK, with industry and other sources combining to contribute the majority of income to PAC (Figure 2). The success of this strategy is evidenced in a net greater income over the period compared with the previous REF cycle (see Section 3; Figure 4). As our reputation has continued to grow and its success at translating fundamental research discoveries into impactful applications has escalated, more opportunities to engage in research on larger scales have arisen. This is most prominently exemplified by the recent award of an EPSRC Prosperity Partnership between Strathclyde, Nottingham, and GSK, with Kerr as PI (£12.9M investment).

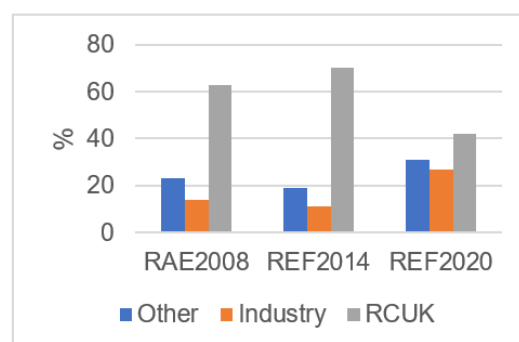


Figure 2. Diversification of Research Income

The third strand of Strathclyde's triple helix is "new knowledge creation". While PAC's mission is the creation of useful knowledge, the potential impact of new discoveries may not be immediately clear. However, we remain committed to the principles of science and the search for fundamental understanding. Therefore, we encourage our academics to apply for funding to allow state-of-the-art fundamental research to be conducted. The combination of funding for applied and basic research allows PAC to sustain its mission while maintaining the vitality of a leading technological institution. To this end, our future research strategy involves continuing our current trajectory and achieving 25% growth in academic FTE and 150% growth in income over the period 2020-2025.

Delivering Impact

Generating impact from research is central to the Department's current and future research strategies. As such, PAC takes a multi-layered approach to enabling impact, leveraging the support offered at an institutional level while also introducing departmental mechanisms for facilitating translation to impact.

At the institutional level, the Research and Knowledge Exchange Services (RKES) Directorate provides holistic support to assist academics in realising the potential of their discoveries. The success of the University in the commercialisation of knowledge discoveries led to the formation of a new Directorate (Innovation and Industry Engagement - IIE) in 2019 with subsequent embedding of a 0.5 FTE business development manager within PAC. During the REF period, the

Unit-level environment template (REF5b)

Department has had a number of successful commercialisation engagements arising from its research. Kerr's Iridium catalysts (see Impact Case Study) have been commercialised for distribution on a global scale via a fine chemicals supplier (Strem Inc/Ltd) and for onward purchase by pharmaceutical companies such as AZ, Merck, Roche, Sanofi, *etc.*, as well as academic institutions. Equally successful has been the development of spin-out companies from the Department's research (see Section 4). Examples include BiogelX and, more recently, ClinSpec Dx, which has received >£5M start-up funding from investors for the development of non-invasive diagnostic methods for cancer.

Within the Department, the translation of research discoveries into impact activities is supported through a mentoring scheme for academics. The Department has three Knowledge Exchange champions who regularly meet with staff to discuss the development of potential impact from their work. Academics are made aware of the importance of recognising impact and signalling this at an early stage, rather than "waiting for the finished product". This has resulted in a strong pipeline of impact opportunities (Figure 3).

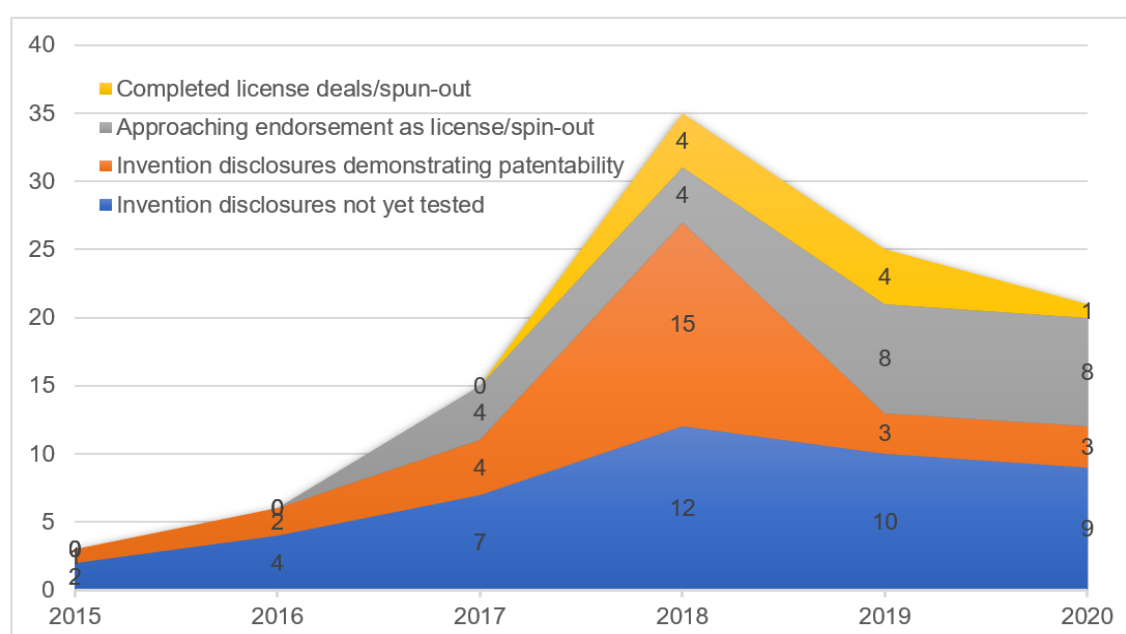


Figure 3. Impact Pipeline During the REF Period

The Department has also devised initiatives to engage directly with companies. An example is the Chemistry Clinic, started in 2014 to support industrial partners on smaller-scale projects by lowering barriers to interacting with the Department. Indeed, the first two clients of the Chemistry Clinic, Tsarina Imperial Dachas Ltd and Buddi Ltd., had never worked with the University but have since become established partners. Tsarina is about to commence their third Chemistry Clinic programme, whilst Buddi returned with a second enquiry which led to a CENSIS (Centre of Excellence for sensing, imaging and Internet of Things technologies) project and two KTPs with the Department. Other major clients, Carron Phoenix and DuPont Teijin Films, were working with the Department but have extended their activities through the Clinic and into more substantial partnerships. Projects for DuPont Teijin and Sandvik led directly to fully-funded PhD studentships and Chemistry Clinic enquiries from Enewall and Rumbol Products were translated into KTP awards (see Section 4 for further details).

The collaborative culture fostered within PAC extends beyond *intersectoral* interactions and is a key component of the research strategy within PAC.

