

Chemistry International Review April 2009 – Action Plan

Chemistry for the Next Decade and Beyond: International Perceptions of the UK Chemistry Research Base

Preface

This document outlines the recommendations in order of importance as seen by the international panel in April 2009. We have canvassed opinions on parts that fall outside the Research Councils or EPSRC direct control. We hope to give context to the statements made and to give clear thoughts of action where possible.

Context

This report follows the well received Whitesides' Report in 2001/2, "Chemistry at the Centre", which asked some tough questions of the community. EPSRC's action plan for which was updated in June 2008.

This Review's findings fed into the process that helped form our Strategic Plan, published in April 2010.

Current vectors

Understanding our support and defining our role within the career pipeline was done through the current Balance of People exercise. EPSRC is committed to training the best students and nurturing early careers for the UK Research Base and economy needs.

Actions will be prioritised using the feedback received through the public dialogue process.

Public Dialogue

This Action Plan is the result of an open and ongoing dialogue with stakeholders:

Activity	Date
EPSRC's Technical Opportunities Panel	08 June 2009
EPSRC's Town meeting, 12 June: Presentation to Community	12 June 2009
RSC's Science Policy Board	17 June 2009 and 21 October 2009
Research Council members of the Review's Steering Committee	14 September 2009
EPSRC's <i>ad hoc</i> Chemistry Academic Forum	09 October 2009
Heads of UK Chemistry, hosted by RSC.	18 November 2009
Website Public Dialogue	January-March 2010

The Council is keen to engage with the many stakeholders this report could affect. We are keen to have an ongoing dialogue with the International Review's Steering Committee members (RSC, IChemE, CI-KTN, Biochemical Society and ABPI, IOP) as well as the other Research Councils especially BBSRC, MRC and NERC who were also represented on the committee.

The response to the web-phase was low, however we feel that through our extensive open and ongoing dialogue through the routes described above, that the proposed responses to the report recommendations as summarised by the Action Plan has been seen and approved by the community.

Five key areas were identified that required action

A. Nurture and support Early Career Researchers (ECR) in chemistry

The panel saw improvements of the calibre of ECRs since the last report however saw the challenge now, is to support the best and provide a clear career path in a climate of restricted funding. The panel thought ECRs suffered overall from insufficient mentoring and inadequate funding; there's no clear career path for academic success; and the absence of diversity in gender, ethnic and cultural backgrounds were the key issues. To quote the report "*The Panel found widespread and vastly heterogeneous dissatisfaction with the plethora of fellowship and other schemes used in part to recruit ECRs in the UK.*"

B. Sustainable infrastructure and facilities

The panel were impressed by the excellent laboratory infrastructure that has been set up in the UK during the past decade. The panel felt strongly that there should be a dialogue between stakeholders to ensure a viable strategy for sustaining this level is set. The panel also saw the UK national facilities such as ISIS as vital resources to unpin the discipline.

C. Build on regional strengths

The panel were impressed with the examples of regional pooling to create centres of excellence. The panel recommended the Research Councils and relevant stakeholders encouraged this to improve and stimulate more efficient use of research infrastructure in the UK.

D. Communication of the Research Councils strategic aims

The panel felt there should be an open dialogue between the funders and the research community to review the balance of funding allocated to responsive mode versus managed mechanisms. The panel felt there should be more leadership from the academic community to promote the need and ability of chemistry to respond to societal challenges.

E. PhD to reflect achievement

Since the Whiteside's report in 2002 the panel saw a movement towards international norms and thought the DTC programmes were excellent. However, the panel felt there was still room for improvement. The panel noted a failure of the UK universities to attract the very best postgraduate students from the global pool and would like the emphasis to shift from time-constrained to achievement based training.

Key Recommendations

The Action Plan has been structured around the five key areas identified above and the additional headings of Leadership, Diversity, Multi-disciplinary & Interface Research, Scientific Opportunities, Knowledge Transfer and Industry Interface. The report recommendations, with their original reference number (e.g. A.1) are grouped under these headings. For each one we have identified the stakeholders we feel we should engage with and our response and/or proposed action.

