CROSSING PATHS:
INTERDISCIPLINARY INSTITUTIONS, CAREERS, EDUCATION AND APPLICATIONS

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FOREWORD

PROFESSOR DAVID SOSKICE FBA

The working group was set up as a result of concern about the state of interdisciplinarity in the contemporary academy. We have been convinced as a result of the extensive evidence we have taken, that there is a deep need to take active steps to promote interdisciplinarity. Interdisciplinary research (IDR), based on vigorous disciplines, is central to academic innovation, leading to new sub–disciplines both within and across existing disciplines. And most of the major challenges which society faces – climate change, the rise of populism, growing inequalities, secular stagnation, computerisation of occupations, as obvious examples – require IDR and cooperation.

Our enquiry was not restricted to research. The central function of universities is teaching. But a very small proportion of university graduates become academics. Most discipline–based degrees bear little relation to the complex of social and analytic competences needed in contemporary careers outside the academy. Another important function of universities is to provide expert advice, in particular to governments; and here again an ability to work across disciplines is seen as of increasing importance.

The university system does not score well in any of these areas, in promoting interdisciplinarity in research, in teaching or in the provision of expert advice. The universities themselves are organised on disciplinary lines, as are the research councils, as well as most leading journals and academic publishers. (Nor do the scientific academies escape: the British Academy is organised on strictly disciplinary lines, even if it is very conscious of the need for reform.) The incentive structures set up by the interplay of these institutions militates against interdisciplinarity, as the Report sets out. And for many academics this was underlined by the recent Research Excellence Framework.

If this is the general picture, we saw exceptions. Some disciplines are significantly more porous than others. Some universities have developed outstanding interdisciplinary centres. Some funding agencies have gone to great lengths to encourage IDR. We use these cases both as useful illustrations and to inform our recommendations.

What are our key recommendations? In this foreword I want to highlight three key interrelated areas where we make recommendations for supporting IDR across the HE and research system. I highlight them because they are ‘doable’, because they are not hugely costly in terms of financial resources, and because we see them of central importance.

We will argue that the disciplinary basis on which the university system is organised creates barriers to interdisciplinarity, and we make recommendations as to how they can be reduced. But I want to underline

that we regard strong disciplines as critical to effective IDR – just as we regard strong IDR as key to innovations within disciplines. Disciplinarity and interdisciplinarity positively reinforce each other.

First, we underline the importance of research evaluation by universities, funding agencies, REF–type exercises and publishers as central to academic careers and critical to IDR. We highlight the need for panels of established academics with high–standing in both interdisciplinary and disciplinary research to be set up by these different institutions to evaluate IDR, and the need for training in evaluating IDR.

Closely linked, we recommend that universities should find ways for such experienced and established interdisciplinary researchers to mentor and guide IDR projects, as well as playing a role in strategic advice at university level in promoting interdisciplinarity.

Finally, universities should consider providing centres for IDR to enable researchers to work together across departments, consistently with a primary disciplinary home base – as well as finding means for overcoming obstacles to delivering teaching and engaging in research projects that bring together diverse disciplinary departments.

In all this we underline the role of strong disciplinary departments – indeed we see strong IDR as complementary to strong disciplinary research and as a fundamental long–term driver of disciplinary innovation.

The members of the working group have come from a range of different academic backgrounds. Despite some initial differences about the most important aspects of interdisciplinarity, we developed a wide measure of agreement through our discussions about both the analyses of the different problem areas and the key recommendations above. On only one issue, that of policy towards early career researchers, was there a disagreement; the arguments are interesting and important enough that we have retained them in the Report.

I want on behalf of the working group to thank very warmly indeed Jonathan Matthews and Natasha McCarthy of the British Academy. They have been exemplars of organisational energy, intellectual input and calmness and friendliness in bringing to fruition the collection and collation of evidence, the organising and managing of our meetings, and playing a large role in the preparation of the Report. We would like also to thank Thomas Kohut who played a central role in establishing the project, engaging with the academic community and collecting evidence.

EXECUTIVE SUMMARY

This report looks at the opportunities and barriers to interdisciplinary research (IDR), from the point of view of all research career stages, and institutional levels. It was produced in a context of growing interest in and funding for IDR and looks at how this affects the research and higher education system as a whole.

Any move towards greater emphasis on public funding for IDR will inevitably affect university structures and how researchers forge their career paths, whether that research results in long–term fusing of disciplines or focuses on challenges that become less prominent or evolve over time. It will also have an impact on the structures and infrastructures within which research takes place, from publication routes to research assessment.

This British Academy project examines how the move to greater engagement in IDR affects, and is affected by, these structures. It also considers the support across the higher education and research system for IDR as a source of evidence to help address global social challenges, and a valuable basis for research–informed university teaching.

Interdisciplinarity: A family resemblance concept

We set out with a 'family resemblance' concept of interdisciplinarity, focusing on ways that it is practised, rather than a strict definition. The kinds of IDR we were considering included:

- Individual researchers learning methods from other areas and applying them to issues that arise in their own discipline.
- Exploratory collaborations between disciplines to find areas of common interest – or to identify new approaches to issues within each respective discipline. These might be close neighbours, such as economics and political science, or more removed, such as philosophy and engineering.
- Challenge- or question-focused research that requires the input of a range of disciplines working together – such as research in public health or sustainability.
- Emerging disciplines that bring together approaches from separate areas – such areas emerge often in the sciences (e.g. biomedical engineering as an emerging discipline that was previously collaborative and interdisciplinary). Digital humanities was often mentioned in the research behind this report as being at least en route to becoming such an emerging discipline.
- Individuals or groups of researchers working in areas seen as inherently interdisciplinary because of the range of questions addressed or the range of approaches taken – such as classics or geography.

This report looks at how the move towards IDR affects humanities and social science subjects in particular, though it takes in all disciplines. It takes stock of the different types and modes of IDR and presents a variety of case studies from researchers working across disciplines and research centres bringing together diverse researchers in collaboration.

Findings and recommendations

A central finding of the responses to the call for evidence was a broad and deep support for IDR. The most often cited reasons were its essential role in addressing complex problems and research questions posed by global social challenges, as well as the increased rigour it can bring to one's understanding of one's own discipline.

Yet, when asked what advice one would provide an early–career researcher wanting to start out on an IDR career or undertake an IDR project, it was noticeable that many said that they would advise against such a move – at least until the researcher was well established with a permanent job.

The working group felt that it was important that early career researchers should be confident in taking up opportunities to carry out IDR. However, all researches, at any career stage, should be established in an academic home from which they undertake IDR.

A number of respondents cited the need to be a specialist and an expert in at least one discipline, in order to be an effective collaborator in any project that crosses disciplines. That expertise lies primarily in knowledge of a set of methods or methodologies without which it is difficult for a researcher to make a robust contribution.

We recommend that researchers should aim to develop an academic home, a secure base from which to carry out IDR. An academic home consists in those critical elements that allow researchers to build a career, including expertise in core methods; a set of publications within a disciplinary area; ability to teach core courses in a discipline; and professional networks forged by attendance at conferences.

The summary of findings and recommendations below highlight what needs to change in the research and higher education sector in order to allow researchers, including those early in their career, to pursue high quality IDR alongside, or as part of, cultivating an academic home. This is not a manifesto for IDR but a discussion of the opportunities and challenges of working across disciplines.

Evaluation

Evaluation is key to many of the barriers to pursuing IDR. Many of the reasons for avoiding interdisciplinary projects relate to the fact that it is harder to publish outputs; such work is perceived to have less value to hiring and promotion panels; and one is less likely to be selected for submission to REF. However, none of these barriers is an essential aspect of IDR and they can be addressed by better and more appropriate evaluation (See Chapter 3).

Recommendations

- Skilled IDR evaluators and coaching for referees. Evaluating IDR takes experience, and understanding of appropriate frameworks. Interdisciplinary panels which comprise individuals who have carried out interdisciplinary work are needed for assessing IDR – and ideally users of IDR as well as academics.
- Evaluating the whole and not just disciplinary parts of any interdisciplinary output. The quality of interdisciplinary work lies in the way that it brings disciplines together.
- Avoiding quantitative criteria such as citations driving evaluation in assessing the quality of interdisciplinary work, which may be less likely to appear in high–ranking journals. Such criteria do not serve consistently well across disciplines.
- Taking account of the time needed for IDR – which can be longer than needed for disciplinary work if it involves bringing together cross–disciplinary teams.

Developing research careers

Successful researchers must develop an academic home and remain attached to it – through developing methods skills, publications, teaching and professional networks. But an academic home will be different for different areas – more focused in some cases, and more diffuse for subjects such as geography, which often present themselves as 'inherently interdisciplinary'.

Recommendations

- Researchers must be aware of the need to develop an academic home, publish in their core area, develop professional networks and, where appropriate, become professionally accredited but they should be encouraged to engage with those working in different disciplines.

- Research managers overseeing IDR projects must ensure that researchers have the time to cultivate their disciplinary home alongside their interdisciplinary work.
- Craft skills are needed for interdisciplinary working – the ability to connect teams, learn new vocabularies and work across boundaries. Universities should ensure that academic staff receive opportunities for development in best practice in IDR. But not all researchers develop these skills and no one should be pushed into interdisciplinary working artificially.

Leadership

Leadership is critically important to supporting researchers carrying out interdisciplinary work. A strong message of support from the university leadership provides researchers with the security needed to explore collaborative working, and the specific expertise of established academics can help younger researchers or newer teams to develop good projects and secure funding.

Recommendations

- Institutions should clearly convey support for IDR to allow researchers to explore new projects outside their academic home with confidence that this work will be assessed and valued appropriately.
- Experienced researchers should be given, and take, the opportunity to mentor younger researchers and research teams, to help create successful interdisciplinary projects.

Managers and administrators

An obstacle to interdisciplinary work that was conveyed through centre visits and responses to the call for evidence was the challenge of reconciling the disciplinary–based structures for organising research and teaching activities and associated resources, and the cross–cutting structures needed to support IDR and provide interdisciplinary teaching.

Recommendations

- Institutions need to establish strategies for managing income across disciplinary and IDR structures and units. The institutional case studies in the next section of the report offer different examples of this.
- Research managers and managers of IDR units are critical to bringing together teams and supporting researchers working in new areas. Their role and skills should be valued and supported.

- Interdisciplinary units are best constructed so that they clearly reinforce disciplinary–based research goals via support of interdisciplinary engagement. Any target goals for securing grant funding should be set and monitored with care not to disincentivise IDR.

Funding

IDR benefits from flexible funding not tied to specific outputs or questions, allowing time for teams to form. However, much IDR is supported by challenge–based calls. Maintaining balance and understanding the funding needs of interdisciplinary teams is central to supporting IDR.

Recommendations

- Seedcorn funding should be protected. IDR takes extra time and groundwork, meaning there is an important role for Seedcorn funding for bottom–up IDR projects, provided directly by universities.
- Calls for IDR proposals need to give both time for teams to develop their work and a level of flexibility to accommodate projects that may evolve.
- A mixed portfolio of bottom-up and top-down, theme- or challenge-led funding is critical. The Department for Business, Innovation and Skills (BIS) should be responsible for ensuring this balance is maintained.

Teaching

Researchers will need to develop teaching experience and skills relevant to their academic home, but there is a real need to support interdisciplinary teaching based on research. With IDR valuable for addressing practical challenges, there is a potentially growing market for interdisciplinary teaching at all levels.

Recommendations

- Academics should develop teaching experience in both core and interdisciplinary areas.
- Institutions should show support for interdisciplinary, research–based teaching and recognise its value in evaluating academic careers.

IDR in public policy

In his 2014–15 annual report[1] the Chief Scientific Adviser emphasises the importance of external advice from the science and research community. Indeed, he acknowledges that the Government Office for Science (GO–Science) has been able to accommodate a reduction in its budget because it can obtain so much support at little or no cost. In parallel, the Cabinet Office open policy agenda[2] relies on increased levels of contribution to policy making from academic and other non–government sources. The REF[3] provides some incentives and rewards for academic institutions to participate in these initiatives, the inclusion of impact case studies in REF 2014 being the major incentive. It remains unclear, however, whether government departments can absorb and deploy more evidence and analysis contributed by these external sources. It is particularly important that government departments be able to use IDR, or bring together diverse sets of evidence, as practical policy challenges will require input from a number of disciplines.

Recommendation

- Government should publish an assessment of the capability of each department to absorb advice and evidence from the science and research community at disciplinary and interdisciplinary levels. The assessment might be led by the Chief Scientific Adviser in collaboration with departmental chief scientific advisers; the Chief Medical Officer; Chief Economist; Chief Statistician; and Chief Veterinary Officer.

INTRODUCTION

What is interdisciplinarity?

The British Academy's call for evidence stated: "We would welcome evidence from anyone who works in an interdisciplinary way, even if this is not explicitly recognised at an institutional level or otherwise."

We asked: "What broad area is your research, teaching or work situated in (e.g. history/psychology/mechanical engineering or humanities/social sciences/physical sciences if more broadly situated)?"

The responses we received were varied. Most individuals readily self–identified as working in a discipline such as history, sociology, or a broader field such as development studies, which can be seen as emerging out of interdisciplinary ventures. The question proved relatively hard to answer for individuals who liked not to think of their work as being confined by any particular field.

We also asked: "What do you consider the key features of IDR? In what ways is the research that you are engaged in interdisciplinary?"

Some people chose to define interdisciplinarity and to differentiate it from trans-, multi- and mono-disciplinary work. Definitions offered in specific journals were referenced.[4] Some commented that lots of pseudo–interdisciplinary work is undertaken under the banner of interdisciplinarity, but many agreed that IDR could involve many different types of research. A single academic drawing on the insights of other disciplines in their own work could be interdisciplinary.