- **Intradisciplinary collaborations** with chemists at other institutions allow academics within the Department to establish global networks. These are supported by the

Department both at an individual researcher level and on a broader programme level. The Strathclyde-CUNY (City University of New York) International Strategic Partnership (ISP) programme exemplifies the latter. This programme provides funding, both from Strathclyde and CUNY, to host workshops between researchers to initiate collaborations and has resulted in several high-impact publications (*Science, Nature Chemistry, Nature Materials, etc.*) joint studentships and funding applications to enhance knowledge exchange between the institutions. Similar ISP relationships have been created between PAC and other institutions such as the Nanyang Technological University, Singapore.

- **Interdisciplinary collaborations** are also valued by the Department and arise both through strategic programme initiatives and the efforts of individual researchers to extend the applicability of their research. For example, two Strathclyde Centres for Doctoral Training (SCDT) were established in the Department to support Chancellor's Fellows (Section 2) who recently joined PAC. The concept behind the **C-INSPRE** (Centre for Interdisciplinary Sustainable Practices for Research in Energy) SCDT is that the future of sustainable energy depends heavily upon the success of interdisciplinary collaborations and requires a solid understanding of policy, research, and manufacturing. The **C-INSPRE** SCDT addresses this requirement by supporting a postgraduate pedagogy with courses from across the Strathclyde Faculties of Science, Humanities and Social Science, and Business.

The benefits of **international, intersectoral, intradisciplinary** and **interdisciplinary** collaborative research to create greater impact is exemplified by the success of the research on DNA minor groove binders (MGBs) described in detail in the related Impact Case Study. The scope of the work has significantly expanded and the potential utility of the Strathclyde S-MGB drug discovery platform was grown by forming a network of relationships with international experts in the biology of diseases: anti-malarial agents in partnership with Griffith University; anti-fungal agents in partnership with Community for Antimicrobial Drug Discovery and University of Manchester; antimycobacterial agents in partnership with University of Cape Town and University of Witwatersrand; and anticancer agents with University of Huddersfield. The potential of S-MGBs as anti-trypanosomal agents against both Human African Trypanosomiasis and Animal African Trypanosomiasis has also been demonstrated, in partnership with University of Glasgow and CSIR-National Chemical Laboratory, Pune, India. Most recently, the potential of S-MGBs to act as anti-SARS-Cov2 agents is also an active line of investigation with Public Health England.

Research Integrity and Accessibility

The Department is committed to the highest standards of research integrity and the principles of the Universities UK Concordat. As part of their initial induction, staff receive online training in research integrity. This includes reviewing the academic policies and procedures within the University such as the Research Code of Practice and the Policy and Code of Practice for Postgraduate Research Study.

PAC mandates Research Data Management (RDM) plans to ensure that our research is FAIR – findable, accessible, interoperable, reusable. Datasets associated with published research are uploaded to the institutional repository, assigned a DOI, and stored permanently in an accessible manner that complies with the FAIR principles.

The dissemination of research through publication and the data management plans that are associated with this are the outward manifestation of our commitment to research integrity, which is supported internally through a number of actions:

- Mandatory Induction courses that include research ethics and integrity;
- Ethics compliance statements on funding applications to ensure that appropriate consideration and precautions are taken;

- Requiring all PGR students to undertake training in research ethics and integrity as part of the PG Certificate in Researcher Professional Development;
- Academics review the accuracy of work that they (co-)author before publication and new academics are made aware of this obligation;
- A written protocol for dealing with queries and complaints regarding research. This involves discussion with the project supervisor, which can then be escalated to the relevant HoS, and subsequently to the Department's Research and Knowledge Exchange Committee if required.

The final aspect of 'promoting collaboration to achieve impact from our research' is accomplished through dissemination and promotion of the research carried out within PAC. Staff publish their research in compliance with HEFCE policy, a policy implemented within Strathclyde since 2014. All authors deposit their work upon acceptance into PURE which provides pre-publication versions of all published work from the Department (Green Open Access). In addition, academics strive to publish their work in open access (OA) formats through journals that provide this option where possible and institutional support is available to staff where required (Gold OA). The institutional support takes a number of forms: (i) "block grant funding", which primarily benefits research funded through UKRI mechanisms; (ii) "Read and Publish" agreements with a number of publishers including, ACS, RSC, Wiley, Springer, which provide free Gold OA; and (iii) the Institutional Open Access Fund, which provides targeted funding for outputs to allow Gold OA if the publisher is not covered by any of the other agreements.

Given the number of intersectoral collaborations in PAC, there is a significant amount of industry-funded research, which is often commercially sensitive in nature. Despite this, the agreements signed with companies typically include arrangements for the publication of material after agreement from the company's legal representative. The companies also have an automatic ability to place a moratorium on the publication of work for two years, which can only be extended after mutual agreement. PURE facilitates the storing of data through the ability to hold work as "non-public" until the moratorium has passed.

2. People

Staffing Strategy and Staff Development

Re-establishing PAC as an independent research school, rather than as part of WestCHEM, resulted in a significant shift in our staffing strategy. In the REF2014 submission, 35 of the 66 FTE returned were Strathclyde-based academics. Although the number in this submission is similar (34.4 FTE), the Department has undergone a turnover of ~30% of academic staff during the REF period. This has allowed the Department to strengthen the research sections in a targeted manner through promotion and recruitment of excellent staff to ensure sustainability in each research area and achieve a balance of staff across the sections, in both absolute numbers and experience (Table 2).

Table 2. Distribution of staff across the research sections in terms of seniority.

	BAC	CaS	MaCC	MCCB	Total
Professor	2	3	4	2	11
Reader	4	1	0	2	7
Senior Lecturer	2	3	1	1	7
Lecturer	1	3	4	2	10
Total	9	10	9	7	35

The Department's recruitment strategy aligned with, and benefitted from, the University's Global Talent Programme (GTP) for senior academic staff and through the Chancellor's Fellowship (CF) scheme for junior staff. In the next five years, as part of the University's Vision2025, PAC will continue to use both schemes to grow the number of research-active FTE by 25% across all research sections.

The success of PAC's staffing and recruitment strategy has delivered an increase in the number of outputs from 1071 in REF2014 to ~1400 in the current period. Moreover, the annual research income from industrial investment has increased from ca. £1.0M/year in the first half of the REF period (2014-2016) to ca. £1.5M/year in the second half (2017-2020).

Whilst our recruitment strategy is aligned with the first principle of the "Concordat to Support Career Development of Researchers", we also recognised that our staffing profile is under-represented at all levels by female staff. Therefore, policies were implemented to help minimise unconscious bias in the short-listing and interview stages of the appointments process. This includes unconscious bias training for members of staff engaged in selection, anonymising applications, as well as the requirement that all panels have balanced gender representation. As a result of these new policies, over one third of staff recruited to PAC during the REF period are female, including 50% of the GTAP and 33% of the CF appointments.