Nurture & Support Early Career Researchers

Action Plan Ref. No.	Report Recommendation	Relevant Stakeholders to Engage	Response and/or Proposed Actions
1	<p>H.1: The majority view on the Panel was that the recruiting mechanism into tenured faculty (lecturer) positions and the treatment of ECRs in general in the UK, needs to be improved in favour of a well-defined career path.</p>	<p>HEIs</p> <p>Individual academics – Senior, RCUK, EPSRC – for Physical Sciences</p> <p>Learned Societies</p>	<p>H1 and H2 linked.</p> <p>The panel stressed the importance of this support in areas of chemistry that required state-of-the-art instrumentation e.g. Physical Chemistry</p> <p>The panel recommended two possibilities:</p> <ol style="list-style-type: none"> 1) Introduce faculty positions with probation periods of 5 years. 2) Research Fellows (1-2 years), where the focus was on research not applying for funding. <p>Action:</p> <ul style="list-style-type: none"> • Promote concerns within the academic sector. • Work with RCUK Careers and Diversity Unit as part of the careers concordat. • EPSRC is currently reviewing its Balance of People Support where the future needs for Fellowship and Early Career support will be assessed. • EPSRC is reviewing its First Grant Scheme.

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2	<p>H.2: There is a lot to be said in favour of introducing a tenure track system decreasing sharply the number of post-doctoral fellows in perceived tenure-track-like situations and increasing the number of real tenure track appointments in the universities.</p>	HEIs	<p>Action:</p> <ul style="list-style-type: none"> • EPSRC to engage discussion with academic sector as this is the responsibility of universities as employers.
3	<p>A.3: Strategic hires (senior and ECR) in critical areas would help to address these shortcomings [identified in the report]. International leaders should be approached because it is likely they could more readily nucleate effective research programmes.</p>	<p>HEIs</p> <p>Research councils</p> <p>Funding councils</p> <p>Industry – as strategic partners</p>	<p>The panel identified subject areas where they believed the UK had strength, in the context of what they were exposed to during the review week. Subject areas in need of rejuvenation and strategic support are identified by the panel in recommendations A5, A6, A9, A10.</p> <p>Action:</p> <ul style="list-style-type: none"> • Sustained support provided through active portfolio management e.g. Larger longer grants, and strategic packages where national needs are identified.

Sustainable Infrastructure & Facilities

Action Plan Ref. No.	Report Recommendation	Relevant Stakeholders to Engage	Response and/or Proposed Actions
4	<p>A.8: Under-exploitation of facilities should be viewed as unacceptable and be resolved as a priority since the physics and chemistry (and biology) communities are affected in the UK and will lose productivity and efficiency.</p>	<p>HEIs Research Community</p>	<p>The panel were impressed by the excellent laboratory infrastructure that has been set up in the UK during the past decade. The panel felt strongly that there should be a dialogue between stakeholders to ensure a viable strategy for sustaining this level is set. The panel also wanted the UK national facilities such as ISIS to be preserved.</p> <p>Action:</p> <ul style="list-style-type: none"> • Consider extending the materials equipment database to Chemistry. • Work with universities to identify facilities where cooperation would be beneficial. • Share best practice through case studies e.g. EaST/WEST Chem. • Build into next steps for Mid-range facilities review.

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5	<p>I.1: There is an urgent need to address the current failure of existing mechanisms of research support to direct resources into university chemistry departments for equipment and start-up funds; an issue that is hampering the development of the discipline in emerging areas that demand technologically sophisticated and expensive instrumentation for start-up.</p>	<p>HEIs Funding councils Learned Societies</p>	<p>RCUK has recently undertaken a review of fEC which consulted widely with stakeholders on research sustainability. (http://www.rcuk.ac.uk/review/fec/default.htm)</p> <p>Action:</p> <ul style="list-style-type: none"> • EPSRC is reviewing the operation of its First Grant Scheme and the extent of university support alongside current funding opportunities. • Work with stakeholders to enhance efficiency savings with universities to provide for greater investment in research activities.
6	<p>B.1: Strategic planning is needed and mechanisms need to be put in place to maintain, upgrade and, eventually, renew the equipment in the years to come. In addition, qualified technical support personnel are needed to run the facilities, to provide long-term continuity and to train the PhD students and post-doctoral scientists, who constitute the primary user base.</p>	<p>HEIs</p>	<p>Action:</p> <ul style="list-style-type: none"> • Influence development of best practice starting with Framework universities but disseminate more widely. • Encourage appropriate technical support to support large pieces of equipment or facilities regardless of funding route.

