Bridging the Gaps between the Engineering and Physical Sciences and Antimicrobial Resistance

Call type: Invitation for proposals

Deadline for Intent to Submit: 16:00 on 23 October 2014

Closing date for full proposals: 16:00 on 02 December 2014

Related themes: Engineering, Healthcare Technologies, ICT, Manufacturing the future, Mathematical sciences, Physical sciences

Summary

As part of the cross-council initiative in Antimicrobial Resistance (AMR) the EPSRC is launching this call which will aim to engage engineering and physical sciences (EPS) researchers with the AMR challenge and to develop networks within their institutions focussed on the four multidisciplinary themes in the cross-council AMR initiative (www.mrc.ac.uk/amr). These networks will support people to build capacity and understanding which could lead to future research proposals.

Up to £5M is available to support institutional Bridging the Gap awards to enable institutions to undertake a range of people-focussed activities to facilitate interdisciplinary collaborations, funding for which can be difficult to find elsewhere. We expect that Universities will focus on the areas of the AMR research agenda that reflect their individual strengths. A key requirement will be the engagement of engineering and the physical sciences (including mathematical sciences and computer science) as part of the multidisciplinary networks.

Background

Antimicrobial resistance (AMR), especially resistance to antibiotics, is a growing global problem. We are facing a rise in the number of bacteria becoming resistant to existing antibiotics without an increase in new antibiotics or new treatments. The UK's Chief Medical Officer has raised the alarm around AMR, and the Department of Health has released a Five Year Antimicrobial Resistance strategy (2013-2018) [https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/244058/20130902_UK_5_year_AMR_strategy.pdf]. The World Economic Forum has suggested that AMR be added to the global risk register, and the WHO has highlighted the serious implications for global public health in its AMR Global Report on Surveillance [http://apps.who.int/iris/bitstream/10665/112642/1/9789241564748_eng.pdf?ua=1].

The research councils, along with other UK funders, have been working together to identify a number of research opportunities and challenges to tackling the rise

in AMR within four themes, these themes are summarised below but more information can be found on the AMR initiative website. [http://www.mrc.ac.uk/research/initiatives/antimicrobial-resistance/tackling-amr-a-cross-council-initiative/]

- Theme 1: Understanding resistant bacteria in context of the host

  Despite a strong basic bacteriology portfolio across the UK, funded through a number of sources, there are still many gaps in our understanding of the molecular and cellular biology of bacterial resistance, especially how bacteria evolve, acquire and transmit antibiotic resistance and how they adapt to life in human and animal hosts.

- Theme 2: Accelerating therapeutic and diagnostics development

  This theme will cover the discovery of new and revisit old small molecule approaches as well as developing novel treatments. Potentially building on discoveries in theme 1 as well as on existing validated targets, elements of this theme will be directed towards strategies designed to exploit chemical diversity for the identification of novel small molecule antibiotics. However, this theme also emphasises the importance of alternative approaches to treat resistant bacteria and develop new technologies for identifying resistant bacteria to underpin diagnostics development. This theme may provide a real-life test bed for bolt on projects/fellowships studying the impact of different economic and business models, or development of novel business models, related to the process and drivers of innovation in the development of new antibiotics and diagnostics.

- Theme 3: Understanding the real world interactions

  It is clear that the environment and the way people and communities interact with the environment hugely influences the way bacteria behave and the transmission of genes within and between bacterial species.

- Theme 4: Behaviour within and beyond the health care setting

  This theme will aim to elucidate the underpinning motivations for human behaviours relating to AMR, and how behaviour can affect development and spread of antibacterial resistance. It will also explore how to best enable effective behaviour change interventions in a variety of settings, relevant to both humans and animals. It may also serve as the basis for research into the economics of AMR.

It is clear that a multidisciplinary approach is needed to tackle these challenges and make a step change in addressing antimicrobial resistance. By working in partnership across traditional discipline boundaries there is potential to create a step change in our understanding of resistant bacteria, their treatment and how to prevent spread. Opportunities exist across the breadth of EPSRC's remit for novel research that will address different aspects of the multidisciplinary AMR challenge. Such areas could include but are not limited to the areas listed below. More details about each of these areas is included in Appendix 1.