Our commitment to an inclusive approach for recruitment and staff development extends beyond gender. PAC ascribes to the philosophy and policies regarding equality and diversity described in the Institutional statement. However, the Department is committed to move beyond these obligations. This commitment was recognised by an Athena Swan Bronze award in December, 2017 and strengthened by the formation of the Equality, Diversity and Inclusion (EDI) Committee. The EDI Committee is PAC's representative body which advocates for, and recognises the differing needs of individuals regarding recruitment, selection, training, appraisal, development and promotion. The committee identifies problems, comes up with pragmatic solutions and monitors the effectiveness of these actions. The ultimate aim is for a positive influence on the Departmental culture and to raise awareness, ensuring that every individual (student or staff) within PAC feels valued, irrespective of their personal circumstances. The committee measures the success of its approaches through the use of annual staff surveys. The October, 2020 staff survey showed 95% of respondents felt that PAC "is a great place to work". Despite this, only 75-80% of staff responded positively to the statements: "PAC is dedicated to gender equality" and "PAC is dedicated to race equality". Thus, while the working environment within PAC is generally felt to be inclusive, the Department continues to monitor and innovate on its policies of equality, diversity and inclusivity.

The chair of the EDI Committee sits on the Department's Operations Committee as an ex officio member to provide input and guidance into all operational decisions within the Department. To promote dialogue and awareness around issues of inclusivity, the Department also hosts multiple EDI events where external speakers are invited to present their views on a topic relating to equality and diversity; past speakers include Polly Arnold (2017), David Smith (2018), Francesca Paradisi (2019), and Alan Harper (2020). The EDI committee has been active in engaging staff through events such as the Twitter campaign for the International Women in STEM day, showcasing the brilliant contributions from the women in the Department at all levels from technician to Professor. Recently, the Department also hosted an IUPAC Global Women's Breakfast, sponsored by the RSC, which was open to all women working in STEM disciplines across the University to encourage peer support, seed interdisciplinary collaborations and stimulate wider discussions. The student population of Strathclyde reflects our commitment to the goal of gender equality demonstrating our belief that providing equal opportunity to both male and female chemists at an early stage is the best method to remove gender bias in the leaders of tomorrow. To this end, 46%

of PAC's undergraduate students are female, which is higher than the UK average, and this proportion is maintained at the postgraduate level where 45% of our PGR students are female (UK average = 40%).

Beyond gender equality, the Department is also mindful of the different needs of staff, and provides flexible working options. This includes the provision of facilities and amenities to enable staff and students with disabilities to participate fully in study and work within the Department: for example, the provision of readers, scribes and quiet rooms for examinations; and personal assistants within labs for students with mobility requirements.

Following recruitment, staff are supported in their career development through mentoring and the annual Accountability and Development Review (ADR). This includes setting objectives for the forthcoming year aligned with the values of the organisation (Bold, Collaborative, Ambitious, People-Oriented, Innovative). Reviewees are coached by their reviewer to ensure that they set SMART objectives not only for research, teaching and KE, but also for their professional development. This latter aspect of objective setting is often the most challenging. However, it provides all staff with a genuine opportunity to reflect on aspects of their career that they want to enhance and obtain feedback from their reviewer on how to progress. While development activities may include scholarship through, e.g., conference participation, academic staff in PAC make considerable use of generic training such as the Faculty grant-writing challenge (which offers peer support and structured deadlines for grant writing) and courses offered by the University's Organisational and Staff Development Unit (OSDU).

OSDU courses support academics through programmes such as the PG Certificate in Advanced Academic Studies (PGCert) for new academic staff, which has modules in course design, grant applications, learning and teaching in higher education, etc. The PGCert is accredited by the Higher Education Academy (HEA) and, on completion, staff are awarded fellowship of the HEA. For senior academics, OSDU offers a series of courses through the Strathclyde Programme in Research and Leadership (SPIRAL), e.g., Research Supervision, Personal Effectiveness, and Leading Research Programmes. Moreover, for new professors (either recruited or promoted), OSDU runs a "New Professors Programme" that focuses on leadership, management strategies and sessions on coaching and mentorship. This commitment to personal development has seen PAC's research staff, at all levels, complete >200 approved courses during the REF period.

Support for Early Career Researchers (ECRs)

The Department offers a high level of support for ECR academics both in order to attract the best talent available and to develop and retain that talent. In addition to the University's training programmes that are offered to all ECRs (see Institutional statement) the Department ensures that each ECR has a mentor aligned with their research interests in the first instance. However, once established in the Department, new members of staff are also encouraged to identify their own mentors and to consider changing mentors annually in order to broaden their experiences and exposure to the Department's staff.

In recognition of this transitional stage in an ECR's career, the Department provides additional support through a phased introduction to teaching over the first years of employment. Specifically, ECRs are typically not given lecturing duties during their first year and are instead encouraged to focus on setting up their research programme, applying for funding and attending the courses required to achieve the PGCert in Advanced Academic Studies. In their second year, the ECRs are brought into the lecturing schedule either through the co-teaching of an established undergraduate course, or through the development of a specialised research-based final year course, again, in collaboration with a senior colleague.

In order to catalyse the growth of an ECR's research group from their first year of employment, final year undergraduate students are assigned research projects devised and supervised by the ECR. PAC provides funding for all staff to offset the running costs of project students. This process not only gives ECRs the opportunity to train themselves as supervisors on short projects and manage research budgets, but they are also introduced to project assessment and the *viva voce* examination system. All new ECRs are also provided with a PhD studentship once they have demonstrated their ability as a project supervisor. Throughout this process, ECRs benefit from the guidance of established members of staff by, e.g., moderation of *viva voce* examinations and second marking of theses.

In the broader research context, ECRs are encouraged to present their research to the academic community at conferences. In particular this is organised through the co-hosting of annual national meetings such as the ScotCHEM Computational Chemistry meeting, the Scottish Dalton meeting, the Scottish Perkin meeting, *etc.*

Additional support provided to staff in PAC

A variety of support and professional development opportunities are available to PAC. These offer the chance for individuals to continually develop and nurture new directions, appropriate to career stage. For those cases where professional growth requires a period of leave from the department, an established policy exists allowing staff to apply for a six-month sabbatical after six years of eligible service (*i.e.*, not including time spent on research fellowships or for family-friendly leave). For staff returning from family-friendly leave, the Department operates the University level policy (see Institutional Statement) which provides 4 months free from teaching and citizenship duties immediately following return from leave. By ensuring academics maintain a sense of personal effectiveness in their work, the research vitality of the Department as a whole is maintained.

The Department has an effective process for identifying and supporting staff who merit promotion, with a 100% success rate achieved in 2014 – 2020 for cases forwarded to the University's Academic Professional Appointments Panel. During the review period, six staff were promoted from lecturer to senior lecturer level, five from senior lecturer to reader and four to professor. Outstanding leadership in the Department is also recognised by the regular appointment of PAC staff to University and Faculty roles: Kerr as (i) Deputy Associate Principal for Research and Knowledge Exchange; and (ii) inaugural Director of the Strathclyde Doctoral School; Faulds and Graham as two of only eight Distinguished Professors at Strathclyde; Liggat as Vice Dean Knowledge Exchange; Willison as Vice Dean Academic; Cormack as Associate Dean International Research; and Moore as Associate Dean Knowledge Exchange.