> *"Research that integrates insights and perspectives from more than one disciplinary standpoint."*
>
> Joanna M. Setchell
> Department of Anthropology, Durham University

> *"Interdisciplinary research opens up new sources and methodologies beyond those found in a single discipline."*
>
> Ian Talbot
> University of Southampton

> *"The identification of an object of study which is produced differently in different disciplinary contexts (for example, the city), and the attempt to engage these different disciplinary approaches to produce a broader, more sophisticated and more satisfactory understanding of that object."*
>
> Charlotte Brunsdon
> University of Warwick

> *"The key feature of IDR is that, whether or not one discipline dominates it, it draws on information, ideas or methods from other disciplines."*
>
> Peter Burke
> Emmanuel College Cambridge

Many respondents working in humanities and social sciences argued that their disciplines were inherently interdisciplinary, such as lawyers who would describe their work as 'law in context', and historians who looked at the evolution of concepts such as rationality.

> *"Some subjects such as archaeology demand an inherently interdisciplinary approach. Archaeology studies the material remains of the past in a way that encompasses the physical, the biological, the environmental and the social. Other disciplines such as geography are inherently interdisciplinary."*
>
> Umberto Albarella
> University of Sheffield

Several responses suggested that interdisciplinarity is more than anything a way of working, through collaboration:

> *"Working with colleagues or subjects outside your own subject area."*
>
> Christina Lee
> University of Nottingham

> *"Interdisciplinarity is best achieved through collaborations, where we each bring our expertise to the project."*
>
> David Anderson
> Global History & Culture Centre, University of Warwick

Or it might rather be an attitude of the researcher:

> *"Interdisciplinarity is a state of mind: people are interdisciplinary if they want to be so."*
>
> David Anderson
> Global History & Culture Centre, University of Warwick

Some responses rejected talk of disciplines altogether:

> *I like to think of 'requisite knowledge': the concepts and skills that are needed to be effective whatever their disciplinary roots. With this kind of research, there is no real alternative; sub disciplines such as urban economics are too narrow.*
>
> Alan Wilson
> University College London

"Anti–disciplinary because it challenges the prevalent view of the discipline as a bounded field of knowledge which maps onto a corresponding territory of phenomena in the world … In practice, disciplines are conversations: not bounded fields of study but convergent lines of interest. And like conversations or knotted lines, disciplines in practice are fundamentally open–ended."

Tim Ingold
University of Aberdeen

The Born Typology

There are various formal schemas looking at different ways of interdisciplinary working. Barry and Born[5] identify three modes:

- The integrative–synthesis mode – might be thought of as multidisciplinarity in the sense that it relies on combining insights from different, pre–existing disciplines.
- The subordination–service mode – in which 'one or more disciplines occupy a subordinate or service role in relation to the other component disciplines'.
- Agonistic–antagonistic mode – which transcends the disciplines that it is drawing on and has critiqued in order to create a new interdiscipline that cannot be reduced down to the original epistemological and ontological assumptions of the original disciplines.

Why look at interdisciplinarity?

Responses to our call for evidence cited many reasons for engaging in IDR, from increased rigour to greater opportunity for impact:

"Learning to be more rigorous in my 'own' discipline … the fascination of working with colleagues with different skills."

David Parker
University of Birmingham

"Permits sharing and exchange of expertise in very different approaches, is intellectually stimulating, and enhances the possibility of cracking difficult problems."

Bencie Woll
University College London

"Deeper understanding of issues. I think that if you add those different angles together (and reconcile some of the language and concepts used) then one can draw together a deeper understanding of a problem, issue or event. The different disciplinary approaches also act as a check and balance on the failings of a single disciplinary approach."

David S. Wall
University of Leeds

However, to the question: "What advice would you provide an early career researcher wanting to start out on an interdisciplinary career or undertake an interdisciplinary project?" the number of individuals who responded simply 'don't do it' was noticeably high. Statements included:

> *"To be honest: 'don't'… there is still a culture where Prof X with expertise on one medieval manuscript is worth more than someone who can do a bigger picture"*
>
> Christina Lee
> University of Nottingham

> *"I would advise them not to do this until they have a permanent contract… too much interdisciplinarity early on could be career suicide."*
>
> Anonymous

> *"So many of the conventional measures of success are within disciplines, reinforced by, for example, the REF – so perhaps the advice should be to undertake IDR but under the wing of a friendly discipline"*
>
> Alan Wilson
> University College London

Structure of this report

The focus in this report has been interdisciplinarity within UK research, and the ways in which the UK's research system supports or hinders it. In Chapter 1, we frame the problem of interdisciplinarity in the context of the disciplinary incentive structures that currently characterise the UK system. The caution about undertaking IDR, widespread in responses to our call for evidence, can be seen as our starting point. However, we argue that greater provision for IDR can succeed if certain changes are adopted.

We go on to discuss elements of the research system in more detail, starting with research funding (Chapter 2) and the cross–cutting problem of evaluating IDR (Chapter 3). Aware of the interactions of IDR and academic research careers with elements outside the research system, we highlight examples of interdisciplinary undergraduate provision (Chapter 4) at one end of the pipeline through to how IDR is used and perceived by government (Chapter 5) at the other.

We have been guided in this project by an expert working group, each of whom has kindly taken the lead on different aspects of this report. Professor Colette Fagan and Professor David Soskice provided the opening framework on the disciplinary incentive structure that shapes the UK's system. Professor Tom McLeish and Professor Barry Smith guided recommendations

on the process of evaluating IDR. Professor Graeme Reid led on how government uses and perceives IDR. The policy team at the British Academy contributed first drafts of chapters on research funding and aspects of research careers.

Methods

This report was developed by collecting qualitative evidence from a number of sources – through a call for evidence, research centre visits and roundtables – which was analysed and discussed by an expert working group.

The call for evidence, from individual researchers, institutions, publishers and funders, elicited 112 responses. The questions are set out in annex 1.

The British Academy's policy team visited a number of IDR centres and carried out semi–structured interviews with research managers, administrators, centre leaders, principal investigators (PIs) of research projects and early career researchers.

The working group held structured evidence roundtables on:

- researchers and university managers
- evaluation of interdisciplinarity
- government use of IDR
- funding of IDR

The material from each of these sources was used by the working group to address its initial terms of reference, which were as follows:

- How can researchers and academics forge long–term careers in interdisciplinary areas, and how does early involvement in IDR influence career paths?
- How do university department structures and teaching delivery systems accommodate IDR?

- Do current models of research funding support IDR to the extent that they should?
- How should IDR be assessed?
- How is IDR carried out in an international context?
- How do moves towards more challenge–based IDR affect the humanities and social sciences in particular?
- What are the publishing routes for IDR, and how do the existing routes affect researchers' career prospects?
- What role does, and should, government have in promoting and supporting interdisciplinary, challenge–led research?

The conclusions and recommendations for action outlined in the Executive Summary are developed in further detail in individual chapters.

The evidence gathering for this project and drafting of this report was undertaken at a time of significant legislative and policy change. It is intended as a contribution to the ongoing debate about the make–up of the UK's Higher Education and Research Landscape.

Working group members

- (Chair) Professor David Soskice FBA, LSE School Professor of Political Science and Economics
- Professor Georgina Born FBA, Professor of Music and Anthropology, University of Oxford
- Professor Graeme Reid, Chair of Science and Research Policy, UCL
- Professor Colette Fagan, Deputy Dean (& Associate Dean – Research), University of Manchester
- Professor Barry Smith, Director of the Institute for Philosophy, School of Advanced Study
- Professor Julia Black FBA, Pro Director for Research, LSE
- Professor Tom McLeish FRS, University of Durham
- Mr Carl Gombrich, Programme Director Arts and Sciences BASc, UCL

CHAPTER 1
RESEARCH UNIVERSITIES: HOW INCENTIVES ARE STRUCTURED AGAINST IDR

Structures

Professional careers take place in a complex of institutions that structure behaviour and choices through incentive structures, whether formal and explicit or informal and implicit. These incentive structures shape short – and long–term decision–making and planning. There is moreover a feedback process: the 'investments' in reputations, professional friendships and networks typically reinforce the institutions and make them and their incentive structures harder to change.

This is particularly apposite to research choices in academic careers. Academics navigate strong institutional incentives to seek success on a disciplinary basis because research universities are largely organised in this way. This structure shapes which conferences and events they attend, who they read and which ideas and research agendas they engage with. Research success is widely judged in terms of publications with prestigious journals or monograph publishers, many of which are explicitly disciplinary based, and much day–to–day academic research and teaching is rooted in discipline–based departments that are the basic organisational unit for resource allocation and appointments. Furthermore, the larger organisational structures that cluster subsets of cognate disciplines into schools or colleges, whether arts, social science or science, seldom have an explicit strategy of fostering IDR.

The disciplinary rootedness of academic life is reflected across the system of subject associations and learned societies, including the British Academy. Research Councils UK and other research funders usually advertise committee vacancies for specific discipline backgrounds and rarely specify IDR expertise. This applies as much in science, technology, engineering and mathematics (STEM) disciplines as in social sciences, arts and humanities.

This discipline–based system has of course been, and continues to be, enormously productive in pushing forward the boundaries of knowledge across the world; and it has clearly not stifled IDR. But in our view it has led to a narrow and disciplinary focus in a lot of research, as academics seek to build their careers within the institutional incentives they encounter. Research quality has increased, but it has meant less work on important issues that cut across disciplinary boundaries. It has perhaps nurtured a relatively simplistic approach in some disciplines, emphasising rigorous demonstration of cause and effect at the expense of efforts to understand society as a complex system of physical, technological, environmental, social, economic, political and cultural processes and feedback loops. It has stifled curriculum development for undergraduates, where cultivating a wider interdisciplinary awareness might be more suited to the competences needed in the non–academic world.

What to do? It is tempting to believe that a root and branch change in the university system is necessary. We argue that that is the wrong way to go, for four reasons:

1. Public policymaking and innovation show it is important to work with the institutional grain of the system to bring about successful change.
2. Most academics have skill sets that are discipline based, and it is politically infeasible to bring about radical change without consensus from the actors involved.
3. Good IDR is based on bringing together the best work from different disciplinary backgrounds, either by researchers collaborating on a common challenge, or an individual acquiring a real understanding of more than one discipline.
4. Given the increasingly global nature of the research university system it is difficult to see how radical change might succeed in one country (or indeed in one university) without affecting the opportunities open to its academics and students in other parts of the world.

We therefore took a closer look at the career incentives set up by discipline–based departments, and the underlying problems that the research university system in the UK currently poses for IDR and teaching.

Institutionalised (Dis)Incentives to Interdisciplinarity

Some academics consider their careers to be inherently interdisciplinary. This might be because their work is in a field considered naturally interdisciplinary, such as classics – which encompasses the study of literature, history, philosophy and other disciplines within a given period – or geography, which interfaces with several physical science and social science disciplines. Or it might be that their jobs have taken them through different disciplinary areas.

However, a number of academics who submitted evidence to this inquiry rejected the idea of an IDR career *per se*. Many felt one cannot be a good interdisciplinary researcher without a prior grounding in a specific discipline.

> *"… Before one moves to connect with other disciplines, one should first master one's own. Each should do their own thing; each should bring something distinctive to the table."*
>
> Andrew Hurrell
> Oxford University

Secondly, there was recognition that devoting significant time to interdisciplinary projects at an early career stage carries a real risk.

For early career researchers, the difficulty is that to start out you need to get published, and for reasons largely to do with peer review… it is much easier to stay put within an established field.

> *"Though there are formal provisions in the REF to give credit for such work, they seem to be poorly understood by department chairs etc. Probably you will receive insufficient credit. And those who make promotion decisions are too unlikely to be able to fully appreciate your work. While many universities claim to want interdisciplinary work to expand, it appears to be not much more than lip service."*
>
> Peter Hammond
> University of Warwick

> *"For early career researchers, the difficulty is that to start out you need to get published, and for reasons largely to do with peer review… it is much easier to stay put within an established field. Regrettably, it is still the case that early career researchers need to establish a disciplinary base first, before being able to branch out into wider terrains. It has been profoundly depressing to me to see my own ex–students having outstanding papers rejected by reviewers who have nothing like their breadth of vision, and see the work only from a narrowly specialised vantage point."*
>
> Tim Ingold
> University of Aberdeen

Given this current risk aversion to IDR, how do you build the kinds of securities that allow people to feel that they will be able to move forward in their careers – "that there are places that they can go to," as one researcher put it?

Table 1 summarises the barriers to IDR and teaching in UK universities as a result of the institutional structure of universities and the incentives embedded in them. This applies particularly to research–intensive universities.

It might be argued that these underlying institutional incentive structures should be changed in order to foster IDR. But if these existing incentive structures are powerful influences on academic careers and how successful research universities structure themselves, we contend that they need to be respected when designing initiatives to promote interdisciplinarity. Industrial and organisational sociology has shown that successful institutional innovation is only possible if it works with the grain of the underlying incentive structures.

Disciplinary structures are deep-rooted. How do career incentive structures militate against IDR for doctoral students, early career researchers, and

to a lesser extent established academics? And why does this apply to interdisciplinary teaching as well?

Given that these incentive structures operate in all major research universities, it is difficult for an individual institution to break away. Academic career incentives and university decision–making structures powerfully reinforce each other, as does the extent to which the UK system of research and research universities is no longer purely national. In a global marketplace, researchers will make themselves attractive to the best employers worldwide. As top American universities are organised on disciplinary lines and academic high–flyers in this country increasingly move across the Atlantic, many will choose to fit this model. Although the best established researchers can attract the best jobs even if they are working outside traditional boundaries, for those building their careers there are reasons to fit the established models. It is an exaggeration to say that the UK is moving towards the US academy, but it needs to be kept in mind and we refer to the North American system at several points in what follows.

There are many incentives to engage in IDR, often leading to useful and striking outcomes, but few incentives to institutionalize interdisciplinary research.

There are some qualifications to our heuristically simplified analysis. Firstly, while the American system is strongly discipline–based, its best institutions offer some important positive lessons for the promotion of interdisciplinarity. Secondly, different disciplines and subject areas are more or less porous and open to IDR. Thirdly, many academics do not respond in a conformist way to the broad disincentives to IDR. There is already a lot of IDR – even if there needs to be a lot more.