- Novel diagnostics
- Improved drug delivery strategies for antimicrobials

- Novel synthetic approaches and innovative manufacture and scale up of new drugs and vaccines
- Smart surfaces and dressings to prevent infection
- Minimally invasive surgical techniques
- Surveillance technologies and data analytics
- Water treatment technologies
- Tools for understanding bacteriology

The aim of this call is to enable Research Organisations to build a programme of new activities that will stimulate creative thinking across disciplines, which address aspects of the AMR challenge and reflect the research strengths and strategies of the organisation. EPSRC expects proposals to be focused around areas of the AMR initiative strategy that are aligned to institutional strengths. This can include a single theme, a part of one theme or parts of multiple themes.

This is an opportunity for Research Organisations to support a suite of people based activities to develop a multidisciplinary working environment. Examples of the types of activities that could be supported include seminars, conferences, sandpits, discipline hoppers, visiting fellows or research pump-priming competitions.

It is not aimed at supporting pre-determined research projects.

Objectives

The objectives of this call are to:

- Initiate new, long-term collaborations between researchers from EPS disciplines and beyond to enable engagement with the AMR challenge.
- Stimulate innovative approaches to collaboration between disciplines.
- Increase cross-fertilisation of ideas and take up of advances across the boundaries between disciplines.
- Enable Research Organisations to encourage and embed multi-disciplinary research between departments and alleviate barriers to collaboration in the area of AMR.

Funding available

Up to £5 million will be available through this call. Whilst there is no limit on the amount that can be applied for, proposals need to provide value for money. Proposals must not exceed 24 months duration. EPSRC would hope to support a range of awards with differing areas of focus such that in totality, a breadth of capability is developed in the UK across the areas where there is potential for novel EPS to contribute to addressing the AMR challenge.

Organisations can use the funds as they see fit in order to best achieve the objectives listed above and the specific barriers to collaboration that they have identified. Innovative approaches to facilitating collaborations are encouraged and we would also encourage each organisation to submit a balance of activities,

from novel /high-risk elements through to well-proven mechanisms. Applicants are encouraged to look at the Bridging the Gaps best practise guidance found in Appendix 2.

It is important that proposals show the potential for the programme to lead to new collaborations, new avenues of research and, ultimately, follow-on research projects that address the AMR initiative strategy.

Eligibility

Each eligible organisation can only be named on one bid to this call. This call is aimed at supporting the development of a multidisciplinary working environment at individual research organisations. Should two or more closely located institutions wish to work together they must contact EPSRC to discuss their eligibility.

We strongly recommend that the Pro-VC for research (or similar) take a coordinating role in selecting the institutional focus for this call, although they should not be listed as an investigator unless they are integral to the programme.

EPSRC would expect the choice of investigators to reflect the full scope of the proposal, with each investigator representing a different area of research. Each proposal should include investigators from at least two different disciplines including at least one EPS discipline. EPSRC would expect the investigators to direct and coordinate the programme and to provide expert guidance and draw in others from across the University as appropriate. This call is not subject to the demand management policy.

Applicants are advised to note that equipment over £10K is not an eligible cost as part of this call.

For information on the eligibility of organisations and individuals to receive EPSRC funding, see the EPSRC Funding Guide: http://www.epsrc.ac.uk/funding/howtoapply/fundingguide/

As this call is a targeted funding opportunity provided by EPSRC, higher education institutions, and some research council institutes and independent research organisations are eligible to apply. A list of eligible organisations to apply to EPSRC is provided at: http://www.rcuk.ac.uk/funding/eligibilityforrcs/

How to apply

Intent to submit

Any institution that is intending to submit a proposal to this call must register their interest by email to healthcare@epsrc.ac.uk by 16:00, 23 October 2014. The following should be included in the email:

- Names, departments and institutions of the principal and co-investigators.
- The approximate value of the funds to be requested.
- Maximum of 1 side of A4 detailing the focus area of your bid, which themes of the AMR initiative strategy it is aligned to and how this aligns to the research strengths of the University.

Please note that this is not intended to restrict detail in the final submission as changes will be allowed, but will give us an indication of the level of interest. Applicants that do not register their intent to submit will have their applications rejected.

Submitting application

You should prepare and submit your proposal using the Research Councils' Joint electronic Submission (Je-S) System (https://je-s.rcuk.ac.uk/).

When adding a new proposal, you should select:

- Council 'EPSRC'
- Document type 'Standard Proposal'
- Scheme 'Standard'
- On the Project Details page you should select the 'Bridging the Gaps Between the Engineering and Physical Sciences and Antimicrobial Resistance' call.