Research Students

Doctoral students are the lifeblood of research within PAC and this is reflected in our recruitment, development, and graduation of PGR students (Table 3). The Department currently has a total of 147 PGR students, which is an average of 4.3 PGR students per FTE. This level of success in attracting and graduating PGR students within PAC is the result of a concerted effort to focus on delivering a welcoming and personal experience during recruitment, excellent training in both research and professional skills during their degree, and continued engagement post-graduation.

Table 3. Number of PGR Students who apply, enrol and graduate from PAC on an annual basis.

	2014	2015	2016	2017	2018	2019	2020
Applications	73	74	69	73	65	81	79
Enrolments	54	58	50	51	61	56	46
Graduations	32	27	38	46	33	35	46
PGR Cohort	135	135	140	142	143	145	147

The flagship of our PhD recruitment is the Collaborative Strathclyde-GSK Doctoral Programme, encompassing synthetic, medicinal, process, analytical, and computational chemistry, alongside drug metabolism and pharmacokinetics and the biological sciences recently added in partnership with Strathclyde Institute of Pharmacy and Biological Sciences. A total of 165 PGRs have been active on the programme within the REF period (115 based primarily in GSK labs and 50 with Strathclyde as their principal base), of which 94 have graduated (72 GSK-based and 22 Strathclyde-based). GSK investment in the programme totals >£7.7M. This unique initiative has won many awards as mentioned in the related Impact Case study. Other large PGR programmes PAC is involved with include two current CDTs which provided several students to PAC each year for the last 5 years: the EPSRC and MRC CDT in Optical Medical Imaging (OPTIMA), led by the University of Edinburgh with PAC as the only other academic partner (Graham as the Strathclyde PI with Faulds the Strathclyde Director); and the CDT in Medical Devices led by Biomedical Engineering, with Graham as a CI.

PGRs who are not part of a large programme are recruited individually either through targeted advertising or direct contact with the Department. In the latter case, PGR applicants are encouraged to identify a preferred supervisor based on information on the research interests of academic staff available on the website and in Departmental and Faculty Research Brochures. If an applicant does not express a preference – or they express a preference for a general area e.g., analytical chemistry – an email discussion takes place to match them with the optimal supervisor. The Department has had success within the review period in recruiting 44 overseas research students fully-funded from various sources including the Libyan Government, Omani Attaché, the Government of Kuwait, the Iraqi Ministry of Higher Education and Scientific Research, the Nigerian Government (TETFund) and the Commonwealth Scholarship Commission.

Each year the Department receives funding for a number of studentships through the Strathclyde Research Studentship Scheme (SRSS, see Institutional statement for details). The SRSS typically provides funding at a maximum of 50% per studentship and is augmented by external sources of funding (primarily industrial collaborators) to maximise the number of students recruited. This approach has the benefit of leveraging more studentship positions from the University's investment as well as encouraging staff to maintain and establish new relationships with external partners, re-enforcing our commitment to intersectoral engagement and impact.

Once the PGR cohort is recruited, the Department delivers a dedicated induction programme that builds on and complements the University/Faculty provision. In 2017, sessions were introduced for students starting 2nd year and 3rd year. This addition proved popular and allows topics to be covered that are less relevant in year 1. Once initiated in the PGR programme, each student is enrolled in Strathclyde's unique PGCert in *Researcher Professional Development*, providing them with two awards at graduation. The PGCert provides PGRs with training in a range of professional skills and personal development activities. From the research perspective, PGRs are supported by their primary and secondary supervisors. This support takes the form of researcher training, but is also pastoral in nature where appropriate. The PGR Coordinator is also available to provide academic advice and pastoral care to students, involving the HoD as required for issues that require higher-level intervention.

The Department monitors the development of the PGR cohort through a first- and second-year *viva voce* that is conducted by a member of staff who ultimately become the "internal examiner" at the final PhD exam. These oral examinations are accompanied by a written report, which in the first year, focuses mainly on a literature review to ensure the development of the background knowledge of the researcher. The second checkpoint is written in the form of a paper to ensure that the PGR is progressing both in terms of their ability to write to an academic standard and

generating sufficient results for publication. The final thesis can be either the traditional format or a series of papers submitted for examination (minimum of four as first author).

The recruitment and development of excellence in our PGR population is recognised externally. Our PGR students have won >150 prizes during the review period. Some highlights are shown in Figure 4.



Figure 4. Selected Examples of External Recognition of PGR Individual Excellence over the REF Period.

Equality and Diversity

In addition to our efforts to negate bias in recruitment, the Department is also committed to fostering an inclusive and socially progressive environment for existing staff. The Chair of the Department's EDI Committee is a member of the 'Women in Science and Engineering' and 'STEM Equals' committees. Knowledge learnt from this participation is discussed at the EDI Committee to ensure best practice is translated and adopted in PAC.

The University has a range of benefits and policies that help staff balance work and family commitments. These include maternity and paternity leave and support, adoption leave and pay, parental and shared parental leave, support for carers, flexible and homeworking arrangements, as well as family-friendly research leave. These benefits and policies are in place for all staff on a permanent contract and at a pro-rata rate for part-time staff. In addition, the Department supports research active staff in activities such as conference participation and travel through a specific budget allocated for this purpose. For staff who are unable to travel to attend conferences due to caring responsibilities, the Department makes available the hardware and software (e.g., web cams, microphones, zoom subscription) for virtual conference attendance and workshops.

In addition to the University policy of family-friendly research leave, the Department applies the same policy to those members of staff returning from extended sick leave. Where beneficial, flexible working has also been introduced to better accommodate the changing needs of staff returning from other periods of leave. The flexible working policy also applies to research students. When research students have need of leave, this is discussed with their supervisor and the PG Coordinator, and the best course of action agreed. This has included voluntary suspension of studies, flexible research hours and extension to periods of study.

The Department utilises the University policies of flexible working and working from home policies in addition to the newly introduced agile working policy that makes it easier for staff to operate across various working locations. The robust nature of these policies and the Department's commitment to operate them was evidenced during the Covid-19 pandemic, where the Department was pro-active in protecting the well-being of staff and students. The Department was able to secure remote working equipment for all members of staff prior to the official requirement to commence home-working. The Department required all group leaders to produce contingency

plans for home-working for members of their group and all staff were encouraged to begin working from home where possible in advance of the official announcements. This pro-active approach allowed the Department to continue all teaching and assessment activities (except for 2 weeks of undergraduate lab-work) for the entire final semester of 2019/20. In addition, the Department transitioned to online *viva voce* examinations for PhD students, ensuring that our research students were not disadvantaged.

3. Income, infrastructure and facilities

Income

PAC's strategic decision to diversify its income stream, by focusing on increasing engagement with industry and third-party funders in addition to Research Councils, had a positive effect on the Department's income. This policy enabled more of our researchers to contribute to the Department's income, particularly in cases where more applied science is carried out. As PAC has maintained an active portfolio of UKRI and EU H2020 funding, the total income for the Department has significantly grown relative to the previous REF2014 period (Figure 5) and its upward trajectory continues.