Build & Regional Strengths

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7	<p>D.2: It is suggested that wherever critical interdisciplinary depth exists, centres or research groupings be created, preferably through public-private partnership and adequate long term funding, to find solutions to some of the key societal concerns.</p>	<p>RSC Roadmap</p> <p>Strategic Partnerships</p> <p>RDAs</p> <p>HEIs, VCs</p> <p>RCUK</p> <p>Science in Society</p> <p>Other councils – BIO/Life Sci</p>	<p>Context:</p> <p>This was in discussion of tackling technological/societal challenges. The Panel recognised the Chemical Grand Challenges as a good platform for this but thought its scope was too focussed to embrace the necessary disciplines to tackle societal grand challenges.</p> <p>Examples:</p> <p>Centres for Doctoral Training supported include: Controlled Quantum Dynamics at Imperial College, Sustainable Chemical Technologies at Bath, Chemical Synthesis at Bristol, Condensed Matter Physics at St Andrews, Edinburgh, and HW, Theory and Simulations of Materials at Imperial.</p> <p>Programme and Platform and grants (currently 15 grants funded in the Physical Sciences).</p> <p>Action:</p> <ul style="list-style-type: none"> • EPSRC have set up the Grand Challenge Networks to foster the ideas generated at the Grand Challenges workshop in November 2008 and develop these concepts further. • EPSRC operates in a flexible manner and is willing to support new centres/key groups dependent on the case being made competitively. EPSRC is committed to supporting

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			transformational research particularly in partnership with other funders

Communication of Strategic Policies

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8	<p>A.1: Greater participation and active involvement by the university community in partnership with the Research Councils is necessary to set priorities to establish and sustain world-leadership positions in Chemistry.</p>	Research Councils	<p>Action:</p> <ul style="list-style-type: none"> • Involve the Physical Sciences Strategic Advisory Team (SAT). • Identify 'Champions' for the community in partnership with the RSC and SAT to act as advocates.

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9	<p>C.1: Increase the number of long-term single PI initiated grants to stimulate more adventurous research. If these grants are processed via responsive mode there should be a cap to ensure a sufficient number of grants can be awarded. Importantly, such grants should not be in competition with very large grants.</p>	<p>Research Councils HEFCE</p>	<p>EPSRC already has a corporate target to support a greater number of longer larger grants e.g. Programme grants, and enables creative thinking through EPSRC sandpits, Grand Challenges etc.</p> <p>Action:</p> <ul style="list-style-type: none"> • Continue progress towards organisational target. • EPSRC’s Physical Sciences Programme has recently introduced a Critical Mass list within responsive mode, which allows larger more complex proposals to be tensioned together. • Engage Chemistry researchers at appropriate Sandpit events. • Planned ‘Big Pitch’ for Physical Sciences which will enable adventurous research using alternative peer review mechanisms. • Planned ‘Dream’ Fellowships to provide time and resources for research leaders to define transformative research challenges. • Creativity@home: Facilitators on creative thinking for larger grants will be piloted with some key groups.