Note that clicking 'submit document' on your proposal form in Je-S initially submits the proposal to your host organisation's administration, not to EPSRC. Please allow sufficient time for your organisation's submission process between submitting your proposal to them and the call closing date. EPSRC must receive your application by 16:00 on 02 December 2014.

Guidance on the types of support that may be sought and advice on the completion of the research proposal forms are given on the EPSRC website (http://www.epsrc.ac.uk/funding/howtoapply/routes/) which should be consulted when preparing all proposals.

Guidance on writing application

Proposal format

The following documents should be submitted with your application:

- Je-S application form
- Case for support
- Justification of resources
- Work plan
- Pathways to impact

If the attachments are uploaded as Word documents, please be aware that once the application has been submitted to the Council/Funder, all the attachments will be converted and held as an Adobe Acrobat file (PDF). Also please note, that whilst we support a wide range, **we do not support all MS Word font types**. Therefore if an unsupported font type is used a different font type may be substituted which may result in changes to the layout of the document. For this reason we recommend that the documents are converted to PDF files before uploading.

Also, please note that on submission to council **all** non-PDF documents are converted to PDF, the use of non-standard fonts may result in errors or font conversion, which could affect the overall length of the document.

In addition, where non-standard fonts are present, and even though the converted PDF document may look unaffected in the Je-S System, when it is imported into the Research Councils Grants System some information may be removed. We therefore recommend that where a document contains any non-standard fonts (scientific notation, diagrams etc), the document is converted to PDF prior to attaching it to the proposal

For advice on writing proposals see:

http://www.epsrc.ac.uk/funding/howtoapply/preparing/

Assessment

Assessment process

Applicants are required to register their intent to submit by email to healthcare@epsrc.ac.uk by 16.00 23 October 2014.

The full proposals received will be subject to peer review by an independent expert panel selected by EPSRC with the expertise necessary to assess the proposals against the criteria listed below, without additional external reviewers' comments. The panel will be asked to produce a rank ordered list taking into consideration the extent to which the proposals have addressed the assessment criteria and the strategic balance of the awards. The Right to Reply Peer Review Principle will be waived for this call. This means that applicants will **not** be given the opportunity to respond to comments or concerns raised by the panel. However, both successful and unsuccessful proposals will receive feedback from the panel after the meeting.

Assessment criteria

- Alignment to the AMR initiative strategy and involvement of the appropriate range of disciplines for the area of focus at the institution.
    - Research themes must be complementary to institutional strengths and strategies, adding value to existing activities
    - Consideration will be given to achieving a range of awards that cover the breadth of the research agenda set out in the AMR initiative.
    - The involvement of engineering and physical sciences (including mathematical sciences and computer science) researchers as a core part of the multidisciplinary networks.
- Potential impact of activities on the future of collaborative research addressing AMR at the institution
    - The extent to which existing barriers to collaboration have been identified and will be addressed
- Quality, novelty and appropriateness of approach to multidisciplinary working

- Demonstrate the potential of the programme to lead to new collaborations, new avenues of research, and follow-on research proposals
- Allow appropriate contact time between researchers from different disciplines
- Provide an appropriate balance of risk and reward in activities

- Quality of the management arrangements
  - The proposal should include a clear statement of objectives and success factors for monitoring and evaluating activities and progress towards the project objectives. Explicit consideration should be given to the monitoring and evaluation arrangements and how these will inform and improve the programme
  - The proposal should include a clear management plan and dissemination strategy, seeking to ensure maximum engagement of the various research communities
  - Clear identification of appropriate roles and responsibilities of the named investigators
  - The proposal should outline a clear and robust process for the allocation of funds with the BTG programme
- Commitment of the organisation to multidisciplinary working, in particular in the proposed areas of research

Additional grant conditions

In addition to the standard terms and conditions for grants, all successful applicants will be required to attend an annual networking event to share experiences and learn from one another. EPSRC expect this event to be organised by the award holders and recommend that applicants request resources to enable their engagement. Award holders may also be required to attend meetings related to the AMR initiative organised by EPSRC or its nominated partners in the initiative.

Key dates

Activity	**Date**
Call launched	26 September 2014
Closing date for Intention to Submit	23 October 2014
Closing date for full proposals	02 December 2014
Panel	February 2014

Activity	Date
Funding decisions announced	End of March 2014

Contacts

For further information relating to this call please contact Vicky Marlow on victoria.marlow@epsrc.ac.uk or 01793 444134

For any queries regarding the submission of proposals through Je-S please contact the Je-S helpdesk on JeSHelp@rcuk.ac.uk or 01793 444164

Please contact your university research office for help and advice on writing your proposal and allow enough time before the closing date for your organisation's submission process.