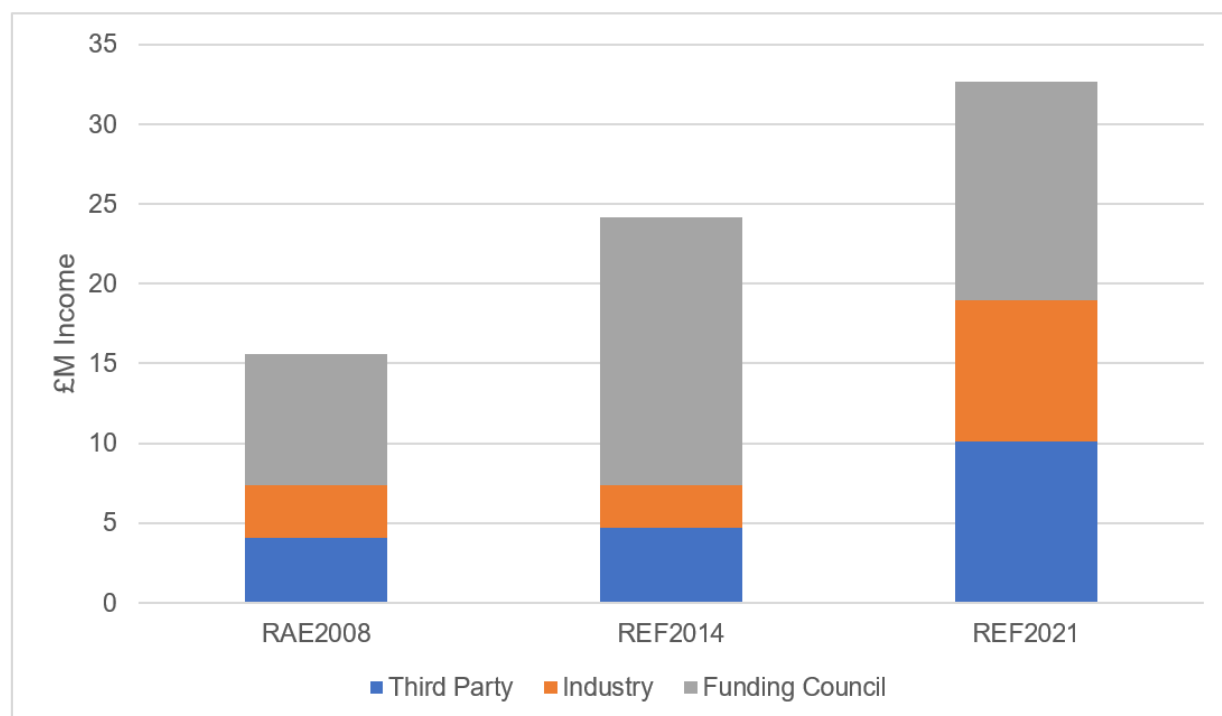


Figure 5. Increase in PAC income and diversification of sources from past REF periods.

The development of research sections based on overlapping research interests and the recruitment of staff to fill specific areas of need has resulted in an ability to specifically target large value research grant schemes more effectively. For example, within the Catalysis and Synthesis section, Kerr led a Prosperity Partnership bid that was successfully funded by EPSRC with a total value of £12.9M of which £7.35M is allocated to PAC (£2.75M from the EPSRC; £4.0M from GSK; and £0.6M from Strathclyde). Within the Medicinal Chemistry and Chemical Biology section, Burley was successful in obtaining funding from the BBSRC in the form of an sLoLa (Strategic Longer and Larger) grant valued at £4.0M, of which £0.9M is allocated to PAC. Nico Bruns (a GTAP appointment) secured €1M through the award of an H2020 ITN, which is hosted by PAC in the Materials and Computational Chemistry section. Similarly, in Bionanotechnology and Analytical Chemistry Graham and Faulds have successfully bid as a partner institution for two EPSRC CDTs (Medical Devices and OPTIMA) with a total value to Strathclyde of £5.5M, as well

as leading on large grants from EPSRC (£3M for *In Situ Nanoparticle Assemblies for Healthcare Diagnostics and Therapies*).

These large grants provide the Department with capacity to build a sustainable research landscape over longer time frames. However, the medium sized grants that typically involve only one or two investigators from the Department also sustain the vitality of PAC's research activities and underpin more "blue-sky" research. Over the REF period 80% of the researchers within this submission have had grant success with UKRI funding applications.

The organisation of the Department into separate research and teaching schools has allowed research active staff to devote a higher proportion of their time to advancing and broadening their research activities. This includes applications for funding, but also training of PGR students, communicating results from research through publications, and the translation of research into technologies that provide impact beyond the academic community. The use of research sections to cluster academics has created critical mass to enable researchers to work together on larger, more challenging problems that require multi-faceted solutions. For example, PAC is a key partner in the multi-million-pound Centre for Continuous Manufacturing and Crystallisation involving partners from Science and Engineering at Strathclyde and various industry partners. In addition, the use of strategic research themes within the University allows researchers in PAC to align with researchers throughout the University with a common research interest. This alignment supports the formation of collaborative, interdisciplinary research centres, such as the SCDT C-INSPRE.

Infrastructure

The research strategy in PAC was devised to deliver world-leading chemistry research; our infrastructure is configured to achieve that goal and allows us to participate in collaborative research, often assuming a leadership role.

PAC benefits from extensive research laboratories in the Thomas Graham building augmented by PAC's infrastructure in the Royal College and the Technology and Innovation Centre (TIC), a £90M facility opened in 2015. The Bionanotechnology grouping within the BAC section is housed in the TIC building, which represents a £12M investment in the facilities available for chemistry. PAC's presence in TIC also acts as an important touch point for increasing collaborations across disciplines and interaction with industrial collaborators. For example, PAC was a co-applicant for an EPSRC strategic equipment grant of £2.5M, led by Physics, for three new instruments based in TIC with a multi-photon Raman microscope aligned with PAC. TIC is the cornerstone of the wider Glasgow City Innovation District project that was launched by Scottish Government in 2019. As part of this, PAC is the lead department in the new Centre for Advanced Measurement Research & Health Translation – a new strategic partnership between the University of Strathclyde and the National Measuring Laboratory at LGC (NML at LGC). Furthermore, PAC has capacity to perform device manufacturing linking us to research in physics, engineering, and materials science.

The University provides a centralised operational support system that relieves the individual departments from the burden of having to administer the increasingly complex management aspects of carrying out modern research. For example, at project conception, the costing and pricing module is integrated within the financial management system that the University runs. This ensures that costing of grant applications, KE work, etc. is seamlessly integrated. Similarly, when research results are obtained, these are stored centrally on the University's data storage service, which has redundant back-up, enhanced security features, etc. to ensure that data are protected to the highest standards. This is a critical aspect in most research, but is also integral for our ability to work seamlessly with industrial and third-party partners, where work is often commercially sensitive. Finally, when publishing results, the centralised system (PURE) allows cataloguing of

the publication and a Green-OA version, and acts as a repository for all data to be stored in a FAIR manner with a published DOI. Centralisation and support for these services by the University allows cost-savings for the Department which can be allocated to specific primary research objectives.