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10	<p>D.1: The research community and the Research Councils should work together to define priorities (balance core versus societal needs) and also jointly develop new support structures to enable the UK to contribute effectively to the transformational research needed in the decades ahead.</p>	<p>Research Councils RSC</p>	<p>EPSRC has recently published its Strategic Plan and is in the process of developing its Delivery Plan priorities.</p> <p>Action:</p> <ul style="list-style-type: none"> • Use RSC Road Map and SAT as input for future priorities for Chemistry related challenges. • Build on EPSRC community-led Chemical Sciences and Engineering Grand Challenges.
11	<p>C.2: The Panel suggests a need for stakeholders to examine with the chemistry community how best to improve the effectiveness of responsive mode grants in enabling more adventurous research.</p>	<p>EPSRC SAT Research Community</p>	<p>See Action plan ref no. 9</p>

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12	<p>D.3: The research community and Research Councils should work in partnership to define the emerging technological/societal challenges and jointly craft appropriate ways to deliver solutions.</p>	<p>Other Research Councils</p> <p>RSC – Roadmap/IChemE</p> <p>CIKTN</p> <p>Industry</p> <p>TSB</p> <p>Senior academics</p> <p>SATs</p>	<p>See Action plan ref no. 10</p> <p>Action:</p> <ul style="list-style-type: none"> • EPSRC Landscapes document published for community consultation, June 2009. • Future signposts relevant to Chemistry will be discussed with the Physical Sciences SAT. • Build on Public Engagement activities that were used to define Nano Grand Challenge 2 and Synthetic Biology.
13	<p>I.3: Adopt the key societal challenges (Energy, Sustainability, Climate, Environment, Health) as the framework basis for strategic planning and direction involving science education. Specifically it could be an excellent strategy to fold into and somehow leverage a national dialogue on Societal Grand Challenges of opportunity as a way to engage the science community and the public. In so doing, the role of Chemistry as a central discipline will emerge.</p>	<p>RCUK Science and Society theme + support from EPSRC</p> <p>RSC</p>	<p>See Action plan ref no. 10</p> <p>Action:</p> <ul style="list-style-type: none"> • RCUK are currently developing cross-Council priorities based on Government societal, economic and policy challenges as part of their input to the next Spending Review. • Link to International Year of Chemistry 2011.

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14	<p>I.7a: The Research Councils need open, thoughtful and constructive dialogue with the academic Chemistry community on how to limit the burden on all concerned.</p>	<p>Learned Societies HEIs</p>	<p>Action:</p> <ul style="list-style-type: none"> • EPSRC has introduced demand management to address the growing number of proposals and has responded to feedback on its policy and is monitoring its impact. • EPSRC has undertaken and continues with a full programme of Physical Science visit days. • EPSRC welcomes individual visits/dialogue by phone and e-mail. • EPSRC will continue to utilise various media routes to communicate its policy and activities including the web, printed and electronic communications and greater use of social networking sites such as Twitter. • EPSRC has held the first in a series of meetings with the Learned Societies to help engage/disseminate consistent messages to its members.
15	<p>A.1: Greater participation and active involvement by the university community in partnership with the Research Councils is necessary to set priorities to establish and sustain world-leadership positions in Chemistry.</p>	<p>HEIs Learned Societies EPSRC SATs</p>	<p>See Action Plan Ref No. 10</p>

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16	<p>I.2: EPSRC and stakeholders of the International Review should open a dialogue with leaders of the UK Chemistry community to develop strategies for guaranteeing the health of academic chemistry in the decade ahead. Key elements to be considered include not only the appropriate ratio of responsive mode versus programme and platform grant support, what to do about the current cap on First Grants, whether or not to cap the size of responsive mode grants, and convene an external panel to examine the nature of the scientific review process (including whether or not to limit the number of proposals).</p>	<p>RSC HEIs Research Councils</p>	<p>Action:</p> <ul style="list-style-type: none"> • Continued use of Learned Societies as advocates for Research Councils. • EPSRC is currently reviewing its first grants scheme as part of its strategic review of the Balance of People Support. • EPSRC is seeking feedback on its Landscapes Documents. • EPSRC is continuing to build on its review of the peer review system to encourage transformative research and taking action to actively manage the unsustainable growth of submitted research proposals.

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17	<p>I.7b: The Research Councils should carry out a thorough and independent review (with international representation) of its funding mechanisms and procedures.</p>	<p>ESF HEIs</p>	<p>Context:</p> <p>This, along with I.7a came with context of demand management and the submission culture of the discipline.</p> <p>No Action required:</p> <ul style="list-style-type: none"> • EPSRC has been part of a wider ESF activity to benchmark its Peer Review process across the European Research Area. • EPSRC has an ISO 9001 accredited process which ensures that our review process is continually evaluated and improved based on feedback from external users. • EPSRC has recently undertaken a review of its peer review process. • EPSRC periodically reviews its schemes and learns from the resulting recommendations e.g. the introduction of Programme Grants builds on the Portfolio Grant review; CDTs build on the EngD and LSI DTC review, etc.