Change log

Name	Date	Version	Change
Vicky Marlow	22/09/2104	1	N/A

Appendices

Appendix 1: Opportunities for where novel research in EPSRC remit can contribute to the multidisciplinary AMR challenge

Novel diagnostics

A key factor driving the development of AMR is the lack of rapid diagnostic and disease surveillance technologies to detect early-stage infections in community settings. The result is that worldwide many infections remain undiagnosed or are diagnosed at a late stage. This leads to on-going transmission by people unaware of their infections and widespread inappropriate use of antibiotics which fuels drug-resistance. Late diagnosis also limits our ability to respond to emerging AMR strains. The development of the next generation of innovative point of care diagnostics is one of the highest priorities for improving the stewardship of current and future antibiotics.

Early detection plays a crucial role in all treatment and prevention strategies. However, current gold-standard diagnostic tests (e.g. RT-PCR and bacterial culture) are slow and require samples to be sent to specialist laboratories. This leads to inherent delays between tests, results and clinical interventions. Public health intervention may be further delayed by a time lag of 1-2 weeks, associated with retrospective surveillance of laboratory tests.

There are national and international drivers to widen access to rapid tests at the point-of-care (PoC) but current tests (*e.g.* lateral flow tests) are typically not sensitive to early infections, leading to missed opportunities for interventions.

A new generation of innovative point of care diagnostics with data linkage is needed for community settings, including better antigen/antibody tests, molecular tests and tests which overcome the need to culture bacteria in order to test for antimicrobial susceptibility. These will be built on deeper understanding of the resistant bacteria and advances in next generation sensing technologies. The challenge is to integrate promising advances in underpinning engineering and physical sciences into simple hand held devices which can be used reliably in clinical and environmental settings. Such advances include new biomarker identification (including data mining for biomarker discovery), novel nanostars and quantum dots, microfluidics, miniaturised sensor systems, low power microelectronics and telecommunications. This requires partnership between industry and academia, and offers great opportunity to the private sector with are a number of companies (including small/medium sized enterprises) operating in this field.

Rapid point of care diagnostics will play an equally important role in improving the stewardship of antibiotics, thereby preserving the effectiveness and reducing the risk of resistance.

Diagnostics will also be needed to target any new non-drug based treatments that can avoid resistance.

There are major scientific and technological challenges associated with deploying new sensing technologies in community settings such as GP surgeries, care homes and pharmacies.

Improved drug delivery strategies for antimicrobials

Improved drug delivery strategies for small molecule antibiotics require an **understanding** of the physiological barriers to successful delivery and modelling the behaviour of nanoscopic materials in living systems.

A further key area of investigation would be the development of new strategies for administering antibiotics in a more targeted fashion to maximise the dose to infected cells whilst minimising systemic exposure and thereby the development of resistance. These could include chemical/biomedical engineering/new material approaches, engineering controlled release formulations targeted to specific tissues and the exploitation of device and drug combinations such as photodynamic therapy, ultrasound mediated delivery etc. All of these could be combined with new formulations of antibiotics and/or new vectors. This could also enable "near miss" shelved compounds to be utilised in the light of deeper analysis of the bacterial cell system.

Novel synthetic approaches and innovative manufacture and scale up of new drugs and vaccines

The development of new antimicrobial agents is needed as more and more strains of bacteria become resistant to current antibiotics. New, efficient synthetic approaches to identify and synthesise new classes of compounds that show antimicrobial activity are required. Traditionally, the process of moving from drug discovery to manufacture at scale is time consuming and research into the scale up and manufacture of novel antimicrobials and vaccines, will be key to accelerating the translation of new therapies in partnership with private companies. Natural product and biosynthetic chemistry strategies are opening up synthetic routes for laboratory production of novel antimicrobial compounds found in nature. Synthetic biology is also a potential route for the manufacture of phage treatments as an alternative to small molecule antibiotics.