> *"In today's Britain, there are many incentives to engage in IDR, often leading to useful and striking outcomes, but few incentives to institutionalize interdisciplinary research – and even fewer incentives to institutionalize interdisciplinary teaching. Thus, interdisciplinary achievements become no more than a bunch of shooting stars. Yet, the most distinctive fields of research in the second half of the 20th century – say, cognitive science and molecular biology – were interdisciplinary hybrids originally with considerable private funding that took hold in academia once they were converted into degree programmes that could train successive generations of researchers."*
>
> Steve Fuller
> University of Warwick

Many institutions also see it as part of their mission and values to support and promote interdisciplinary working, as several statements from institutions in response to our call for evidence show:

> *"Over the last 10 years, Cardiff University has been developing the research environment to explicitly support IDR. We have taken a broad view of the range of ways that research development can support interdisciplinarity, from multidiscipline approaches to fostering new research methods across and within traditional disciplinary settings. Our approach has been built on a strong foundation of disciplinary excellence, which has been critical to the subsequent development of high quality IDR."*
>
> Cardiff University

> *"Interdisciplinarity has been at the core of the University of Sussex since its foundation, in terms of both its teaching and its research. The university seeks to encourage and support interdisciplinarity through its culture as well as through specific mechanisms. Our current University Strategy, published in 2013, has interdisciplinarity embedded and threaded throughout."*
>
> University of Sussex

> *"Interdisciplinary research is at the heart of Goldsmiths intellectual life and has been for decades. As a small, specialist organization, interdisciplinarity has also become crucial for its sustainability given the move towards larger grants and the concentration of resources in increasingly fewer research intensive locations."*
>
> Goldsmiths, University of London

However, this support may not mean a departure from standard institutional structures:

> *"The research community at the University of Cambridge spans a very broad spectrum of disciplines, and we regard collaboration between these as essential for addressing both fundamental research questions and complex societal challenges. But we believe that building excellence in interdisciplinarity depends on research and teaching rooted in the depth of excellence in individual disciplines. The rigour of discipline–based training and expertise provides the firm foundation for multidisciplinary collaboration and impact."*
>
> University of Cambridge

And finally, there is more than one form of IDR and it may be easier to foster some forms (for example, cooperation between those with strong disciplinary

backgrounds on two sides of the same problem), than others (tackling major issues such as climate change).

So we are not arguing that interdisciplinary initiatives will be unsuccessful – far from it. But structural disciplinarity imposes real constraints, and initiatives to foster IDR need to operate *within* this framework. In this section we look at the incentive structures that steer engagement with IDR at each academic career stage, supported by a summary in Table 1.

Doctoral research students

For researchers to get a starting position in a good research department, doctoral work has to be largely discipline–based. There is increasingly strong expectation that one or more publications be produced promptly, preferably in prestigious journals of the discipline, to demonstrate a convincing career trajectory. The department has a reputational (including REF) incentive to ensure its doctoral students are contributing to the field and are 'well–placed', which also boosts the reputation of the researcher's supervisor.

The closer we move to the North American model, the more important the performance and placing of doctoral students becomes to the reputation of the department. For good UK doctoral students from certain (though not all) disciplines, with the right (discipline–based) publications, starting positions in top American departments are very attractive, and underwrite the incentive to pursue discipline–based research.

As one of the submissions of evidence advised:

> *"Wait until you have established yourself as an expert within a discipline before trying to venture into interdisciplinary work"*
>
> Charlotte Brunsdon
> University of Warwick

Of course, these incentive structures do not prevent IDR where students have an interest, and it can be facilitated where RCUK funding for doctoral students has been attached to IDR programmes through centres for doctoral training (CDTs) and doctoral training partnerships (DTPs). However, an IDR doctoral thesis incurs career risks (Table 1), in particular that the researcher may not develop the requisite discipline base and methodological expertise for subsequent career progression. As one researcher put it during an institutional visit: they may be perceived to be 'discipline–less' in a job market largely organised on a discipline basis.

Many of the researchers we spoke to on institutional visits and some who submitted written evidence referred to the need to develop an expert understanding of methodologies in their discipline. This is in order to have

Table 1. Summary of the institutional structural (dis)incentives for IDR and the associated career risks, by career stage

Career Stage	Institutional incentive structures which favour disciplinary research	Incentives for engaging in IDR?	Career risks of engaging in IDR?
Doctoral research student	• Consolidating disciplinary knowledge and methodological expertise	• Intellectual interest in research questions and complex issues which cannot be adequately addressed though a mono–discipline lens. • Funding opportunities, including for collaboration in IDR teams.	• Need to secure a firm theoretical and methodological foundation in one or more disciplines in order to be equipped to undertake high quality research • Need to secure relevant (discipline) publications and research experience as a basis for post–doctoral employment. • The lack a disciplinary 'home' and identity can make it more difficult to form networks and a sense of belonging.
Postdoctoral researchers and Early Career Academic	• The five–year period following the award of a doctorate is frequently judged to be the 'make or break' career stage. • Publishing pressures increase compared to the doctoral stage but have the same disciplinary emphasis. • Most tenured academic positions are discipline–based (teaching and research)	As above	As above, plus: • IDR can take longer (devising the research plan, building a team, learning a shared language and other methodologies etc.); hence the publication profile might develop at a slower pace. • Hence it may be easier to pursue a discipline–focussed publication plan while establishing teaching experience, passing probation etc. • The university/department judged that the individual's IDR publications do not provide a good 'fit' for the UoA REF return.
Mid–career established academic	• Path dependency – career may have been built, and rewarded, largely on disciplinary focussed research.	As above, plus: • May now have the professional confidence/ need to undertake IDR to make further progress on a chosen research agenda • Expectations about securing research funding, and demonstrating research leadership by building research collaborations increase at this career stage, may be conducive to IDR.	As for ECRs, but perhaps in a diluted form.
Senior academics	• As above	As above, plus: • May have additional leadership demands on their time at department, university or research centre/institute level.	As for mid–career established academics

the foundation to collaborate and contribute effectively with others in cross–disciplinary or IDR, or to develop a successful publication profile, be it in subject–specific journals that reflect dominant methods in a discipline or in interdisciplinary outlets.

Doctoral students interested in small sub–fields of a discipline experience similar challenges. While it is important for a research student to study the topic that engages them, for their career it is important to be able to show that their view from the margin, or from across disciplines, *strengthens* their ability work within the supposedly core sectors of the discipline.

Early career researchers

> *"A lot is expected of ECRs. They are chasing grants – but also chasing courses – especially those that can allow a lectureship."*
>
> Centre visit
> Edinburgh

Early career researchers build on the advice and institutional learning of their doctoral stage. Being recognised in a sub–field within the discipline is usually important, because it is difficult to build a reputation across several fields at this early career stage; it is also hazardous, because of the low likelihood of finding relevant academic communities. Discipline–based departments may be concerned about young academics not working in established fields.

The three routes to research success are:

1. Publishing in recognised disciplinary journals, or books or monographs by high status publishers.
2. Building social–academic networks (reinforcing doctoral networks) via conferences or workshops, which provide:
    a. information about positions in other universities and help getting outside offers by spreading the ECR's reputation;
    b. reputation–building and profile, as someone who is making a mark on the field and has the social and organisational skills (friendly, reliable, organised) valued for joint research, invitations and outside offers etc;
    c. research partnerships; and
    d. invitations to workshops and conferences.

3. Securing research funding, and hence demonstrating one's capacity to get further research grants – in particular disciplines at least. This increases employment security and the likelihood of progression.

At this career stage, research funding is more likely to be secured for disciplinary research than IDR, given that grant proposal assessors and referees will take publication track record and methodological experience into account, unless the ECR is part of a collaborative interdisciplinary team with senior colleagues.

IDR openings do exist for postdoctoral research on some large collaborative research projects, but this brings both risks and opportunities. This is where careers are established and it is 'make or break' for many researchers. One early career researcher talked about embarking on interdisciplinary work as *"a treacherous journey, and a fragile career path."*

For the ECR intending to stay within academia the ultimate driver is the search for the first permanent job. Although the consultation behind this project identified a number of institutions that were seeking to appoint across departments, such jobs can be challenging to set up and are still in the minority. Therefore, researchers must be strong in a given discipline to keep their employment options open.

Furthermore, some teaching experience is important, and the tendency among recruiting panels will be to prefer someone with experience in core and foundational subjects. Research expertise built up in interdisciplinary working may not signal an obvious connection to the teaching on offer, with the onus on the applicant to demonstrate a commitment, to, and specialist competence in, particular core parts of a subject. This is despite the fact that there are often opportunities to teach on interdisciplinary courses that draw on the academic's research.

Once in post, juggling a full teaching load with the demands of publishing may encourage ECRs to stay within their discipline rather than investing in developing IDR. Much of the evidence collected included a strong opinion that IDR will not lead to the types of publications that are critical for career success.

> *"Perhaps the greatest challenge in interdisciplinary work is publication. Students must locate journals that are hospitable to interdisciplinary methods, interpretation, and analysis and craft articles that meet interdisciplinary standards. While the number of such journals is increasing what constitutes a rigorous interdisciplinary standard remains elusive. Often, interdisciplinarians find themselves writing multiple papers,*

> *on the same topic, each couched within the discourse framework for a separate discipline."*
>
> *Shona Kelly*
> *Sheffield Hallam University*

All in all, an academic 'home' is important for ECRs. It is about becoming a specialist, and having the security and firm basis from which to build a career and academic networks. This is important to being 'taken seriously', which can be problematic for researchers not firmly within a discipline.

> *"In order to successfully carve out a career trajectory that includes interdisciplinary pathways, one needs advice about how to navigate snobbery. Good mentoring is crucial and there is a need to understand the landscape and context. One needs to build informal networks around topics to gain confidence and combat snobbery."*
>
> Discussion at centre visit
> Portsmouth

Despite these various institutional disincentives, many of the early career researchers doing IDR who were consulted in this project were also passionate about interdisciplinarity. Some felt a strong drive to work on interdisciplinary projects because they felt led by questions that were inherently interdisciplinary. There is also a value in working on projects with potential for impact now that impact is a factor in the REF. According to Digital Science, "*Over 80% of the REF impact case studies included underpinning research that was multidisciplinary*".[6] Other ECRs lacked a clear sense of disciplinary identity and did not see this as problematic.

> *"I have never been solely within one discipline, and have no strong sense of belonging to one discipline."*
>
> Early career researcher, centre visit
> Manchester

Nonetheless, the commonly held perception was that the REF eligibility criteria, or their interpretation by those preparing the institutional submissions, create obstacles and penalties for IDR.

> *REF is a point where you have to choose a discipline – or your discipline chooses you. That is a major challenge for IDR posed by the REF.*
>
> Centre visit
> Edinburgh

While there is evidence that REF does treat IDR well (see above), the importance of being selected to submit to the REF means that a researcher has to consider what discipline they are writing for at an early stage. Different disciplines have different practices, and many have different preferred

journals. Early in an academic career then, there is a need to choose an identity in order to publish in the ways accepted by that discipline if one is to be submitted to the REF.

Finally, time is a constraint for ECRs who may be on short fixed–term contracts. Groundwork is needed to learn the terms and approaches of other disciplines. This can make it difficult for an IDR project to reach maturity within the timeframe of an ECR's contract or fellowship.

> *"Interdisciplinary research often means that projects need more time to develop, since new methods need to be learnt or collaborations need to be organised/maintained/managed, which is often not understood by non–interdisciplinary fellow researchers."*
>
> Daniel Hebenstreit
> University of Warwick

The groundwork for really good interdisciplinary work is quite substantial; one needs at least a year or even two years to get the groundwork in place.

Sandra Fredman
Oxford University

Perhaps most fundamentally, there was a sense from some of the ECRs consulted that early engagement in IDR was problematic for winning a job in a discipline–focused department:

> *"People 'don't know where to put me'. Things that count, like applied research, policy, impact work, count for little in terms of how universities hire people to tenured positions."*
>
> Centre visit
> Edinburgh

The experiences of these ECRs again highlighted the importance of building an academic home, which ensures that researchers have clear methodological skills to bring to a department for teaching and for collaborative work.

Mid–career academic

Incentives to engage in IDR are perhaps stronger for mid–career and senior academics, but risks remain (Table 1). Even with no real disincentives to pursuing innovative IDR, perhaps in a sub–discipline, it can represent a relatively high risk by comparison with pursuing leading–edge work in an established field in one's existing academic social network. In addition, the more outside the established discipline the work is, the less it will attract the attention of junior colleagues (unless it becomes very successful). This in turn makes it harder to attract top doctoral students; and if we move closer

to the North American system, then attracting top doctoral students will become more important to one's standing in the department and university.

How does this shape the decision–making of a mid–career academic? She or he may well have a permanent job and a clear specialism and an academic home, but there are continuing pressures to publish and to be selected for a department's REF submission. Attracting research funding and being the PI of a major project become more important, particularly for promotion. This may steer academics to disciplinary–based funding applications. While funders devote considerable resources to IDR programmes and are receptive to IDR proposals in 'responsive' funding mode (see Chapter 2), replies to our call for evidence suggested a perception that interdisciplinary proposals have lower success rates. If this perception is widely shared (through networks and mentoring) this reinforces incentives for academics to design a disciplinary–based application rather than build an IDR proposal.

> *"Funding bodies (or their peer reviewers) are very conservative and although they say they desire interdisciplinarity, they almost never support it."*
>
> Christina Lee
> University of Nottingham

At this career stage, the time pressures any academic career creates may compete against the family needs of those with young children or elderly parents. This may be more acute for those working on interdisciplinary projects, because of the additional groundwork previously discussed.

Nonetheless, the advantages of engaging in IDR are perhaps greater at this point in an academic career than in the earlier stages. IDR can enable researchers to open up a new research area and work towards the critical 'second book' or equivalent, and responses to the call for evidence noted the value in allowing researchers to feel even more established in their own disciplines while shedding new light on issues.