PhD to Reflect Achievement

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18	<p>B.2: Provision to support international exchange, as appropriate, should be made available to PhD students funded through other means than DTCs, for example DTAs.</p>	<p>HEIs</p> <ul style="list-style-type: none"> • Admin, Senate, exam owners • HoDepts • Students • DTC directors <p>Learned Societies</p>	<p>This is already possible through the EPSRC Doctoral Training Account and is actively encouraged by EPSRC's Platform Grants scheme.</p> <p>EPSRC Centres for Doctoral Training (CDTs) often include an overseas exchange as an option as part of the training experience.</p> <p>Action:</p> <ul style="list-style-type: none"> • Collate current practice on this and disseminate. • Encourage community to extend this opportunity as part of EPSRC's project studentship support through Responsive Mode.

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19	<p>H.3: PhD requirements in the UK should give more emphasis on achievement and be flexible enough to allow up to 5 years, if necessary, for completion without penalty to the individual involved. A flexible approach would not prohibit 3 or 4 year PhDs but overall would probably allow for more adventurous research.</p>	<p>HEIs</p> <ul style="list-style-type: none"> • Admin, Senate, exam owners • HoDepts • Students • DTC directors • Learned Societies <p>HEFCE/Funding Councils</p>	<p>To be discussed in dialogue with HEFCE who are currently undertaking a Framework review. The consequences and impact across the whole remit covered by universities needs to be considered as part of any changes. Currently awaiting formal response.</p> <p>Need Learned Societies and HEIs to lead.</p> <p>Action:</p> <ul style="list-style-type: none"> • Possible future agenda item at bilaterals with Learned societies and framework/Russell group universities. • Planned future discussion at HEFCE research and training committee.
20	<p>E.1: More DTCs and other mechanisms are needed to help define local, regional, and even national efforts with sufficient “mass” to have a global impact.</p>	<p>Research Councils – EPSRC lead</p>	<p>EPSRC is supportive of additional CDTs and can take a leadership role in promoting this mechanism but new CDTs will be resultant on available resources determined at future spending reviews. HEIs can develop CDT-like environments bottom-up for example using EPSRC DTA studentships.</p> <p>Action:</p> <ul style="list-style-type: none"> • Consider recommendation as part of future strategic planning and undertake a CDT gap analysis. • Encourage greater adoption of CDT-like analogues.

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21	<p>A.4: The presence of a DTC in synthesis is a positive development, as are those other recently announced DTCs which will stimulate capacity generation and help sustain new activities in chemical biology, nanoscience and medicinal chemistry at competitive level.</p> <p>However, it is necessary to support several vigorous research groups in these areas to reap the rewards of this investment. Moreover, DTC funding should extend beyond a one-off opportunity; a plea resonating in other sub-disciplines of Chemistry.</p>	HEIs	<p>This recommendation came from the panel's discussions of the Organic Chemistry (synthesis) CDT. Recognising the strengths in the area but a plea to keep sustained support for core and applied elements of this subject. The review highlighted the impact benefit of PhD training in this area seen by the fine chemicals and pharmaceutical industry.</p> <p>Action:</p> <ul style="list-style-type: none"> • Sustained support provided through active portfolio management, encouraging the good groups to apply for critical mass and programme grants where appropriate. • Input to future CDT gap analysis and postgraduate review.
22	<p>I.5: Create viable mechanisms to support foreign graduate students.</p>	<p>Research Councils</p> <p>Funding Councils</p> <p>Other funders of PhDs – EU, Charities,</p> <p>HMI Treasury</p> <p>RSC</p>	<p>Ongoing discussions continue with the Department of Business, Innovation and Skills, HM's Treasury and RCUK over the valuable role of international students in the impact on the UK research base.</p> <p>Action:</p> <ul style="list-style-type: none"> • Consult Funding Council on their views. • Potentially extend International Doctoral Scholarship scheme subject to available resources.