Smart surfaces and dressings to prevent infection

New strategies to prevent infection are a major priority. Infection can be transmitted via surfaces, interfaces and materials (including those within medical devices, dressings etc.) which come into contact with humans, animals and the environment**.** The development of antibacterial surfaces and surface coatings for use in healthcare settings could reduce the risk of infection. Opportunities exist for frontier research at the interface between chemical sciences, advanced materials, engineering sciences, modelling, pharmaceutical sciences, life sciences and clinical science.

Research challenges could include for example novel surface chemistry for the development of antimicrobial surfaces- surface functionalisation and modification, surface characterisation and surface patterning at the nanoscale. These in turn would feed into work on interacting adaptive dynamic systems and externally triggered systems (such as responsive surfaces which deliver a response when required).

Minimally invasive surgical techniques

A route to infection prevention is based on minimally invasive surgical procedures which could reduce the risk of infection by reducing the opportunity for exposure to infectious bacteria. The future trend is towards high precision and minimally or non-invasive approaches. Techniques such as robot-assisted surgery, image-guided interventions, smart instrumentation, augmented reality

and laser surgery are already in clinical practice with future research leading to breakthroughs in areas such as robotic surgery and smart, targeted therapies; for example utilising biomaterials, nanomaterials or synthetic antibodies as delivery systems.

Surveillance technologies and data analytics

As testing becomes more widespread there is a need for data linkage into clinical and surveillance pathways to prevent the spread of infectious diseases. This requires data analytics, innovative tracking technologies, mathematical modelling.

Early detection capabilities could be improved by the use of web information and crowd sourcing to track infectious diseases across populations. Every week millions of people use the internet to search for information about health and self-report symptoms of an illness, often before they visit a doctor. For example, symptoms such as “fever”, “cough” or “diarrhoea” are investigated using search engines (e.g. Google or Bing), and posted on social networking and microblogging sites (e.g. Twitter). Although not everyone who types in symptoms is actually ill, a pattern emerges from trends in the total number of anonymised searches and tweets.

Up-to-date estimates of outbreaks based on web-information linked to current epidemiological information may enable doctors to better respond to AMR. Web-information also has the advantage that it could potentially track infections across a much larger proportion of the population than current surveillance and might identify outbreaks even before people attend clinics.

The low cost of these methods is likely to be of particular benefit in resource-limited settings such as developing countries, where infectious diseases are an enormous problem.

More research is needed to improve the evidence-base of these potentially highly valuable technologies and extend their use to AMR. Future research should target tools to improve their accuracy, geographical granularity and evaluate of their cost-effectiveness. However, one of the key challenges facing the academic community in this area is restricted access to data, such as queries and tweets, held by private companies. New public-private partnerships, policy changes, governance frameworks are urgently required to responsibly develop this powerful resource for AMR, balancing the privacy of individuals with the benefits of research for the public good. Data linkage to current surveillance systems will also be crucial.

Water treatment technologies

The natural environment hugely influences the transmission of resistant bacteria and their genes at local and broad scales. Water quality especially plays a key role: i.e., poor water quality combined with the inappropriate use of antibiotics particularly in developing countries has been shown to lead to significant development and transmission of AMR. Therefore, much greater investment is needed to help improve sanitation and water quality in the emerging and developing world where a huge portion of serious multi-resistance develops. By funding research to solve such problems, we will benefit the UK by reducing the probability of multi-resistance migrating to the UK, but also develop a deeper understanding of relationships between AMR, and waste and wastewater treatment applications within the UK itself. This includes understanding

underlying molecular genetics and ecological principles related to transmission, but also diagnostic evaluations required to design and optimise treatment processes needed to reduce AMR bacteria and genes from any system. To deploy innovative diagnostics in such real world settings they need to be robust, specific, sensitive and simple to use with the capability for real time data connectivity and continuous monitoring.

Tools for understanding bacteriology

There are still gaps in our understanding of bacterial function. This includes how bacteria develop and transmit resistance, how they interact within their host environments and how their genomes control function. Deeper understanding of resistant bacteria will unveil new paradigms for diagnostics and surveillance and greater understanding of fundamental mechanisms of resistance development.

Systems biology and computer modelling approaches are needed in partnership with basic and clinical bacteriology to develop in silico models that can then be used to accelerate translation of potential treatment candidates. Solid state NMR, synchrotron radiation, neutron scattering and advanced imaging techniques can be used to provide a better understanding of bacteria and antimicrobial molecules and the molecular mechanisms of antibiotics at the single cell and single molecule level.