Senior academics

Many of the professional pressures and incentive structures encountered by mid–career academics also affect senior academics (Table 1). One difference is that their professorial status means they are generally recognised as experts in their fields and this professional security provides a good position from which to work on more high–risk interdisciplinary projects. There may be the drive to break new ground at this career point. Researchers well known in their field are also more likely to be identified by those in other fields as key figures to collaborate with. Engaging with major issues that require collaboration between experts may, therefore,

be particularly attractive. Some of those consulted considered this the ideal point in an academic career to engage in IDR.

Opportunity presents itself not just in the drive to research but also in providing leadership in departments and the university, and PIs on major research projects. In general, more senior academics are better positioned in skills, experience, professional standing and career security to provide leadership for higher risk and complex projects. They also have the vision and the professional responsibility to set up and lead interdisciplinary centres and institutes, and to mentor and support younger academics.

However, even at this career stage there are risks in undertaking IDR. This is especially pronounced for academics running departments, schools, research centres, institutes or large research teams. As one dean of faculty engaged in IDR put it, there is a great investment of time to learn the language of collaborators. This can be a barrier to academics seriously engaging in IDR themselves or shaping a programme within which other researchers do so.

> *"The primary challenge is building up a sufficient level of competence in an unfamiliar field of research. This is time consuming, and may only indirectly impact my immediate research outputs."*
>
> Jonathan Patterson
> St Hugh's College, Oxford

Being a PI on a cross–disciplinary research project can be complex even once funding is found. Some university visits revealed that budgeting resource allocation, including PI academic time for IDR projects that traverse more than one cost centre, can be difficult to agree across multiple stakeholders. This can make IDR projects complicated to set up and run, even in institutions with an explicit commitment to fostering IDR.

IDR projects may also bring additional responsibilities for managing the researchers in the team, in terms of providing additional training, guidance and career support.

Weaving, translating, convening, collaborating: Skills for IDR

There is no ideal interdisciplinary researcher, but some key skills that should be cultivated for a career involving IDR emerged from our evidence gathering:

- Methodological expertise: security in the methods of at least one discipline, in order to share these with other researchers and apply them in a complex project
- Methodological flexibility: openness to, and understanding of, both quantitative and qualitative methods and approaches, both of which are often needed in IDR

- Language learning and translating: the ability to learn the language of different disciplines sufficiently well to talk to other researchers and understand the relevance and import of their contributions to a project
- Synthesising: the ability to weave together diverse methods and findings into a coherent whole
- Collaborating: team-building and team working-skills are necessary in any joint research project, and are especially important when teams are academically diverse
- Convening: IDR often needs quite pragmatic skills in bringing researchers together in ways that enable them to work effectively in sharing ideas and working constructively on a research project, from sandpits to writing up findings
- Engaging: the ability to engage with, and present findings to, diverse academic audiences, as well as non-academic audiences

Summary

The discipline–based systems in which most academic careers are rooted create various disincentives to IDR. This is reinforced by the way the application and interpretation of the rules in research evaluation exercises – the Research Assessment Exercise (RAE) and subsequently REF – have created incentives for discipline–focused publishing. The working group was struck by the widespread perception of academics that their departments favoured disciplinary publications in established discipline–based journals over IDR. Yet the quality of the IDR, and the parity accorded it in the REF2014 (see below), is testament to the relatively determined academics who work across the institutional grain, undeterred.

So, the first conclusion is that although disincentives apply throughout academic careers, they arguably operate more strongly at early stages of research–focused careers. This underlines the point that serious incentives are needed to encourage top researchers into IDR.

The second conclusion is that established researchers have fewer disincentives than younger researchers. And this suggests that, despite the intuition that universities and research agencies should develop incentives for IDR directed towards younger researchers, the payoff from building incentives for older researchers may be significant.

The third conclusion concerns teaching. There is little incentive for academics in a discipline–based academic world to invest in interdisciplinary teaching, unless they are already doing IDR or have a particular desire to engage in interdisciplinary teaching. Departments are generally more concerned to cover standard disciplinary teaching requirements. Teaching on joint degrees may only involve teaching one discipline. Departments and universities are keen to reward good teaching, and most academics take pride in being a good teacher. However, even at doctoral level in top research universities this will be largely discipline–based teaching and supervision.

The fourth conclusion concerns university administration. Simply put, the fact that high–level academic research and teaching careers are largely discipline–based reinforces the incentive for the administrations of research universities to structure key decision–making along departmental lines, which in turn reinforces the departmental system.

There are important exceptions to this, which will be discussed below, but a more or less common pattern is that decisions on academic careers in research universities – hiring, retention, promotion, salary, performance assessment, and so on – are primarily organised on a departmental basis, typically around a framework of university rules interpreted and implemented by senior leadership teams comprised of academics and administrators.

This internal organisation is shaped by the incentive structure for research created by the wider environment of research evaluation exercises and research funding opportunities. Departments with a strong research reputation (usually measured by the REF, external evaluations of departments, internal monitoring of publications, prizes, fellowships, grants, academy memberships etc) will have a dominant voice in retention decisions and investment in additional appointments. A strong research reputation is increased by the ability to attract substantial research funding (grants and contracts plus the quality–related funding allocation following the REF evaluation) and doctoral students. Indeed, the political capital of a department in the university depends on its being able to pay its way, and research performance is of major importance. With a strong research and grant–getting reputation, departments have autonomy and can hope to get a significant share of discretionary funding from the university centre. It is thus rational for departments to perpetuate discipline–focused research.

Key lessons

How might institutions foster and support more IDR, if this is part of their strategic objectives? There are several key lessons:

a. In research university systems operating on a disciplinary basis, career structures do not favour IDR. Existing disciplinary boundaries do evolve (as has been the case in biochemical research, informatics or environmental science, and education or business studies), but such developments are unlikely to flourish if crudely imposed from above. Thus in seeking to encourage IDR, the primary goal should be to focus on researchers who already want to do IDR and to reduce barriers to their doing so. These are likely to be the motivated researchers who will do the most interesting IDR and

are least likely to 'game' incentives to do IDR – submitting what purport to be joint IDR proposals to continue with their own – slightly dressed–up – discipline–based research.

b. Established academics in permanent posts face fewer disincentives to IDR than more junior ones. But they still need incentives, especially in mid–career while building their reputations. The intellectual case is often made that effective IDR is best done by researchers with strong (if different) disciplinary backgrounds.

c. Although funders and league tables do not discourage research universities from promoting IDR, in practice universities face strong incentives to devote resources to their discipline–based departments through high–level hires, which in turn increase the departments' political weight in the university. This underlines the importance of funding agencies that are external to the university in building IDR incentives.

The problems of IDR in a discipline–based system have been aggravated by the increasing specialisation and professionalisation within disciplines, in part as the consequence of increased competition. Research 'excellence' is seen increasingly in terms of publications in top disciplinary journals or by major university presses, with editors and reviewers chosen for their standing in the discipline, underwritten by evaluation criteria including the REF. This may have had the unintended consequence of sheltering relatively narrow and discipline–focused research.

INSTITUTIONAL CASE STUDIES

University of Manchester Research Institutes and Research Beacons

Providing an institutional narrative for interdisciplinarity

The University of Manchester's research strategy includes a commitment to fostering IDR. This has been an explicit objective since 2004, when the university was established by the merger of the University of Manchester Institute of Science and Technology (UMIST) and the Victoria University of Manchester, which were both traditional in structure with clearly delineated departments along disciplinary lines. The merger left fewer faculties and created large schools that are more interdisciplinary.

University of Manchester Research Institute (UMRI)

Research institutes are built into the statute of the university, with a commitment to accommodate and promote IDR on a large scale. There are currently 19 institutes, eight hosted and led by the Faculty of Humanities (which compasses arts and humanities, social sciences, education, business and law).[7]

For governance purposes all institutes are part of the single University of Manchester Research Institute (UMRI), which brings together the deans and other senior academic budget holders of the university with the specific remit of fostering IDR excellence. It has proven to be an effective mechanism for encouraging and governing research areas that have emerged in very different ways. It creates resource, communication and governance decision–making that transcends and coordinates across faculty and school structures.

This includes an annual pump–priming competition for initiating new IDR activities. For example, the emergence of the digital humanities network was supported by investment by the Faculty of Humanities and subsequently secured UMRI funding for a collaborative project with computer science. This type of seedcorn has been a key mechanism, responsible for many interdisciplinary initiatives at Manchester.

Other initiatives have emerged through IDR collaborations bidding for external RCUK or charitable funding, such as the Economic and Social Research Council (ESRC) Centre on Dynamics of Ethnicity, philanthropic donations, such as the Global Development Institute, or commercial

partnerships, such as the Sustainable Consumption Institute, which was established in response to an opportunity presented by Tesco.

Research Beacons

As part of its commitment to wider public engagement, the University of Manchester has identified five so–called research beacons: Cancer, Energy (nuclear), Industrial biotech, Advanced materials (graphene), and Addressing global inequalities. Each captures an area in which Manchester has many academics engaged in research judged excellent or world leading by REF2014 and other international measures, and all are interdisciplinary, including involvement from more than one faculty.

The beacons have evolved into a means of fostering new IDR developments by stimulating groups to initiate and deepen collaborations, supported by a concrete research strategy. They have also helped internally by clustering activity and ensuring coherent terminology and practice. In addition to the five flagship research beacons, other IDR groupings exist and are evolving across the institution.

CRASSH, University of Cambridge

A now well–established research centre, CRASSH (The Centre for Research in Arts, Social Sciences and Humanities) hosts a range of externally funded interdisciplinary projects, which together employ around 40 postdoctoral researchers. These projects stand alongside a programme of international conferences, schemes for visiting fellows, and several series of seminars, all of which act as development laboratories for further ambitious funding bids.

An interdisciplinary home

It was notable that CRASSH has been able to carve out a role within the university as a well–recognised home for projects that would not fit elsewhere. It has proven itself to be particularly successful at applying for and holding large research grants and is often looked to as the place to hold very large grants that departments might not be comfortable managing. For example, there are currently two centres of this kind that sit within CRASSH– the Centre for the Study of Existential Risk (CSER) and the Centre for Digital Knowledge. CRASSH also oversaw the submission of a successful £10 million bid for a new Leverhulme Centre for the Future of Intelligence.

Leadership, time and trust

Time and trust: it was emphasized by both post–doctoral researchers and programme leaders that CRASSH allows for a kind of independence that is seldom available elsewhere, partly because of the trust bestowed in PIs by the directors. The relatively long period for undertaking projects at CRASSH was recognised as an important factor – there is a long settling in period and learning curve that one has to go on when engaging in IDR, and this was well accommodated.

Centre directors also pointed to intellectual generosity and openness: there needs to be an understanding of one's own discipline alongside an appreciation that other disciplines have something to offer and that the end of one's training is not the end of one's PhD.

Some simple, practical, good practice suggestions that facilitate an environment for successful interdisciplinary working were also made: meeting regularly and in person with your collaborators and pre-cirulating papers before meetings, all with a view to creating an open and collaborative atmosphere. This is as simple as meeting regularly and in person with your collaborators or pre–circulating papers before meetings, all with a view to creating an open and collaborative atmosphere.

University of Durham and the Institute of Advanced Study

Home away from home: developing disciplinary homes and creating space for collaboration

At the University of Durham, the Institute of Advanced Study hosts visiting researchers, supports junior research fellows, and works with an informal network of interdisciplinary centres across the University. At our visit, we spoke to a number of those centres about how they manage IDR and support early career researchers.

Supporting ECRs: Centre for Medical Humanities

Medical Humanities is a high–profile interdisciplinary area. The Medical Humanities Centre at Durham is funded by the Wellcome Trust, the funding received building on an existing research core at Durham. The leaders of the Centre, Professors Jane McNaughton and Corinne Saunders, talked particularly about the importance of finding the right individuals

for interdisciplinary work, developing their skills, and supporting them in developing their careers.

The importance of how you actually assess people at interview was made clear in our discussions. The Centre aimed to invest in individuals as much as their specific research programme, and awards gave people space and time to develop their work. Researchers applying to the Centre had to demonstrate experience in collaboration through their CV. In addition, a workshop is held as part of the interview process whereby people are asked to work on a problem collaboratively.

The Centre leaders felt that post–docs have a hunger for IDR, but they were very much aware that researchers needed to be good disciplinarians. Therefore researchers at the Centre were encouraged to publish within their primary discipline as well as producing interdisciplinary outputs, and the leaders were careful to nurture links between the researchers and the departments of their 'home disciplines'.

The IAS as an interdisciplinary home

The Institute of Advanced Study at Durham supports researchers visiting from overseas, providing them with time and space to work on a short–term interdisciplinary project in their three–month tenures. But it offers more to the University as a whole, acting as a conduit for connecting parts of the university. It does this through its programme of open, thematic interdisciplinary programmes (on topics such as Water and Evidence), through supporting people across the university to put together interdisciplinary bids, and through seedcorn–funding for workshops or engagement with stakeholders which can be foundational to new projects. It is able to do this at least in part due to providing a significant physical space in the heart of Durham, where researchers can meet and network and set aside time for interdisciplinary working away from their home departments.

University of Portsmouth

Teaching and research and responding to external drivers

Research or teaching as the driver of interdisciplinarity?

The relationship between research and teaching can be problematic in the case of interdisciplinarity. Researchers argue that they need to be able to teach in core disciplinary areas which might not match their IDR backgrounds and that as a result their IDR is not reflected in their teaching.

Portsmouth is a university which was traditionally focused on teaching and is making a transition to increased research activity. Staff at Portsmouth argued that this had encouraged researchers to be interdisciplinary, to be more open to innovative approaches to knowledge and to be flexible about the skills that one has.

The intrinsic link between teaching and research was emphasized in particular at the Institute for Criminal Justice Studies, where there is a successful professional doctoral programme with 90 active students, as well as relationships with different departments across the University, such as the Centre for Counter Fraud Studies, the Business School and the School of Environmental and Earth Sciences. A mix of traditional academics and practitioners form the Institute's staff and this enables the development of research that is relevant to practitioners.