Other Recommendations for a Healthy UK Chemistry Base

Leadership

Action Plan Ref. No.	Report Recommendation	Relevant Stakeholders to Engage	Response and/or Proposed Actions
23	D.4: The Research Councils, the Royal Society and charities should enhance their efforts to identify and support emerging leaders in Chemistry	Research Councils	EPSRC supports a number of Fellowships specifically to enable future research leaders i.e. Career Acceleration Fellowships and Leadership Fellowships. Action: <ul style="list-style-type: none">• EPSRC is proposing to introduce “Challenging Physical Sciences” – based on the Challenging Engineering model to provide opportunities for researchers to move beyond their current research boundaries.

Diversity

Action Plan Ref. No.	Report Recommendation	Relevant Stakeholders to Engage	Response and/or Proposed Actions
24	<p>I.4: The Research Councils and Chemistry community should carry out a detailed study of the diversity of university educators and researchers in UK to establish if there is a reason for concern.</p> <p>If there is a systematic problem direct steps should be taken to rectify this at all levels with respect to hiring, promotion and rewards.</p>	<p>RCUK – careers and diversity</p> <p>Learned Societies – RSC, IChemE.</p> <p>External:</p> <ul style="list-style-type: none"> • RSC group • Dorothy Hodgkin • Daphne Jackson • Overseas • Industry 	<p>The RSC has been very active collecting evidence to understand the current position and highlight the good practice that currently exists. This complements the Athena Swan Charter activity supported by the UK Resource Centre for Women in SET, which the review panel did not get exposed to.</p> <p>Action:</p> <ul style="list-style-type: none"> • Continue to work more closely with the Athena Swan Charter through RCUK Careers and Diversity Group/HEFCE to identify position across the sector and disseminate best practice. • Continue to monitor gender support across the sector through the Funders Forum. • Continue to monitor best practice from other countries with respect to diversity. • Benchmark and evaluate the implementation of the 2008 Concordat to Support the Career Development of Researchers signed by Universities UK and funders.

Multi-disciplinary & Interface Research

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25	<p>A.11: Attention should be given to improving the interface between physical, theoretical, computational and supramolecular chemistry.</p>	RSC	<p>The panel highlighted the strength of UK supramolecular chemistry but cautioned that the influence of modern Physical Chemistry (Theory, Computation and Experiment) on this field was lagging behind other nations.</p> <p>Evidence suggests that attracting funding research interfaces is no more difficult than within the core subject discipline.</p> <p>Action:</p> <ul style="list-style-type: none"> • EPSRC will stimulate greater engagement across disciplines through schemes like 'Bridging the Gaps'. • Explore through signposting. • Identify issues through EPSRC Landscapes document and feedback received.

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26	A.13: Attention to be given to improving the interface between chemistry and biology via schemes that further stimulate real collaborations.	Research Councils Learned Societies: BioChem Soc, RSC, Biological Soc	<p>The panel noted that the field of chemical biology had made significant strides since the Whitesides' Report in 2002. They identified the next step for UK chemists to develop an in-depth understanding of the critical questions in biology and how chemistry can be adapted to uniquely address these questions.</p> <p>Action:</p> <ul style="list-style-type: none"> • Work through EPSRC's Cross-Disciplinary Interface Programme (C-DIP) to understand the nature of the problem. • Option for a possible Chemistry related signpost. • Explore with MRC and BBSRC about priorities at the Chemistry interface.
27	A.7a: Mechanisms to stimulate collaborations at the physics/chemistry materials interface should be improved and an effort should be made to encourage the training in this multidisciplinary area, which is the clue to discovery of new materials with as yet unrealised properties	Learned Societies CIKTN/Materials KTN	<p>Action:</p> <ul style="list-style-type: none"> • Improve through EPSRC's Physical Sciences and C-DIP Programmes by working together to encourage greater collaborations and adventurous research at this interface.