The Department is organised to translate research outcomes into science that can have a positive impact on society. The Department's DoKE sits on RKEC within the Department to ensure direct guidance on the status and opportunities of the various impact activities in the Department. In addition to this, DoKE is a standing member of the Faculty KE committee, where reporting and advocacy for the Department's activities occur.

When impact opportunities within the Department are recognised, the University's centralised RKES Department is able to provide support for initiating projects or commercialising research outcomes. A recent example is the successful spin-out of the ClinSpec Dx company from PAC. The centralised services were instrumental in the formation of ClinSpec Dx. Following an application to the University's impact acceleration fund, £10k was secured to engage a commercial champion, which allowed the team to scope the market. The company initially won £560k in high growth spin-out funding from Scottish Enterprise and subsequently secured £5M in funding from a mixture of private equity and grants. The University's support on IP advice, contracts advice, business formation, negotiating with investors and pitching opportunities, enabled the company to have success in obtaining funding and accelerating its launch.

Facilities

PAC's major facilities are operated by skilled technical staff and all researchers in PAC can access the facilities and resources. This includes technician support for X-ray crystallography, spectroscopy (NMR, ESR, UV/VIS, IR, Raman, ROA, CD), microscopy (Raman, fluorescence, FLIM, SEM), microanalysis, elemental analysis and mass spectrometry. The investment in skilled technicians is complemented by an Institutional commitment to maintain our facilities as state-of-the-art resources. This is most recently exemplified by a £1.5M investment in mass spectrometry and X-Ray crystallography equipment in 2020 to accompany smaller investments (~£200k in core equipment from the institutional EPSRC block grant) and a BBSRC Alert success for a new switchSENSE helix instrument to measure K_d s of specific biomolecular interactions (£309k).

PAC's research strategy is to capitalise on our areas of strength and we have unique, world leading facilities that allow us to do so. For example, our facilities include the largest multi-line Raman facility in the UK (recently expanded to include a multi-photon Raman microscope) and one of the largest globally as part of the Centre for Molecular Nanometrology. As a key partner in CMAC, the department has access to the extensive facilities of the Future Manufacturing Research Hub in TIC which includes state of the art AFM, small angle X-ray and single crystal diffractometers.

The Department also benefits from several strategic partnerships that broaden the skills and techniques deployed in research projects. For example, the international strategic partnership with CUNY involves multidisciplinary collaboration in the area of biomolecular gels, with capability spanning from fundamental discovery and characterisation to application in biomedicine. In addition to research expertise, the interaction with the Advanced Science Research Center (ASRC) at CUNY provides access to state-of-the-art microscopy equipment, which includes TEM, cryo-TEM, SEM, video-AFM and super resolution optical microscopy. This type of collaborative partnership is possible because of the resources and expertise that Strathclyde is also able to offer to the partner institution. In the CUNY example, the use of computational methodology to design and discover new soft materials is the complementary expertise contributed by Strathclyde. PAC has particular strength in this area through access to the high-performance computing (HPC)

facility Archie-West that is based at the University. Archie-West is a cross-HEI resource created through initial funding of a £1.6M award from the EPSRC e-infrastructure fund to provide a regional centre of excellence in HPC. The main computer was upgraded in 2018 through a £2.4M investment by Strathclyde and comprises more than 2500 INTEL Skylake 6138 cores for distributed parallel computing, two 3TB RAM large memory nodes and 210TB of high performance GPFS storage.

The use of cross-HEI facilities also provides significant benefits for PAC and contributes to our ability to translate research results into meaningful impact. PAC researchers have been particularly successful in securing funding for access to central UKRI facilities amounting to >£1M over the assessment period. This involves mass spectrometry at Swansea (~£145k), neutron scattering experiments at ISIS, laser spectroscopy access at RAL and beam time at the Diamond Light Source for X-ray crystallography and high-resolution infrared analysis (~£873k).

Finally, the Department has a number of legacies and donations that contribute to its overall research activities. Most notable are the Laurie Bequest (~£650k), the Mackie bequest (£35k) to support PhD students and the Cooksey Trust fund (~£1M) to support research in analytical chemistry. There are also numerous items of equipment that have been donated or supplied to support research programmes including a long-term loan of specialist microwave equipment, over 6 Raman spectrometers (DSTL), a Raman microscope (DSTL) and 2 FTIR instruments (Agilent).

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

PAC plays a leading role in the chemistry community both nationally and internationally. The Department is a member of the ScotCHEM pooling initiative in Scotland – engaging and leading initiatives (such as the Lightweight Manufacturing Centre) within this network. PAC further enhances the local research community through organisation of regular research seminars. These are organised on a Sectional basis and additional cross-sectional speakers are invited on a regular basis as part of the Departmental seminar series. While maintaining our commitment to equality, diversity and inclusion, speakers at Departmental seminars are often internationally leading scientists and emerging leaders who have recently received awards for their research.

Sustainability of the Discipline

On a national and international level PAC contributes to the sustainability of the discipline through a variety of different mechanisms (Figure 6). This includes membership of EPSRC Strategic Advisory Boards; occupying leadership roles; being members of ca. 60 different RCUK panels; Royal Society panels; and International panels. Given the diversity and number of contributions by all staff, only select examples are listed below.

Mulvey – President of the Dalton Division of the RSC, Member of the Royal Society Newton International Fellowship Committee, Member of the EPSRC peer review college; **Graham** – EPSRC Physical Sciences Strategic Advisory Team Member, MRC Confidence in Concept Panels, MRC Molecular Pathology Nodes Panel, CRUK/EPSRC MDERP Panels CRUK Science Committees, BBRSC Tools and Resources Panel, UKRI Future Leaders Panel, RSC Analytical Division president; Chair of the publishing board for the RSC (oversees all of the publishing activities within the RSCs portfolio and sets the strategic direction for the future sustainability of publishing within the RSC), Trustee of the RSC as a member of the RSC Council; **Faulds** – Chair of the Infrared and Raman Discussion Group [first female and youngest Chair of the Committee], Member of the Federation of Analytical Chemistry Spectroscopy Societies Governing Board, appointed member of the Royal Society of Chemistry Chemical Biology Interface Division and elected member of the RSC Analytical Division Council, Panel Member for the 40 under 40 list for The Analytical Scientist, Member and Chair (2018) of the Optical Society of America Lippincott

Award Committee, Panel member and co-Chair for BBRSC Tools and Resources Development Fund and UKRI Future Leaders Fellowship Panel member; **Murphy** – Member of the RSC Organic Chemistry Awards Panel (2017-18), Member of the Philip Leverhulme Prize Chemistry Panel,