Interdisciplinary university structures in direct response to external signals

IDR Centres that have been formed at Portsmouth, such as the Centre for European and International Studies Research, have been part of an effort to build critical mass in certain areas of research expertise. There is already an IDR culture and it has been recognized at Portsmouth that some of its greatest strengths are where research areas overlap; there is a drive to push this further with a view to strengthening the opportunities for external funding. Specific external funding calls, such as RCUK's global challenges, were pointed to as shaping institutional level research priorities.

University of Edinburgh

Seedcorns and sandpits: the role of the university in supporting bottom–up interdisciplinarity

Seedcorn funding: the benefit of small–scale funding provided directly by universities was felt in a number of the centres that were visited. This sort of funding supports researchers in developing collaborations, through establishing common questions and shared approaches and testing the viability of research questions.

The role of this funding was discussed in particular detail at the University of Edinburgh. The College of Humanities and Social Sciences at Edinburgh delivers the Challenge Investment Fund, which is intended to: "support capacity building for interdisciplinary working. Grants from this Fund engage with the College's strategic objective to exploit and develop existing synergies and areas of cross–disciplinary expertise within the College and across College boundaries."[8]

This funding supports projects that will be too experimental or risk–taking for existing, external funding but can be seen as helping to bring projects to the stage of development where they are eligible to be supported by existing funding schemes. They help that development through means such as providing funding for meetings and networking, and for courses to develop researchers' skills. Similar funding resources were provided by CRASSH at the University of Cambridge (see p 40) and they offer a key role in the ecosystem of support for interdisciplinary projects.

Sandpits: In order to help build interdisciplinary teams and to identify viable research topics, sandpits provide an opportunity for researchers to carry out early–stage scoping of projects. Our visit to the University of Edinburgh also highlighted the role of sandpits in establishing projects – but also ensuring that the sandpits are run in an inclusive way to bring in a diverse set of researchers: allowing members of staff with family commitments to attend without committing full weeks away from home (as some sandpit activities can demand), but still benefitting from time out to think about new projects and new ways of working.

TORCH, University of Oxford

The role of academic and non–academic facilitators as well as 'TORCH and'

The Oxford Research Centre in the Humanities (TORCH) is a relatively new centre, formed in 2013 within the Humanities division at Oxford. It supports a range of established research programmes, experimental networks, knowledge exchange activity and early career fellows, and has an academic director, who is bought out of their teaching role at 50%.

Critical role of non–academic staff in facilitating connections and outreach work

One of the tasks of TORCH is to animate and to keep channels open, both within and outside of the university. TORCH can act as a facilitator within what can be an otherwise disparate university. A dedicated centre also means that there is institutional memory for collaborative activities so that researchers "don't have to reinvent the wheel" with each new research project.

A large part of TORCH's value is also its public and wider engagement. Such an engagement function does not sit within any one department within the university, so it is a clear added value that TORCH can offer and has become core to its brand both within and outside of the university.

It has also established itself as fun and outward looking and as part of this, it was emphasised that the impact agenda was important and TORCH is a valuable mechanism for capturing public engagement.

The role of the non–academic staff in facilitating the connections, both internally and externally, was critical. The Centre Manager at TORCH was supported by an expert team skilled in acting as translators between researchers and the public through outreach activity and between researchers from different academic backgrounds looking to make connections through the centre.

"TORCH and" – Early Career Researcher

It was emphasised at TORCH that often its value to the wider academic community within Oxford is to give a space to experiment. Alongside this space for experimentation, "TORCH and" was repeated often as the mantra and there was an emphasis on advising post docs to acquire disciplinary identities parallel to the interdisciplinary working they were doing at TORCH.

Centre for Interdisciplinary Methodologies (CIM), University of Warwick

Interdisciplinary identities, the role of methodologies and integrating teaching and research in taught postgraduate courses

Physical and administrative space and identity

The Centre for Interdisciplinary Methodologies (CIM) is still new and experimental. It was set up by the University to be a cross–faculty, independent research centre. However its physical and administrative location in one particular Faculty, sometimes makes it difficult to realise its interdisciplinary identity and research aims. There is a tension that exists between the Centre "needing a home but also wanting to have a non–disciplinary identity". This tension is played out in routine but consequential decisions around website design, course development, access to internal funding for research and studentships and placement in the prospectus.

Interdisciplinarity as bringing together methods and practices as well as bodies of knowledge

At CIM, it was emphasized that interdisciplinarity is not just about bringing substantive disciplinary knowledge into new relationships, but also developing different research practices, for example, combining online and offline research and issue mapping with digital methods. Approaching interdisciplinarity through methods allows for new ways of thinking.

Methods of interdisciplinary working can be learnt practices. It was said that interdisciplinarity often needs a shared space to facilitate collaboration and for making connections between practices.

Linking research and teaching

CIM runs a PhD in Interdisciplinary Studies and there are also 3 Masters programmes: an MA in Digital Media and Culture, an MSc in Big Data and Digital Futures, and an MSC in Urban Informatics and Analytics. Some of these courses were set–up in response to gaps in provision at Warwick, some to external demand, but they all focus on equipping students with critical, creative and technical skills so as to be able to engage in problem solving. The postgraduate taught level is crucial in enabling IDR to directly link to teaching provision.

CHAPTER 2
HIGHER EDUCATION AND IDR FUNDING

The higher education landscape

The funding of IDR must be placed in the context of ongoing changes to the UK's higher education and research system. Significant features of the UK's research funding architecture are being redesigned at the time of writing.

Evidence gathering for this project was undertaken alongside a flurry of reviews and reports in higher education, notably Sir Paul Nurse's *Review of the UK Research Councils*,[9] *The Dowling Review of Business-University Research Collaborations*,[10] and the Higher Education Green Paper, *Teaching Excellence, Social Mobility and Student Choice.*[11]

The Higher Education and Research Bill has now been introduced to Parliament. As far as the UK's research funding architecture is concerned, further to the High Education White Paper, *Success as a Knowledge Economy: Teaching Excellence, Social Mobility and Student Choice,*[12] the Bill proposes that the Research Councils along with Innovate UK are merged into UK Research and Innovation (UKRI). HEFCE will be broken-up: elements of it will become the Office for Students (this will administer the Teaching Excellence Framework) and the research arm will become Research England, which will be brought under UKRI to administer the REF (which is itself being interrogated through an independent review chaired by Lord Stern, president of the British Academy) and distribute Quality Related funding.

Together, these changes will mean that the UK's funding and assessment structures hang together differently in future.

But some of the foundations will remain untouched. Government has committed to maintaining the dual support system, with a peer review–led REF in 2021. The diversity of the UK's research funding landscape is one of its strengths, and within that landscape, the quality–related (QR) funding element of dual support allows for excellence to be funded wherever it is found, for curiosity–driven, bottom–up research, giving universities the flexibility to make their own decisions about fostering and developing their research environment.

As the British Academy has said elsewhere,[14] QR should be protected by any new body that has responsibility for administering both legs of the dual–support system, so that there is no risk of the erosion of one in favour of the other. Both legs are crucial to different aspects of researchers' careers, and to the health of the research base as whole and its ability to generate the knowledge and skills required in the UK economy. It is comforting to see that government has listened to this message and will be considering the enshrinement in law of the dual–support system.

The UK's varied and diverse portfolio of research funding opportunities is a recognised strength, nationally and internationally, and many of the difficulties involved in funding IDR are not always peculiar to IDR. However, it is felt that many of the difficulties involved in funding research generally are more acute for those schemes that aim to address interdisciplinarity.

One of the motivations for beginning this project was that challenge–led funding was becoming more common, perhaps due to general pressures on the public purse and a cultural shift towards the need to demonstrate the 'impact' or wider benefits of research.

In this context it is interesting to note the language employed in the White Paper around the role of UKRI: "*… a greater focus on cross–cutting issues that are outside the core remits of the current funding bodies, such as multi – and interdisciplinary research, enabling the system to respond rapidly and effectively to current and future challenges.*"[15]

The new UKRI board will oversee a common research pot, as proposed by Sir Paul Nurse, for IDR. The budget for this will be top–sliced from the individual research council budgets. This offers a significant opportunity for the creation of truly IDR programmes that are appropriately reviewed and delivered.

While interdisciplinarity is not synonymous with this kind of research, challenge–led or problem–focused research is often recognised as interdisciplinary, with major societal challenges such as climate change or an ageing population demanding insights from numerous disciplinary backgrounds to find solutions. The impact case studies submitted to REF2014, where narratives were provided about how academic research across the disciplinary spread had achieved impact outside academia, show 60% drew on IDR.[16]

The perception of funding provision for interdisciplinarity

There is a perception that IDR is not done well in many UK and international funding agencies. Many researchers felt that appropriate funding structures do not exist.

> *"This was rather clear when trying to develop a project that included museums and theatres – to one funder we were too academic and to another not academic enough!"*
>
> David Parker
> University of Birmingham

There was also a perception, shared by some large funding bodies, that only 'lip service' is paid to the encouragement of IDR by funding bodies, with schemes that are superficially interdisciplinary actually hiding much monodisciplinary work.

Existing efforts by funding organisations still fall short of providing adequate support for interdisciplinary and multidisciplinary work. National funding schemes still tend to be highly discipline–based and obtaining funding for emerging areas of research can be challenging.[17]

The Royal Society

In addition, there seems to be a lack of confidence that IDR will be as well received as monodisciplinary research by funding agencies, even if schemes are ostensibly open to it. This perception may be felt particularly keenly at an early career stage.

Funders' challenges

There has perhaps been a confused narrative around interdisciplinary funding provision. This confusion was recognised by the research councils, which have through targeted interdisciplinary schemes perhaps unintentionally encouraged the perception that a top–down mode is the only one that welcomes interdisciplinary applications, and that responsive–mode calls are more open to more conservative, disciplinary work.

> *"The research councils are regarded as having been successful at funding large challenge–led interdisciplinary consortia, but the support of interdisciplinary activities does not satisfactorily extend to the smaller scale responsive–mode grants, which play a particularly important role for those starting out in their interdisciplinary research careers."*
>
> Royal Academy of Engineering

There is a recognisable rhetoric in the way funders organise and direct their funding schemes that is easily interpreted in this way. The Arts and Humanities Research Council (AHRC), for example, has four research themes and three priority areas. Similarly, cross–council programmes such as Living with Environmental Change avoid disciplinary labelling.

Clearly, all public funders are under intense scrutiny and they have individual communities to serve and protect, as well as the health of the research base as a whole. Some narratives about interdisciplinarity may have been caught up with an attempt to engage with a new impact agenda, and there is a risk of conflating interdisciplinarity solely with this top–down, challenge–driven research.

Identifying funding sources for IDR

In an attempt to investigate the level of interdisciplinary work that is funded, it is interesting to note that research funded by the British Academy was assessed by 29 out of the 36 REF2014 sub–panels.[18] Similarly, research council–funded grants were submitted to:

- *Arts and Humanities Research Council (AHRC)* – 28 of the 36 REF sub–panels across all 4 main panels
- *Biotechnology and Biological Sciences Research Council (BBSRC)* – 22 sub–panels across all 4 main panels
- *Engineering and Physical Sciences Research Council (EPSRC)* – 31 sub–panels across all 4 main panels
- *Economic and Social Research Council* (ESRC) – all 36 sub–panels
- *Medical Research Council (MRC)* – 30 sub–panels across all 4 main panels
- *Natural Environment Research Council* (NERC) – 22 sub–panels across Panels A, B and C
- *Science and Technology Facilities Council* (STFC) – 15 sub–panels across Panels A, B and C[19]

A distinction should be drawn between targeted research calls and responsive–mode schemes. Research council responsive–mode schemes are protected specifically to respond to emerging trends in research that arise organically, either within disciplines or between them. They are not designed to encourage any kind of research in particular.

A large portion of research council funding, especially in the humanities and social sciences across the ESRC and AHRC, remains dedicated to responsive–mode grants. Approximately 60% of the AHRC's annual funding pot, for example, is dedicated to research and knowledge exchange, and the other 40% to doctoral training in the form of block grants. Of the 60% dedicated to research and knowledge exchange, 70–75% is reserved for responsive–mode grants.

When it comes to the research councils, it is important not to conflate IDR with cross–council collaboration. Looking at the range of disciplines within the AHRC's remit, one sees that there is much scope for IDR. Sometimes that might be near–neighbour IDR, but the disciplinary spread is very broad. Dance and law are both within the AHRC's remit.

There is much scope for interdisciplinary provision within the individual research councils, and a lot of work that goes on 'behind the scenes' was

highlighted to us. Over £142 million has been awarded to 176 projects and programmes using the 2011–12 cross–council agreement.[20] Within the AHRC's remit, around 30 projects of the 700 currently live share remits with the MRC, BBSRC, STFC and the ESRC,[21] but the AHRC does not promote this fact.

Moreover, the research councils do have a track record of funding a variety of organisations. Since 2011, the AHRC has funded 165 different universities and independent research organisations, such as the British Museum and British Library.

This is not to say that there is no territoriality among separate research councils bidding for their respective budgets from within the wider science budget. This can lead to pernicious disciplinary hierarchies that mean that research proposals are looked at through strictly disciplinary lenses attempting to identify a sufficient presence of one discipline or another in a certain grant in order to retain the dominance of that discipline. Chapter 3, on the evaluation of IDR, points to ways of assessing research proposals that would enable any interdisciplinarity within them to be appropriately judged.

> *"Interdisciplinary research might be at a disadvantage when reviewed by research funders, as there can be greater risk where researchers are moving into areas in which they do not have a track record of expertise." While it might be higher risk, there are potentially greater rewards. The response stated that "selection criteria are focused on the strength of the candidate and the quality of their research, rather than their fit within a specific discipline".*
>
> The Royal Society

Importance of crafting and communicating the right narrative

Building confidence in interdisciplinary working will be a slow and necessarily hard–won process. Nevertheless, the perception and reality of interdisciplinary funding need to be more closely aligned. Securing funding for research is challenging, but the perception that avenues for IDR do not exist is misguided. There may be a need for researchers to be more confident that their IDR will convince others that it is valuable and worth funding. To help build this confidence, funders could promote more widely the steps that they are already taking towards supporting IDR – perhaps by reporting back to recipients through the research councils, for instance, when their successful award has been funded through the cross–council funding agreement.