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28	<p>A.12: Serious consideration needs to be given to establishing programmes in the area of biological materials chemistry with emphasis on nano-biomaterials, with its obvious links to supramolecular chemistry, as well as chemical and bio-engineering.</p>	<p>HEIs BBSRC/MRC SATs</p>	<p>See Action Plan Ref No. 25 & 26</p>

Scientific Opportunities

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29	<p>A.9: Because the scientific and engineering issues in climate modelling and climate change are so immense the UK atmospheric chemistry community, and society, would best be served by further uniting forces to maximise the UK's impact on the international stage of climate change.</p>	<p>NERC to lead on atmospheric chem.</p> <p>RCUK Energy programme</p> <p>RSC atmospheric chem. interest group</p>	<p>Action:</p> <ul style="list-style-type: none"> Physical sciences Team to improve communication between the research community and the EPSRC Mission programmes and other Research Councils. Currently doing this -through a series of programme visits and cross-Council review of report recommendations.
30	<p>A.10: Serious consideration needs to be given to sustaining and improving the quality of polymer and colloid science through opportunities in managed and responsive mode programmes. Noteworthy opportunities exist in addressing new synthetic methodology for both specialist and commodity polymers, and issues that relate to environmentally friendly footprint for commodity chemicals.</p>	<p>Physical Sciences SAT</p> <p>RSC</p>	<p>Action:</p> <ul style="list-style-type: none"> This has research area has already been considered by the Physical Sciences SAT, and was not prioritised as a possible signpost. Therefore continue to monitor the health of this research area through active portfolio management.

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31	<p>A.6: UK Inorganic Chemistry is well positioned to make essential contributions to Sustainable Energy, including developing efficient and selective catalysis for biomass feedstock and solar energy conversion and storage. The new DTC in sustainable chemical technologies is a welcome development, and further attention to these areas by the funding agencies might encourage qualified individuals or teams to undertake the risk of potentially transformative research in this arena.</p>	<p>RCUK Energy programme – future calls/workshops</p> <p>EPSRC – energy team and PS – advertise opps on visits/newsletter</p> <p>RSC – roadmap- do they have energy group or even inorganic group?</p> <p>ETI/TSB</p> <p>Talk to industry about their needs – energy sector team</p>	<p>This is a very positive recommendation. The panel recognised the strength of the UK Inorganic Chemistry community and thinks this should be utilised more towards the Energy Societal Challenge.</p> <p>Bioinorganic, the panel agreed with the Whitesides' Review the UK is yet to be dominant – but recent senior positions could give the much needed boost.</p> <p>Action:</p> <ul style="list-style-type: none"> • Possible link to the next Spending Review themes “sustainable society” also link to EPSRC Nano Grand Challenges: , Energy, Healthcare and Environment calls.

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32	<p>A.5: More should be done to increase the current international standing of experimental physical, theoretical and computational chemistry.</p>	<p>EPSRC</p> <p>Learned societies</p> <p>SATs</p> <p>HEIs</p>	<p>Context:</p> <p>The Panel highlighted the strengths of experimental and theoretical chemistry in parts of the UK but were left with the impression that the community was not responding to current challenges.</p> <p>Ensuring the community is ready for the next generation of super computers that will be available on the international scene.</p> <p>Action:</p> <ul style="list-style-type: none"> • EPSRC will work with community to identify ways of improving this part of the portfolio. • An EPSRC Sandpit in Extreme Computing is currently under development.

Knowledge Transfer

Action Plan Ref. No.	Report Recommendation	Relevant Stakeholders to Engage	Response and/or Proposed Actions
33	<p>G.1: A significant number of spinout companies are successfully exploiting UK chemistry research. These examples of chemistry innovation are worthy of more detailed investigation by the Research Councils and stakeholders as templates for success.</p>	<p>HEIs TSB CIKTN</p>	<p>Action:</p> <ul style="list-style-type: none"> • EPSRC is currently undertaking an Impact Campaign to promote the benefit of Engineering and Physical Sciences research. • EPSRC is currently working with RSC to demonstrate economic impact. • Work in partnership with TSB/CIKTN to identify additional case studies.
34	<p>F.2: Academia together with industry could be further encouraged to build a more visible, collaborative framework for exchanging knowledge in both directions. In particular, appropriate government agencies should consider helping to develop programmes that help companies make longer term commitments to industry-academic partnerships.</p>	<p>UP TSB RSC CIKTN Research Councils esp. BBSRC Universities Industry (+ any other relevant organisations) BIS</p>	<p>Action:</p> <ul style="list-style-type: none"> • Explore opportunities through EPSRC's sector work particularly the strategy of the Medicine and Healthcare sector team.