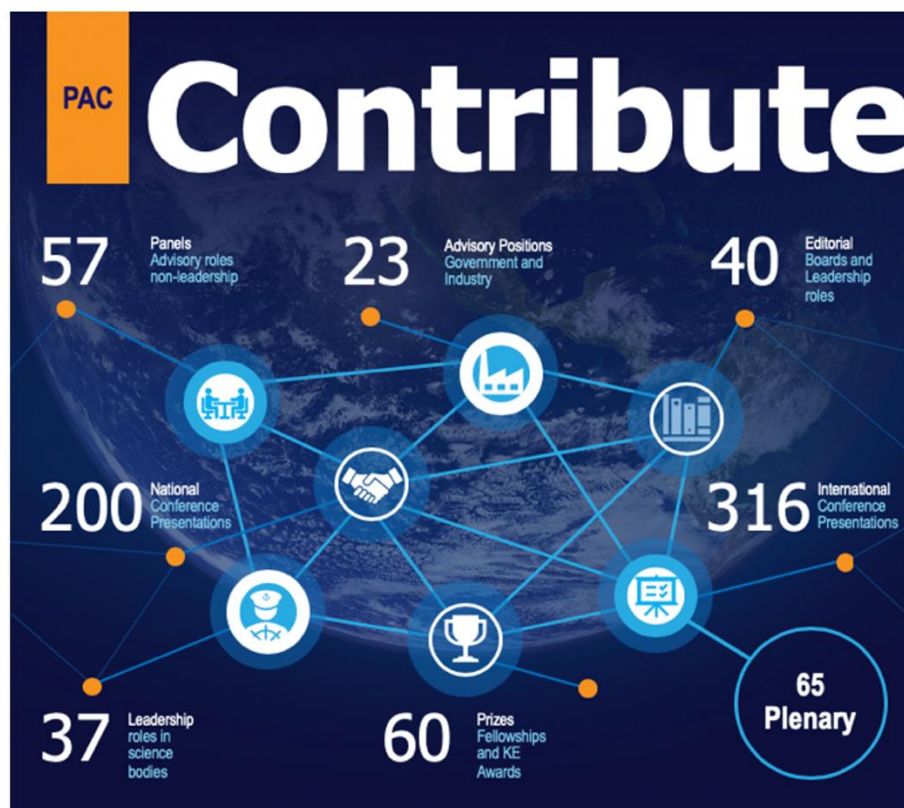


Figure 6. PAC Recognition and Contributions to the Sustainability of Chemistry

Panel member for the Royal Society International Exchanges Scheme Panel; **Kerr** – Marine Alliance for Science and Technology Governing Council Member and Board of Trustees Member for Marine Alliance for Science and Technology – Scotland, Scottish Institute for Policing Research Member of the Board of Governance, National Physical Laboratory Postgraduate Institute Steering Committee Member, Economic and Social Research Council, Scottish Graduate School in Social Sciences, Member of the Supervisory Board of Governance; **Liggat** – Member of RSC Scottish Steering Group, Committee Member RSC Thermal Methods Group, Committee Member Polymer Degradation Discussion Group, Member of EPSRC Peer Review College; **Nordon** – Chair of Glasgow and West of Scotland Local Section of RSC; Member of Measurement Science Research Institute of the Community for Analytical Measurement Science, Technical Director of the Centre for Process Analytics and Control Technology.

A number of our researchers also occupy advisory appointments at national and international universities. These include **Kerr** – External examiner University of Dundee; School of Life Sciences; **Liggat** – External examiner University of Central Lancashire; **Graham** – External examiner Trinity College Dublin, External examiner University College London, External examiner Imperial College London; **Faulds** – External examiner Queen's University Belfast, CDT Applied Photonics Advisory board; **Tuttle** – Advanced Science Research Center Steering Committee, CUNY; **Tomkinson** – External examiner University South Wales, External examiner University Bath, External examiner Undergraduate Degree Programme University Birmingham, Member of West of Scotland Cancer Centre Management board, Member of Management board for UK Regenerative Medicine Platform Niche Hub; **Nordon** – External examiner Keele University; **Kennedy** – External examiner University of West of Scotland; **Parkinson** – External reviewer

Wageningen University and Research Centre, The Netherlands; **Hoskins** – External examiner Liverpool University, external examiner University of Ulster.

The Department's commitment to creating impact through our research has led to a variety of interdisciplinary collaborations (see Section 1) to support specific research programmes (e.g., Human Frontier Science Program networks and EU initiatives such as ITNs). However, while support of the discipline as a whole has benefitted through this approach, we believe that larger-scale partnerships are required to create lasting impact, such as the flagship GSK-Strathclyde programme which has both interdisciplinary and international aspects, as well as through leadership of the Centre for Process Analytics and Control Technology, comprising 29 company and 14 academic/institute organisations from the UK and worldwide. Moreover, our academics have played a leading role in bringing together the international community through chairing significant international conferences such as Faraday Discussions, GRC and Spring SciX, and SPEC to name a few.

Supporting the Economy and Wider-Society

The Department's strategy to embrace external partners as a key component of its research has led to various different ventures and mechanisms for industrial and third-party sector engagement. In addition to the Department-led approaches to engaging with industry and the relationships forged by individual researchers through their professional networks, the University also supports a variety of events to promote engagement with Strathclyde researchers.

The Faculty-led "Business Breakfast" allows for targeted interactions with stakeholders to increase their knowledge of particular subject areas. However, for broader engagement purposes the University hosts "Engage with Strathclyde" – an annual outreach programme. Chemistry is a regular contributor to many of these events and the opportunity to interact with industrial and third-party sector delegates has led to new engagements with the Chemistry Clinic as well as sponsored research programmes.

PAC's focus on the implementation of our research findings to create greater positive impact for the wider economy and society has led to several initiatives from the Department that support this goal. The largest and most successful of these initiatives have been submitted as impact case studies (GSK-Strathclyde partnership, Ir-catalysts in Industry, and the development of MGB drugs). However, the strong pipeline of KE activities in the Department (Figure 3) is not limited to these cases. The Chemistry Clinic directly engages with small and medium-sized businesses, that do not necessarily have a history of exposure to the chemical sciences, with small specific problems to try to understand whether chemistry, as a discipline, can provide solutions. The ability to contribute to the development of companies through problem solving, but also through informing them of the benefits of engaging with chemistry to address their technical concerns, adds value to the company and enhances the reputation of the discipline as a whole. The success of this approach is measured through the desire of companies to re-engage on multiple occasions and in many cases to escalate the extent of their investment through KTPs and other longer-term commitments to funding research (part-funding PhD students, etc.).

ClinSpec Dx, is a new spin-out company from the Department, having spun-out February, 2019. This company is based on collaborative research between Palmer (MaCC section) and Baker (BAC section) that uses machine learning to analyse spectra of blood serum samples for the early identification of brain cancer. The technology being developed has shown particular promise in early testing and has received significant investment (£1.7M) from both private equity and funding bodies. The first clinical study was successfully completed and published, and ClinSpec Dx is now running a further clinical study recruiting 600 patients funded by an Innovate UK Precisions

Medicine Accelerator Grant. ClinSpec Dx subsequently raised a further £3.3M through external investors for this work.