Need for a varied portfolio of funding options

The diversity in formal funding sources available for IDR is a recognised strength. But QR is important for flexible bottom–up funding that enables interdisciplinary interactions that can grow into larger scale projects over time. Various activities contribute to successful interdisciplinary working, and these need providing for – and assessing – in different ways. There needs to be a balance between top–down large–scale projects designed to address a specific challenge, and response–mode smaller grants that are less risky to award and might engender bottom–up, organic interdisciplinarity that would be better integrated from the beginning.

Time and trust

The time–intensive nature of IDR is often poorly accommodated in existing funding calls – when the groundwork for interdisciplinary collaboration needs to be laid down and languages need to be learned before research can take place.

Interdisciplinary research also needs substantial time commitment, and complexity of the research means results cannot always be produced within periods that grants are currently run. The opportunities for making interdisciplinary grant applications are therefore still relatively restricted.

The Royal Society

The constraints of cuts to funding are therefore perhaps felt more keenly by interdisciplinary researchers, who are less able to demonstrate outputs in the same amount of time as their monodisciplinary counterparts. In order to better accommodate IDR, funders could offer greater flexibility in the kind of reporting that they require for interdisciplinary grants in the initial stages of the research process, or ringfence a response–mode call for IDR projects.

Role of private funders

Examples of particularly innovative funding provision for IDR often came from large private research funding bodies, such as Wellcome and Leverhulme. Again, the diversity in provision for research in the UK is a strength, and the role of these private funders is often to inject new ideas and innovative approaches that others are less able to take. Philanthropic funders may have a particular role dependent on the terms of their endowments, with some funders mandated to sponsor research that tackles challenges which necessarily require IDR, and others with potentially broad remits that may allow them to support more exploratory research.

Wellcome's recent evidence synthesis paper, Frontiers: One Science – Life at the interface,[22]notes that the trust is "*in a unique position*" and "*can afford to take risks, unencumbered by the usual constraints of academic structures, institutions and financial resources*".

The Leverhulme Trust is also frequently cited as more friendly towards IDR than other funders. There may be reasons for this linking back to the trust's philosophy, which has always been about problem–solving and collaboration, stemming from its non–academic, company roots. In some ways, being small also helps – the trust's internal structures are necessarily flexible and cannot be aligned in disciplinary structures. Moreover, the assessing panels take a more holistic view.

The Leverhulme Trust is all responsive–mode, but the perception is that it is much better at accommodating interdisciplinary provision within that mode. The trust does not ask for bids to be cross–disciplinary, nor demand any explicitly interdisciplinary working, which means the proposals it receives are often better integrated and less artificial than a top–down process might have engendered.

Informal networks that funders can facilitate

Funders and national academies should also be aware of the kind of informal support they can provide for interdisciplinary interaction without investing any further funds. National academies have a clear responsibility as national voices for their disciplines to bring their respective communities together on specific topics of mutual interest and in ways that enable the building of new networks. The British Academy conferences in particular aim to be highly interdisciplinary and provide an opportunity for sharing different perspectives.

Different ways of crafting research calls

Where IDR was based on collaboration across the humanities and social and natural sciences, there was often the perception that the humanities and social sciences were, unhelpfully, brought in only at a late stage of the design of the call for funding, which tended to be heavily focused on natural science. The social or humanistic element was introduced as an 'add–on' to capture how society might react to a technological change or scientific advance.

There are clear advantages in getting different disciplines to work together on the design of IDR calls from the start. Some calls do explicitly recognise this, for example the EPSRC Responsible Research and Innovation framework.[23]

The research question will then be framed in such a way that it requires input from a range of disciplinary knowledge banks and methodological approaches. The risk otherwise is that some disciplines are subordinated in a way that undermines the project's claim to be interdisciplinary. RCUK noted several methods for putting together interdisciplinary calls: scoping studies, sandpits, and workshops for targeted calls.

> *"For the forthcoming NERC–led/ ESRC/ AHRC Valuing Nature programme, a cross–disciplinary team has been established to run an interdisciplinary network and a cross–disciplinary scoping workshop was held on 20 March 2015, supplemented by an online survey to feed into the call. Interdisciplinary approaches crossing the three councils' remits will be a requirement under the call. To support prospective applicants, a town meeting will be held on 14 July 2015."*
>
> Research Councils UK

A sandpit involves a group of researchers, perhaps from different disciplinary backgrounds, being brought together over a short but intense period of time to concoct a creative brief for a research call that might address a specific problem in a new way, or fill an identified gap in the landscape of knowledge. These sandpits must be well designed to bring in all disciplines and kinds of researchers. See the case study of University of Edinburgh (page ref) for an example of an approach to sandpits that aims to be sensitive to IDR approaches.

Practical guidelines on the valuation of IDR are outlined in Chapter 3. But it is worth noting that, for larger centres in particular, the interview method is good for assessing the extent of the collaboration being claimed in an application. Team working can be assessed more accurately face–to–face than in a written application.

Conclusions

There are ways of working that could be adopted at little or no extra cost, that involve a reorganisation rather than a radical overhaul of or addition to existing funding provision, and that might encourage and treat IDR better – for the good of the UK research base, the economy and society.

CHAPTER 3
EVALUATING IDR

The way IDR is evaluated was cited as a barrier to undertaking it. In this chapter we focus on the funders' perspective on this barrier rather than the researchers' and draw together the evidence that the insufficiency of current peer review procedures is an impediment to realising the potential of IDR. A recent review[24] of the (limited) available literature (using the terminology of 'transdisciplinary research' – TDR) concludes:

> *"The lack of a standard and broadly applicable framework for the evaluation of quality in TDR is perceived to cause an implicit or explicit devaluation of high–quality TDR or may prevent quality TDR from being done."*

It has proved important to differentiate the divergent evaluative tasks that a comprehensive review needs to recognise, although some aspects of IDR evaluation appear in every one. There are at least five levels at which the question of evaluation emerges, involving differing methodological approaches:

1. Research outputs (concerning journal publishers)
2. Research grant proposals (concerning funding organisations)
3. Individual career progression (concerning higher education institutions)
4. Evaluation of HEI–based centres or other structures in support of IDR
5. Institutional research assessment (concerning national funding councils)

Finally we show that this kind of reflection on the evaluation of IDR radically illuminates the structural position it holds in academic practice. As Callard and Fitzgerald[31] put it, '[moments of peer review] stage the complexities, tensions, and excitements of 'interdisciplinarity', precisely at the moment in which interdisciplinarity inveigles itself into the strictures and assumptions of (to use a flat–footed term) 'normal science'.'

The evidence

> *"Peer review processes are cited repeatedly as a critical issue for interdisciplinary proposals and are regarded as a serious hindrance for interdisciplinary research. Improved evaluation criteria and processes are the key to achieving a more stable and consistent role for interdisciplinary research and for improving its intellectual status within academia."*
>
> Catherine Lyall
> University of Edinburgh

The narrow remits of journals and the disinclination of high–profile 'general interest' journals to publish IDR, as distinct from a wide range of single–discipline research, are among a staircase of barriers peer review presents. At all levels of academic evaluation the evidence gathered by this project reflected that incapacity within current review processes to address IDR effectively militates strongly against the adoption of IDR.

Throughout the levels of academic evaluation identified above – grant proposals, journal articles, individual career progression, and institutional research evaluations (e.g. REF) – the evidence reflects a lack of capacity within current review processes to address IDR. Summarising by level of evaluation:

(1) Specifically, at the level of journals (and comments were also received along similar lines concerning publishers of academic books), several respondents contributed experience along these lines:

> *"The largest barrier is the incentive structure laid out by journals, where (1) the most prestigious journals within my field are not looking for, and do not encourage, research using multiple disciplinary insights or methods, and (2) interdisciplinary journals do not have a wide readership, and thus, prestige."*
>
> Jennifer Sheehy-Skeffington
> London School of Economics and Political Science

The issue was also reflected in the response from the Royal Academy of Engineering:

> *Journals specialising in specific interdisciplinary research by definition tend to represent a very narrow field and consequently can have comparatively low citation rates and impact factors.*
>
> Royal Academy of Engineering

(2) Many respondents reflected a perception of a conservative, discipline–based process at the level of research funding:

> *"Grant awarding bodies (excluding Leverhulme) and in particular the AHRC, tend to reward conventional discipline–specific work that is geared towards the production of data, the distant past and dissemination rather than interdisciplinary innovation at the level of ideas. Having been on the AHRC Review Panel for years, I feel this may well be due to councils not knowing how to identify and reward interdisciplinary innovation or choose reviewers capable of doing so. This could well be a specific*

area where the British Academy could offer opportunity for excellence in future."

Joy Porter
University of Hull

(3) Researchers said some funders had to 'pigeon–hole' their research into pre–determined and narrow categories, rather than being able to let the breadth of disciplines and methodologies speak for itself.

Researchers' concerns that IDR would not propel their careers as effectively as single–discipline work was supported by statements from universities, such as this Russell Group institution:

"... in our promotion requirements from Lecturer to Senior Lecturer we do not (yet) suggest that there is any importance attached to interdisciplinary research."

(4) Institutional and individual evidence points to the increasing, and successful, deployment of interdisciplinary centres and institutes, but some of the difficulties in setting them up and running them are associated with the evaluation of their effectiveness. One Russell Group university reported:

"There are difficulties with interdisciplinary working within centres and institutes. There can be concern that there is an intellectual 'dilution' caused by the process. Moreover the process, as noted above, is difficult, primarily due to the requirement to transcend cultural and language barriers between disciplines."

Another admitted problem is in aligning financial structures with the identification of 'value for money' in interdisciplinary centres:

"Budgetary systems tend to militate against initiatives where they cross organisational structure boundaries, as each unit is usually keen to maximise its own return, which can make it harder to negotiate leadership and split of responsibilities and resource (the same may apply between institutions)."

(5) At the level of institutional assessment of research quality, there was widespread concern in our qualitative evidence that the disciplinary structure of the REF has disincentivised submission of IDR projects:

"The major drawback is the REF. This does not encourage 'slow' ID research and the publication bias on high impact narrows

researcher focus. The BA needs to work with HEFCE over this aspect both for teaching and learning."

Tim O'Riordan
University of East Anglia

The subsequent citation–based quantitative analysis performed for HEFCE on the proportion of IDR submitted to REF,[25] compared with the proportion of UK research as a whole, lent partial support to these views; a lower proportion of IDR was submitted to REF as outputs than exists in the entire UK research output. On the other hand, the judged quality of submitted IDR outputs did not differ from the entire output distribution (Chapter 2).

Was there a perception within institutions that there was greater risk in submitting more IDR outputs and that all but the very best would be judged to be of lower quality than single–disciplinary research outputs? It impossible to determine how the quality of IDR outputs would have been judged overall had more been submitted. The REF exercise, however, took a number of measures to encourage the submission and effective evaluation of IDR outputs. These included encouraging joint submissions from more than one institution, multiple use of interdisciplinary outputs by more than one unit of assessment in an institution, and a similar arrangement for impact case studies. The subsequent analysis of the research cited in the impact case studies indicated a very high level of IDR outputs.

There is limited reported work on the development of general peer review processes in the evaluation of IDR at all levels, but some significant recent studies have made experience and theory–based suggestions:

1. Research by Lyall et al.[26] itself drawing on a collection of studies, proposed a much closer working relationship between researchers and funders in the case of (typically large) IDR projects.[27]
2. A report commissioned by the RCUK Research Group identified aspects of international best practice in peer review of IDR.[28]
3. A Canadian group reviewed literature on evaluation of IDR (they refer to it as TDR) and suggested an evaluation framework.[29]
4. Klein[30] draws together literature on IDR evaluation, proposing a seven–point categorisation of 'principles' that rehearse but go beyond those applied to disciplinary research.
5. Callard and Fitzgerald[31] provide a detailed textual analysis of experiences of peer review in IDR that clarify the epistemic crevasses into which IDR can fall within discipline–based peer review.

6. A working group of funders, researchers and funding councils convened by Durham University's Institute of Advanced Study published recommendations on best practice in evaluation at levels 1–4 (above).[32]

The problem

The evidence collected by this project and the literature explored indicate a complex collection of challenges associated with evaluating IDR. It is not that we do not possess a highly evolved set of mechanisms, procedures and criteria for peer review at all five levels identified above. Rather, the challenges arise from the special character of IDR when compared with single–disciplinary research, which is the context within which our current peer–review evaluatory frameworks evolved.

The additional challenges are multiple, but among them we identified from our findings:

- The deployment of mixed methodologies arising from disparate disciplines.
- The increased complexity and multiple criteria required in the evaluation of IDR; the need to evaluate the role of more than one disciplinary expertise, and the extra dimensions of team–building, team–working and management that IDR calls upon (examples include the notion of 'disciplinary hospitality',[33] and the role of participants external to the academic team (especially important in 'challenge–driven' IDR).
- The more extended timeframe, size and cost typical of IDR projects; the increased need for openness and flexibility during the development of the proposal, in the less familiar territory of IDR, and the consequent complexity of planning contingencies and risk–mitigation.
- The limited ability to frame the outputs and outcomes of IDR within the existing evaluation processes of the participating single disciplines; the requirement to frame an IDR project or output in language unfamiliar to many of the evaluators themselves; the occasional involvement of 'token' disciplines in response to inadequate framings of, or perception of, a call for proposals.

- The differentiated roles, sometimes unequal, of the different disciplines within IDR; the risk that disciplinary components of a project may simply proceed in parallel with one another, without intensive interaction, mutual dependency and emergent added value.
- The danger of double or multiple jeopardy in the evaluation of IDR through all its disciplinary lenses sequentially; a filtering effect instead of recognising the quality of the whole proposal.
- The perception of the journals in which the IDR outputs are published as being less prestigious or of lower profile than those accessible by single discipline research.