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35	<p>F.3b: Research Councils and stakeholders should commence a dialogue on ways to stimulate creativity and innovation in approaches to Knowledge Transfer; the 'Open Innovation' approach adopted in the Netherlands is a model deserving further consideration.</p>	<p>BIS CIKTN</p>	<p>Action:</p> <ul style="list-style-type: none"> • Explore opportunities through EPSRC's sector work particularly and our support for Knowledge Transfer Accounts/Knowledge Transfer Centres.

Industry Interface

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36	<p>F.1: Appropriate mechanisms should be developed through partnerships between stakeholders to encourage UK industry to continue to invest resources (e.g. people, finances) into academic chemical research.</p>	<p>HEIs</p> <p>TSB/CIKTN</p> <p>UKTI</p> <p>Industry – via Strategic Partnership</p>	<p>Action:</p> <ul style="list-style-type: none"> • Work with the current strategic partners in this sector to develop the case that the UK research base is strong and worth investing in. • Organic Studentship call in partnership with AZ, GSK, Pfizer, Novartis is an excellent example. The final call was announced this year – EPSRC to review impact and develop how we take our interactions forward with Pharma sector.
37	<p>G.2: Further efforts should be made to improve the interface between academia and industry across the various sub-disciplines of chemistry. This includes technology transfer and IP management.</p>	<p>HEIs</p> <p>TSB/CIKTN</p> <p>UKTI</p> <p>Industry – via Strategic Partnership</p>	<p>See Action Plan Ref No. 36</p>
38	<p>A.14: Research Councils, stakeholders and academia should look for ways to create viable partnerships to further drug discovery in the UK to retain its globally competitive position.</p>	<p>Pharma industry (ABPI)</p> <p>Strategic Partnerships</p> <p>TSB (+ CIKTN)</p>	<p>Action:</p> <ul style="list-style-type: none"> • GSK Respiratory Diseases Call. • EPSRC is working with MRC and BBSRC to improve interactions with Pharma.

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39	<p>A.7b: An increased effort should be made to stimulate collaborations between industry and the materials chemistry community via programmes, fellowships, and exchanges.</p>	<p>Need to sustain engagement with companies</p> <p>Sector teams are engaging manufacturing team could lead</p> <p>Link with MIR action plan</p> <p>Prog/plat contacts</p>	<p>Action:</p> <ul style="list-style-type: none"> • EPSRC is already doing this through Nano Mission Programme using stage-gating to shorten the innovation pipeline. • Encourage more studentships e.g. CDTs/DTAs, fellowships (Dream) and research grants to engage with industry through placements and exchange programmes.
40	<p>F.3a: The RSC and other stakeholders, in partnership with the chemistry community, should commission an in-depth study of the importance of the UK chemistry research base to UK industry and the national economy.</p>	<p>Research Councils</p> <p>CIKTN</p>	<p>Action:</p> <ul style="list-style-type: none"> • Work RSC report on economic impact of Chemistry. • GSK economic impact report. • EPSRC Impact campaign. • CIKTN are already doing this. • Working with our Strategic Partners in Pharma along with the other Councils on gathering evidence for this.

Action Plan Ref. No.	Report Recommendation	Relevant Stakeholders to Engage	Response and/or Proposed Actions
41	I.6: UK plc needs to boost its R&D investments in the UK to stay globally competitive.	UKTI BIS TSB CBI	Action: <ul style="list-style-type: none"> • Engage and explore further with TSB/CBI/UKTI/BIS. • Report from (evidence) F.3a.