A more established example of a successful spin-out company from PAC is BiogelX. In 2012, BiogelX was spun out of PAC by Prof. Rein Ulijn. The company began trading in early 2013 and has successfully developed patented, cell-matched hydrogel products which offer academic users, medical researchers and major pharmaceutical companies significant advantages over competing complex, animal-derived 3D cell culture products. Evidence of the impact BiogelX technology is making within the life sciences industry is in the form of multiple awards including the RSC Emerging Technologies Winner 2013, Scottish Edge Winner 2014, and being named on the IP100 Intellectual Property League Table 2015. Furthermore, the company has secured four highly competitive Scottish Enterprise SMART awards (each worth £100,000) to fund the further development of its hydrogels. BiogelX is generating steady sales income from customers in the UK, mainland Europe, South Korea and the United States. These include major pharmaceutical companies such as GlaxoSmithKline, Novartis, and GE Healthcare, together with some of the leading universities in Europe and the USA, including University College London, the University of Manchester, Queen's University Belfast, the Technical University of Berlin, the City University of New York and the Massachusetts Institute of Technology.

Indicators of Wider Influence

PAC's researchers contribute to the research base through their efforts as editors and editorial board members for a range of journals, these include: **Mulvey** – Member of the Editorial Board of *Chem. Eur. J.*; **Kerr** - Editorial Advisory Board Member of *J. Label. Compd. Radiopharm.*; **Bruns** – guest editor for *Adv. Mat.*, guest editor for *Europ. Polym. J.*; **Cormack** – Editorial Board, *React. Funct. Polym.*, Editorial Advisory Board, *Molecular Imprinting*, Guest Editor of a special issue of *Polym. Chem.*; **Hoskins** – Editorial Board Member for *J. Nanomed. Res.*, Editorial Advisory Board Member for *Recent Pat. Drug. Deliv. Formul.*, Guest Editor for *Cancers*, European Editor for *Pharm. Nanotechnol.*; **Graham** – Editor in Chief of *Analyst*, Editorial Advisory Board member for *Chem. Sci.*, *Chem. Soc. Rev.*, *J. Raman Spectrosc.*, *Anal. Methods* and *CHEM*; **Faulds** – Editorial Board for *Science and the Law* Primer which is joint venture between the Royal Society and the Royal Society of Edinburgh, Editorial Advisory Board for *Anal. Chem.* and *Chem. Soc. Rev.*, Associate Editor of *Analyst* and Editorial Board member of *Analyst* and *RSC Adv.*; **Burley** - Editor *Sci. Rep.*; **Wark** – Editorial Board Member for *Biosensors*; **Murphy** – Associate Editor of the *Beilstein J. Org. Chem*; **Kennedy** – Co-Editor of *Acta Crystallogr, Sect. C*, Editorial Board member for *Crystals*.

PAC's researchers have been very active in delivering invited international (>300) and national (>200) lectures during the research assessment period. In addition, over 50 plenary and keynote lectures were given at major conferences during the assessment period, such as the *ACS National Meetings* (**Bruns, Graham, Hoskins**) *Gordon Research Conferences* (**Bruns, Faulds, Tuttle**), *Pittcon* (**Faulds**), *SciX* (**Baker, Faulds, Graham**), *ICORS* (**Faulds, Graham**), *ICOMC* (**Mulvey**), etc. PAC's members have also been very active in leadership of conference organisation both internationally and nationally and have served on local organising committees and advisory boards for >50 conferences during the REF period. These include large international conferences such as: ICSM 2020, ~1000 attendees (**Dennany**); SPEC 2018, ~260 attendees (**Baker**), APACT 2015, 2016, 2018, 2019 ~100 attendees and EuroPACT, 2017 and 2020 ~250 attendees (**Nordon**); Programme Chair for SciX conference held in the USA, ~1200 attendees (**Faulds**). As well as smaller national level conferences such as: RSC Chemical Nanosciences and Nanotechnology Annual Network event, 2016-present, ~50-100 attendees (**Hoskins**); RSC Scottish Organic Division Meeting, ~150 attendees (**Nelson**); ScotChem Computational Chemistry Symposium, 2015, 2020, ~80 attendees (**Tuttle, Palmer**).

The Department recognises the important contribution that all our staff members make to the sustainability and vitality of the research in the Department. We are pleased to report that the efforts of our faculty have also been acknowledged by external bodies. Examples of this external recognition include Fellowship of the Royal Society of Edinburgh (FRSE) during the REF2021 assessment period for: **Faulds, Hevia, Kerr, Ulijn**. Our researchers have also been awarded >50 distinguished prizes and fellowships for their research during the assessment period, including two prestigious EPSRC Future Leader Fellowships in the last two years to **Beveridge** (2019) and **Reid** (2020). Other notable recipients are: **Mulvey** (Humboldt Research Award, PKU-Eli Lilly Lectureship Award), **Edkins** (Royal Commission for the Exhibition of 1851 Research Fellowship), **Craig** (*Japan Society for the Promotion of Science (JSPS) Fellowship*), **Ivaturi** (EPSRC Early Career Fellowship), **Hoskins** (Academy of Pharmaceutical Science Emerging Scientist Award), **Graham** (Charles Mann Award for Applied Raman Spectroscopy, FACSS, Theophilus Redwood Award, Royal Society of Chemistry, Named in top 100 Analytical Chemists by Analytical Scientist, and JSPS Fellowship), **Nelson** (Thieme Chemistry Journals Awardee, JSP Fellowship to attend the Bürgenstock Conference), **Faulds** (Charles Mann Award, FACSS, Named as one of the *Top 100 Power List of most influential analytical scientists* published by The Analytical Scientist, Named as one of the *Top 10 Spectroscopists* by The Analytical Scientist, Coblentz Society's Craver Award, Named as one of the *Top 50 Women in Analytical Science* by The Analytical Scientist), **Baker** (RSC Harrison – Meldola Memorial Prize Winner, The Analytical Scientist Power List 2018, Top 40 Under 40), **Burley** (Alexander von Humboldt Research Award), **Kerr** (Melvin Calvin Award of the International Isotope Society), **Dennany** (The Analytical Scientist Power List 2018, Top 40 Under 40), **Murphy** (Alexander von Humboldt Research Prize, Charles Rees Award), **Mosquera** (Ángeles Alvariño Award (Outstanding Career), Ramón Areces Fellowship, Marie Skłodowska-Curie Individual Fellowships), **Weetman** (TU Munich Foundation Fellowship, EuroTech Marie-Curie Fellowship).

The above selected evidence shows that PAC takes seriously its role in society in terms of producing, directing and contributing to the management of the highest quality research. We embrace equality, diversity and inclusion in the workplace to ensure the vitality and sustainability of our research activities and their impact. This commitment to our researchers extends to translating their research into useful technologies for the benefit of Chemistry, science in general and the wider society. It is consistent with our identity and forged from the University's founding principle as "*a place of useful learning*".