The items on this list, and others, appeared in many forms in the community consultation and in the published literature on interdisciplinarity. What emerged was a tension between answers to two questions: respondents were positive about IDR, but when asked if they would recommend early career researchers to choose an interdisciplinary pathway, some said 'No'. The working group attempted to probe this tension in evidence sessions.

However, there is a summative central issue. It arises from the underlying motivation and rationale for IDR in the first place; it is the question of evaluating the emergent whole of IDR that is not expressible in terms of its (disciplinary) parts. It tests the degree to which the disciplinary strands have communicated and engaged until new knowledge and understanding can no longer be expressed as a sum of, or arising from any of, their separate contributions.

Klein[30] reports the same high–level aspiration from a Harvard study: 'More primary or epistemic measures of "good" work [other than discipline–based proxy measures such as citations] are needed that address the substance and constitution of the research'[30] This is a central question, and as it emerges from an apparently bewildering set of special requirements of IDR, it needs to be broken down into a detailed yet connected set of evaluative measures.

The evaluation of the emergent whole is precisely the core task that differentiates the evaluation of IDR from the evaluation single–discipline research. It is vital, because the difference between high quality and poor IDR is most often *not* in the quality of the disciplinary ingredients, individual researchers in a team, or knowledge sources, but rather in how they are combined. The core question then ramifies into compatibility of epistemologies, mutual learning and language acquisition within teams, high–level responsibilities for managing and nurturing the internal communication, development of IDR skills, combination of research results

at high levels, and so on. The inability of our current frameworks of peer review, career advancement or institutional evaluation to assess IDR stems from the absence of prior pressure to develop measures and methodologies that address emergent structures, knowledge, understanding, wisdoms, whose articulation cannot be framed within any single discipline.

This shows us why it has also proved ineffective to address the 'problem' by simply *adding* to existing frameworks. The 'sticking–plaster' approach to evaluation assumes an additive, linear structure to IDR rather than the highly nonlinear processes that drive the emergence of qualitatively new results.

Simply assembling experts corresponding to all the constituent disciplines within a single IDR proposal does *not* guarantee effective evaluation of the whole. A Finnish study[34] of panel evaluation of IDR proposals confirms qualitative evidence that without effective coaching, or the inclusion of members whose expertise lies in identifying good IDR, such panels will resort to judging the quality of each disciplinary element, effectively filtering out each IDR proposal on single–disciplinary grounds.[34] When reviewing IDR proposals, it is not sufficient for research councils simply to ensure that members of panels cover all the single–disciplinary areas mentioned in the submitted proposals. Panel members are not there to judge proposals according to their disciplinary expertise alone.

This more fundamental way of describing the problem of evaluating IDR points in the same direction as the other findings of this report. Although the challenge is severe, the rewards are great – in the renewed access to a fundamental level of learning that we are in danger of losing. The challenge is not to create additional evaluatory criteria but a more fundamental evaluator framework.

Towards solutions

The few suggested frameworks for evaluation of IDR have an interesting commonality of *form*: the drive to identify the holistic structures of good IDR through the formulation of *questions*. So, Lyall and King[35] and Strang and McLeish[33] condense their findings into a 'checklist'. We have indicated in bold those questions that might appear to be new in the case of the evaluation of IDR:

1. Does the proposal describe clear goals, adequate preparation, appropriate method, significant results, effective presentation, reflective critique?
2. How was the problem formulated?

3. How diverse are the disciplines, methods and researchers and how suitable is the combination of disciplines?
4. Is there a clear justification for the choice of disciplines based on the needs of the research questions?
5. Is the study sufficiently anchored in relevant literature?
6. What is the relationship with the methodology?
7. How will communication be tackled?
8. Does it describe how the disciplines involved will be integrated (in the design and conduct of the research as well as in subsequent publications) and how this relates to the type of interdisciplinarity involved; does it demonstrate how the quality of integration will be assured?
9. How is the collaboration organised – is there an understanding of the challenges of interdisciplinary integration, including methodological integration, and the 'human' side of fostering interactions and communication, and an effective strategy to achieve this?
10. Is the leadership role and management strategy to deliver the desired outcomes clearly articulated?
11. Do the researchers involved have demonstrable interdisciplinary skills and experience?
12. In particular, is there evidence of interdisciplinary leadership?
13. Is there an appropriate plan for stakeholder/user engagement from the outset of the project?
14. Does the proposal budget for, and justify, the additional resources needed?
15. Is it clear how interdisciplinarity will be reflected in the project outputs and outcomes?

These questions tend towards the assessment of the integrative and emergent, and will require particular expertise to address. However, they are questions that would be natural to address to any research proposal or output where 'disciplines' might be replaced by 'integrated knowledge' or 'methodologies'. This is supported by the working group report from the Durham Institute of Advanced Study (IAS):

"With the recognition that IDR represents a foundation, rather than a superstructure, in the organisation of knowledge (for a historical perspective see Weingart,[36] it is evident that:

- *Principles that guide good IDR can also serve as guidelines for good disciplinary research.*
- *Approaches to evaluation that work well for IDR may usefully inform evaluations of single–disciplinary research.*

"This does not work reciprocally. When the starting point for evaluation is that of single–discipline research, attempts to add special 'bolt–on' criteria for IDR can be awkward. But if a holistic, interdisciplinary perspective is assumed from the beginning, then there is no point at which special criteria need to be inserted into an evaluatory scheme."

The Durham report is also a checklist – a very large one, as separate frameworks of questions are derived for each level of evaluation. But these detailed lists are generated from an overarching set of criteria, reproduced below:

1. Is the emergent whole of the IDR greater than the sum of its parts? Do the ingredient disciplines do more than work in parallel but also interact, reciprocate, communicate and recombine? Are they sufficient?
2. Is the leadership structure characterised by inclusivity, facilitation, transparency of roles and an equality of contributing disciplines in terms of voice and status?
3. Are additional resources and time planned for dialogue, co–learning and integration between the contributing disciplines?
4. Is it clear how the individual disciplines may benefit on their own terms by engaging with the IDR, noting that this can be transformational?
5. Is there a disciplinary hospitality between the researchers, and to external participants, which avoids a hierarchical view of the contributing disciplines?
6. Are there ways of supporting the social cohesion of the collaborators (recognising that interdisciplinary support structures may help)?
7. Have the different scales, and communication between them, been recognised in the structure of the research?

8. Are there processes for ensuring coherence between the different data in the research, quantitative and qualitative, recognising the need for translation where this is necessary?

9. Is the necessary experience with IDR represented by the team and the leadership, as well as training and development, in place?

10. Are research plans sufficiently open and flexible to adapt to new questions or directions that might arise unforeseen at the outset?

11. If there are 'service disciplines' identified in the research, has this been driven by the project needs and not by assumed prevalence of one discipline over another?

The framework proposed by Belcher et al.,[37] drawn from a wide survey of the literature, is rather different in form. These authors take a narrower definition of IDR (which they term 'transdisciplinary'), identifying it as research "*with explicit goals to contribute to real world solutions and strong emphasis on context and social engagement*". Their list of criteria is rather universally applicable in the evaluation of research quality: Relevance, Credibility, Legitimacy (which contains many of the special requirements of healthy IDR explicit in the 'checklists'), and Effectiveness (including training and development with IDR in mind).

These, too, can be mapped onto the cross–corresponding classes of evaluative criteria from Lyall and King[35], and Strang and McLeish[33] (table 2).

Klein[38] extracted seven perspectives, or 'principles' in evaluation of IDR from her comprehensive review. These were (in her specific definitions): (1) variability of goals; (2) variability of criteria and indicators; (3) leveraging of integration; (4) interaction of social and cognitive factors in collaboration; (5) management, leadership, and coaching; (6) iteration in a comprehensive and transparent system; and (7) effectiveness and impact.

Meshing these four approaches (a rather comprehensive set, as they include reviewed work themselves), reveals a strong emergent classification of evaluative criteria. Together these draw on structural, epistemological and participative aspects of entire IDR projects to articulate powerful sets of guiding questions. We have labelled these criteria sets (see table 2) as Holistic, Social, Experience, Leadership and Effectiveness. The way these break down into particular guidelines, at the five levels identified in the introduction, is specific to each of those levels. We indicate how that process might develop below in the two cases of research grants (level 2) and institutional review (level 5).

All four of these studies either explicitly or implicitly reflect a conception of IDR as academically fundamental rather than additional. IDR does not

so much bridge borders between disciplines as dig into the foundational and higher–dimensional spaces of learning that underlie and support our current division of the university world. As evidence for such a view, a set of evaluation criteria designed with IDR in mind works very effectively when deployed within single–disciplinary research. However, single–disciplinary review procedures appear severely lacking when applied in the IDR context.

Table 2. Correspondences of criteria in four recent surveys of IDR evaluation

Lyall & King	3, 4, 8	9	11	12	15
Strang & McLeish	1	1, 6	9	2, 9	1, 8
Belcher	4, 3	2	2	4	1
Klein	3, 2	4, 5	4,5	5	7
Criteria Class	Holistic	Social	Experience	Leadership	Effectiveness

Practical guidelines (Level 2 – Research Grants)

There are detailed recommendations on the frameworks in the surveyed literature, although there has been no serious attempt to measure their effectiveness.

The composition of panels, and how they are used to address IDR funding proposals, is clearly critical. Research and consultation have repeatedly identified the need to employ reviewers with experience of 'translation' between the languages of different disciplines. Ideally, they should have engaged significantly in effective IDR themselves. Single–discipline experts ought to be subordinate to those chosen for their ability to judge the critical 'emergent' structures of IDR.

Other examples of good practice in core IDR evaluation criteria include:

- Arranging for remote referees to communicate in the production of a single assessment of an IDR proposal rather than individual assessments.
- Ensuring that proposers are able to address in writing comments by remote referees before a proposal is assessed, or ranked, by a panel.
- Including user–community or other non–academic reviewers on panels.

- Avoiding '2–stage' review processes for IDR in which a single–disciplinary hurdle is placed before the integrative evaluation of the proposal.
- Spending time with referees and panels in making sure that they individually and corporately understand the process and criteria of IDR.
- Probing beyond the research proposals or programmes themselves to the support and development structures of the institution(s) in which the research will be pursued is more important in IDR than in single–discipline research. A strong track record at the level of such support structures, such as centres and institutes, is a good indication of likely success.
- Integrating the track records of the researchers, especially the research leaders, in IDR with the proposals themselves.
- Avoiding reliance on quantitative publication measures such as citation rates and impact factors is advised.

Many of these recommendations address IDR in the context of team–working, which has become more prevalent in the humanities. However, some humanities researchers working as single scholars self–identify as interdisciplinary researchers, because their research interests span several disciplines. In such cases, it is important to probe the familiarity with and competence in the methods and findings of the contributing disciplinary areas.

Practical Guidelines for Implementation (Level 5 – Institutional Evaluation)

All of the approaches to evaluating IDR in the surveyed literature make recommendations as to how they might be implemented, but as yet there have been no serious attempts to measure the effectiveness of different implementations. For example, the Academy of Medical Science's 'Team Science' report[39] includes in its list of recommendations (recommendation 6 of the report):

Team science grant proposals need to be appraised holistically, as well as from the perspective of the relevant disciplines.

- *Funders should review policies and processes for obtaining appropriate peer review and appraisal of team science grant applications, and make changes where necessary.*

- *Funders should induct and train peer and panel reviewers, as well as grant managers, to meet this challenge.*

There are particular challenges at the highest scale of institutional evaluation in research assessment exercises such as the REF. The consultation found researchers feel the unit of assessment structure at present pre–disposes a fragmented and disciplinary approach. Remedial measures for IDR tend to be additional, and not well suited to identifying the transformational and emergent value of IDR.

Current measures such as the ability to 'flag' outputs as interdisciplinary, to cross–reference between panels, to have outputs reviewed by a panel different from the one to which the researcher's unit of assessment is submitting, and to allow multiple submissions of interdisciplinary outputs to different panels are reported to have made IDR more acceptable and raised its profile. However, they have not prevented (in the UK at least) a disinclination to submit IDR to the exercise. Other evaluation criteria such as research 'environment' (which can reward structural support of IDR) and especially 'impact' (where there is evidence that IDR constitutes a strong majority of the supporting research) have equally not shifted the impression that core–disciplinary research will earn higher rewards – though impact is a new element that may have more influence over time.

More radical suggestions would respond to the foundational structure of IDR:

- Create one or more explicitly interdisciplinary panels.
- Identify and deploy a pool of panel members with strong interdisciplinary expertise, either within a focused IDR panel or on subject panels.
- Create evaluatory structures that do not differentiate between 'output' and 'impact' as strongly as at present, but combine them in ways that respond to the non–linear nature of IDR and involve partners external to the university, and that can capture the transformative effect of IDR on contributing disciplines.

Conclusion

Understanding IDR is key to evaluating it and disseminating its value. Effective and informed evaluation illuminates the fundamental role that IDR can play in the acquisition of learning.

Participants in outstanding IDR research regularly comment on how its constructively disruptive context, and its broader view of shared research questions, can accelerate change, provide fresh perspectives and identify

new and relevant data for their own disciplines. Callard and Fitzgerald[31] counter the common claim that IDR is a 'risky option' for a career with the notion that, in the 21st Century, it is not particularly 'safe' to remain within the confines of traditional disciplines, in the face of rapidly changing academic opportunities.

The central question in any effective evaluation of IDR is whether a new and integrated whole emerges from the disciplinary ingredients. This holistic approach induces evaluation of a rich range of academic practice, including career development, continual learning, interdisciplinary translation, 'disciplinary hospitality', integration of epistemologies and data, and rewards those comfortable working at the interface between disciplines and developing new cross–cutting areas. Methodologies for effective evaluation should be tailored to the scale at which they apply, from individuals to institutions.

From embarking upon a very practical task – the formulation of an evaluatory framework tuned to IDR – we have arrived, at a reappraisal of the shape of the academy itself. Anthropologist Marilyn Strathern[40] employs an ancestral metaphor, suggesting that disciplines can differentiate themselves and 'multiply their positions … precisely because they have common origins'. So a focus on interdisciplinarity revives a sense of the academy as a holistic intellectual and social organism, integrated into the wider community, in which multiple flows and exchanges between all of its parts ensure its vitality.