Appendix 2: Bridging the Gaps Best Practice Guidance

This guidance was prepared by the attendees of the 2011 Bridging the Gaps network symposium which was organised and hosted by the University of West England. The theme for the 2011 event was 'Bridging the Gaps in interdisciplinary research: the good, the bad and the beautiful'. The aim was to enable delegates to share their experiences and develop best practice in creating and facilitating an interdisciplinary research environment.

This document presents the best practice identified by the delegates during the event.

Programme approach

Get the team right: The Bridging the Gaps programme team is essential to its success. Teams need strong leadership, energy, enthusiasm and a passion for interdisciplinary research.

Identify the right project co-ordinator: There needs to be a specific point of contact for the programme that can also follow up collaborations and provide support to teams. It helps if this person has experience of the research environment. Models include a full-time manager or a rotating set of RAs.

Act creatively and flexibly: This is central to a successful project. Creativity and flexibility in terms of the approaches used, types of events, activities and funding offered. Also, be flexible enough to recognise when things aren't working and try something different.

Be supportive: The programme should provide a supportive environment for interdisciplinary research. This could include providing good feedback on bids for funding, support with writing and submitting bids for external funding, mentoring programmes for more junior staff or those new to interdisciplinary research or encouragement for all career stages to get involved.

Start off on the right foot: Research who the key contacts are at the institution and communicate the programme with them face to face. Find people who can talk across disciplinary boundaries and involve them in the programme.

Accept failure: Interdisciplinary research is not right for everyone and an important skill is knowing when to give up. All of those who are involved in the programme and the projects stemming from it need to see the benefits clearly for them and their discipline. Interdisciplinary research is challenging; some initiatives, ideas and projects will succeed and others will fail. The programme needs to be prepared to take risks, accepting that some will not come to fruition.

Create the right space: Neutral spaces are important for meetings and events. Use different spaces such as art galleries to bring people together.

Be patient: Interdisciplinary research can take time to develop; some projects may come to fruition later than others.

Be transparent: The programme should be transparent to encourage wide participation. Invite participation from all, for example, all grades from students to professors as well as all the disciplines of interest. Provide constructive feedback to unsuccessful proposals. Having a network can work well to promote the programme and its activities.

Programme activities

Link the activities: Activities that link together or to external activities work well, for example BtG funding linked to an event or BtG events linked to external funding calls.

Plan the right events: Develop events around their aims and objectives. There is a difficult balance to strike between events that are exploratory in nature and those that start with identified themes. Exploratory events may work well at the beginning of the programme to encourage a wider range of participants and open minds. Targeted events around a theme may work better to encourage 'key people', especially those with busy schedules. Small group discussions within larger events allow ideas to be developed.

Hold seminars: These can work well, especially when used as a social event as well (e.g. with some food and drink). Have short presentations, for example from different disciplinary perspectives, and plenty of time for socialising and discussions. Have sessions at other institutional events (e.g. introductory sessions on the disciplines of interest in events organised by other disciplines).

Get the right people, including facilitators: Ensure events are well managed and facilitated. Having an external facilitator can break down barriers between disciplines, hierarchy and individuals but the programme must work with the facilitator to get the most out of the event. But, external facilitators must have experience of working with universities in the context of research. The programme team can be trained in facilitation and having a facilitator that understands the programme and institution context can also be beneficial. The success of an event can depend on the participants as well! Ensure that the key academics are available and select participants carefully.

Develop the right online tools: Online and/or virtual tools can provide a useful resource for communicating and managing research. Only use online tools where there is a clear purpose for them and the target audience want to use them.

Offer small grants: Use small grants to enable academics to build partnerships. These can be particularly useful for early career academics with a limited track record creating a bridge to larger sources of funding. Additional funding can then be provided for projects that are working well. The mechanisms for funding should be fast and simple, examples include sandpit/Dragons' Den-style events, open and continuous calls for funding with one page applications and a programme credit card to buy low cost pieces of equipment or consumables easily. Funding can be offered for a range of expenses including buy-out from other duties, software, travel costs or consumables.

Programme challenges

Overcome institutional challenges: Interdisciplinary research can pose challenges to institutional systems not designed to work across faculties or departments. Programme teams should work with colleagues in HR, finance and research offices to try to overcome these challenges.

Consider where to go next: Projects that are successful can struggle to find sources of external funding to develop their research. It is crucial to maintain the funding for interdisciplinary research. Some institutions have continued to fund their Bridging the Gaps programme with internal resources.