CHAPTER 4
INTERDISCIPLINARY UNDERGRADUATE TEACHING: THE ARTS AND SCIENCES BASc AT UCL – CASE STUDY

Although this report is primarily concerned with IDR and research careers, undergraduate education is an essential backdrop to the scene. On the one hand, universities are educating the academic researchers of tomorrow; on the other, most graduates will not have academic careers.

Do interdisciplinary undergraduate programme help or hinder a research career? In the UK there is very little if any data on this. There are of course many individual stories of eminent academics (several of whom appear in this report) who have built interdisciplinary academic careers from various mixes of disciplinary and interdisciplinary bases (and may not have been able to become the thinkers they are without doing so) but, in the UK at least, we are not aware of any large cohort studies that examine this in detail.

In the US, there is some research which shows scientists educated in the liberal arts tradition are disproportionately successful in research careers Cech[41] and Rogers Hollingsworth[42] has shown the value of 'cognitive complexity' and 'scientific diversity' in leading research labs, but we will need more careful and comprehensive longitudinal studies if we wish to analyse how this plays out in the UK.

The student emerging from UCL's Arts and Sciences BASc (described below) and other interdisciplinary courses – e.g. from Birmingham University's Liberal Arts and Sciences degree – might be a natural cohort to follow. Certainly, the early signs are that these graduates have no problems progressing to a wide range of Master's and PhD programmes.

There have been notable attempts at some kind of broader, more interdisciplinary higher education in the UK in the last half century. The degrees at what were then the new universities of Sussex, East Anglia and Keele in the 1960s and 1970s made bold and creative moves to cross existing academic boundaries.[43] There have also been hugely successful inter- and multidisciplinary degrees from Oxford (Philosophy, Politics and Economics, Human Sciences, and Psychology, Philosophy and Physiology) and Cambridge (Natural Sciences, and Human, Social and Political Science) and in Scotland, where the standard four-year undergraduate programme offers more possibilities for breadth and exploration.

A simple but operationally helpful definition of an interdisciplinary degree is one in which:

a. Students study in more than one academic department.

b. Students study some courses that are explicitly inter-/cross-/post-disciplinary.

c. Students are asked explicitly (by means of a dissertation or other work) to synthesise or contrast the knowledge acquired in more than one discipline.

There are many possible additions and amendments but this form of words distinguishes such degrees from single and joint honours programmes, or programmes with 'electives', which together form the large majority of undergraduate degrees in the UK.

How many interdisciplinary undergraduate degrees are there? Using mainly UCAS searches for 'interdisciplinary', 'liberal arts' and the Joint Academic Coding System code 'Y', which indicates that programmes cut across subject groups, S. Au[44] estimates that fewer than 1% of undergraduate degrees in the UK are truly interdisciplinary – although a higher proportion are 'joint honours'. Lyall et al.[45] found that nearly half their respondents estimated their institution had 'more than five interdisciplinary undergraduate programmes'.However, it is not clear what percentage of overall provision this constitutes.

UCL's BASc can therefore claim to be innovative and interdisciplinary, both in adding a major new degree to a sector of undergraduate provision greatly under-represented in England and because the curriculum insists on some crossing of the arts/sciences divide and some synthesising of disciplinary perspectives. The venture was also bold: the first intake of 87 students was probably the largest initial cohort of a single undergraduate degree in UCL's history,[46] and from September 2016 the BASc will comprise more than 450 students in steady state.

Structure of the Arts and Sciences BASc curriculum

The BASc curriculum is divided 50-50 between a core and four pathways. The core contains 15 inter- (or cross-) disciplinary modules, six of which are compulsory and the remainder of which students must choose between as electives (Table 3.) (Tables from Gombrich and Hogan, in press).[47]

Table 3: A timetable schema for an individual student

CORE

Compulsory core modules	Interdisciplinary electives (include…)
Approaches to Knowledge: An Introduction to Interdisciplinarity	Data Visualisation
Exploring Complexity: Quantitative Methods	Evolution and the Human Condition
Interdisciplinary Research Methods	Qualitative Thinking
The Knowledge Economy (a 'real world' consultancy project, in the final year of the degree, on which all students work in small teams to assist a local business)	Technology, Heritage and Material Culture
Final year (capstone) interdisciplinary dissertation	Migration and Health
Foreign language (students choose their own language to study)	Object–based Learning: Museum Stories
	Psychology and the Real World
	Understanding Cities
	Environmental Sociology

Value	0.5 course units	0.5 course units	0.5 course units	0.5 course units	0.5 course units	0.5 course units	0.5 course units	0.5 course units
Final Year	The Knowledge Economy – Consultancy Project	Dissertation	Dissertation	Language	Major	Major	Major	Minor
Year abroad (on four–year programme) Internship								
Year 2	Object–based learning OR Making Value Judgements: Qualitative Thinking OR Quantitative Methods II	Interdisciplinary Electives	Option to take further module in Major or Minor	Language	Major	Major	Major	Major
Year 1	Approaches to Knowledge: Introduction to Interdisciplinarity	Interdisciplinary Methods	Quantitative Methods and Real World Problems	Language	Major	Major	Major	Minor

The four disciplinary pathways divide into four broad bands:

- Cultures (humanities and arts)
- Societies (social sciences, law)
- Health and Environment (health and environmental sciences)
- Sciences and Engineering (hard sciences, maths and computer sciences)

Students must take a mix of non-science and science (or maths).[48] For example, if a student majors in Cultures or Societies, they must minor in Health and Environment or Sciences and Engineering (and vice versa). They also take a foreign language. About half the cohort opts to study abroad, attending a partner university overseas in year three, where they are encouraged to study academic subjects in their core language and take extra language classes. The programme employs a member of staff from UCL Careers full-time to enable students to find an internship during the summer months after the second year of study.

The new curriculum and new overall approach stimulate innovative ways of teaching and learning, including flipped lectures (lectures filmed and accessed online), multimedia work, problem-based team projects, consulting for local start-ups and SMEs, and engineering modules with no maths, and so on.

Graduate outcomes

The first cohort of 41 BASc students[49] graduated in 2015 with 35% first class honours and 65% 2.1s (upper 2nd class) – which is a typical distribution for a UCL department.

Students have achieved a wide range of jobs in financial services, consultancy (including three students to one large consultancy firm in Hong Kong), journalism, insurance and law (see Gombrich in press for some case studies).[50] About half have gone on to master's and postgraduate degrees, including:

- Science and Technology Studies (UCL)
- Management (UCL)
- English (UCL)
- Sustainable Energy Futures (Imperial College London)
- Sociology (Oxford)

- Palaeobiology (Bristol)
- International Relations (London School of Economics)
- Urban Design (Stockholm)
- Evolution (Erasmus Mundus)
- Computational Cognitive Neuroscience (PhD – Edinburgh)

Current finalists have offers for MSc Theoretical Physics (King's College London), MBBS Medicine (Imperial), Environmental Change and Management (Oxford) and many others in a range of social sciences and humanities disciplines.

The obvious metrics of success for the programme are:

1. Do arts and sciences students do well on the institution's own terms – in terms of marks in modules assessed by all the usual procedures?
2. Do the students do well in progressing to graduate jobs?
3. Are the students able to progress to master's programmes of their choosing?

By these three metrics, the Arts and Sciences degree has indeed been successful. Whether it has been more successful than other degrees in these things is too early to say, but this may well be the wrong question. One can be successfully different and offer something of value to students and society without necessarily being 'better' than existing models. An HE ecosystem in which both interdisciplinary and disciplinary degrees exist is probably best.

Voices and views of academics

There are only two full-time academic staff working on the BASc, and for the first three years there was only one. In addition, there are three full-time administrators and one position at UCL Careers dedicated to the programme. However, there are approximately eight academic staff on fractional contracts (mostly 0.1FTE and 0.2FTE but with three on higher fractionality, but below 0.5FTE) and many staff from other departments involved in the development and teaching of core interdisciplinary modules.[51]

The 25 staff who teach on the core modules of the programme were asked 'how the teaching that [you] undertake relates to the research that [you] are engaged in' and whether there were any worries that 'pursuing interdisciplinary research leaves [you] without the skills/knowledge [you]

need to secure teaching posts within disciplinary departments'. There were 13 replies. Overall, the responses were strongly positive.

> *"The teaching that I've done in the BASc programme has had a profound influence on my research … Teaching this course has focused my attention on how to put molecular evolution more in an evolutionary context, in a manner congruent with its basic perspectives."*
>
> *Professor, Pathogen Evolution*

> *"I use part of our introductory lectures to introduce our students to collaborative and interdisciplinary work I have done as a researcher in Arts and Humanities and Modern Languages at UCL. In this course we want our students to think about the at times surprising research areas and real-life situations in which analytical skills and knowledge of language use, cultural and social value formations may help us […] offer innovative solutions in dialogue with other disciplines and methodologies. The examples I offer are my work with several colleagues from across UCL on the UCL-Lancet commission on Culture and Health, in which we expose the dangers of ignoring culture in health provision and medicine."*
>
> *Senior Lecturer, Comparative Literature*

The teaching that I've done in the BASc programme has had a profound influence on my research.

> *"Using museum objects [requires working] in a deliberately interdisciplinary way. [The BASc] students already have a range of disciplinary strengths. We work with but also challenge these strengths by encouraging students to step out of their comfort zone and work within fresh epistemological frameworks that they are not familiar with … In the same vein, as lecturers on this module we are also forced to interrogate our disciplinary perspectives very thoroughly. In my case, this has already helped produce more imaginative and original approaches to our well-rehearsed research pathways."*
>
> *Teaching Fellow, Public Engagement*

> *"Teaching on the BASc provides an excellent opportunity to showcase the IDR I have been involved in, but also encourages me to investigate work in other areas to include in the course. This has probably widened my knowledge base and a sense of where my own perspective as a mathematician fits in (and has the potential to fit in) with the wider academic community."*
>
> *Lecturer, Mathematics*

In Chapter 1 we noted that there is little incentive for academics in a discipline-based academic world to invest in interdisciplinary teaching, unless they are already doing IDR or have a particular desire to engage

in interdisciplinary teaching. What we see from these comments is a positive story. There are no mentions that teaching interdisciplinary courses or being involved in the BASc has had any negative impact on career progression. Of course, this is a self-selecting sample, so we should not be surprised at a certain level of positivity. There is an element of build it and the right sort of people who feel positive about the project will come. Several of the academics quoted here work primarily in IDR institutes where interdisciplinarity would be required.

Summary, conclusion and prognoses

The success of the Arts and Sciences BASc has been greatly facilitated by the sustained involvement of many academics from all levels of seniority and numerous different faculties who feel passionate about the cause. However, the daily running of the degree is a challenge. Students study more than 500 modules between them, which means constant negotiations with departments that have their own priorities. Further, many institutional processes can militate against cross-faculty ventures.

Nevertheless, we are optimistic about the future of the BASc and similar degrees. Since Arts and Sciences BASc launched, several other broader degrees, each with their own take on an interdisciplinary curriculum, have launched or are about to launch in the UK, at Bristol, Leeds, Surrey and Warwick. We are also optimistic that many graduates will contribute to the positive proposals put forward in this report.

CHAPTER 5
IDR IN APPLICATION: PUBLIC POLICY

IDR is likely to be of particular value in public policy where challenges are complex and require input from multiple disciplines; where IDR is not available, policymakers need to be skilled in bringing together evidence from a broad set of disciplines. This chapter considers the UK government's current capacity to receive this advice and its role in supporting IDR in the academic sectors.

Public services such as law enforcement, healthcare and defence have long histories of using research for policy. The second half of the 20th Century brought an expansion of government funding for research and scholarship, following recognition[52] that the benefits were spread widely through the publication of findings and the mobility of researchers, which in turn led to the development of policy for research.

Research for policy

Governments and public bodies face complicated challenges and decisions. To increase the capacity of a national transport network requires optimising the balance between road, rail and air after taking into account wider economic, environmental and societal factors. Recent debates in the UK about additional airport capacity and high–speed rail reveal the span of academic fields that contribute to such policy challenges. Or an outbreak of disease in farm animals may need government decisions on inoculation, transport, international trade and food safety. Decisions and policy debates around these kinds of issues will need to be communicated to a wider public, to explain, promote and justify.

These challenges rarely map neatly onto academic disciplines, and academic responses are unlikely to be optimal if they are assembled along disciplinary lines. Indeed, one source of confusion in discussions between academics and policymakers stems from the different perspectives on the evidence required to support policy analysis. Research and scholarship synthesised across several disciplines is normally required in advice for government.

Governments and public institutions usually prepare for policy and public service challenges by establishing administrative structures through which they can obtain professional advice in areas such as economics, statistics, medicine and law. In the UK, government uses diverse combinations of specialist civil servants (such as the Chief Medical Officer and the Government Chief Scientific Adviser); scientific laboratories (such as the National Physical Laboratory); expert advisory committees (such as the DECC/DEFRA social science expert panel or the Scottish Science Advisory Committee); and academic networks.

Some policy advice will be assembled within a recognised academic discipline such as medicine or law, but chief scientific advisers (CSAs) in government departments have a broader remit seldom exercised within a single academic discipline. Contributions from CSAs on animal health, cities, volcanic eruptions and nuclear safety each require their own combination of disciplinary knowledge and expertise.

Economists, lawyers, social scientists and natural scientists will each offer compelling reasons why their profession or discipline should feature prominently in advisory systems and the development of policy, but a requirement for cross–disciplinary advice is taken as read. Distinct perspectives from different disciplines are valuable, but decision–makers will ultimately need to assimilate and prioritise the components of evidence and they will value those who can do some of the assimilation for them.

There is also a role for disciplines within the social sciences and humanities that examine the nature of evidence presented, pointing out value judgements or highlighting ethical aspects of recommendations.

The response we received from the Defra/DECC Social Science Expert Panel notes that:

> *"Government Social Research (GSR) is an essential component of evidence and analysis for government decision making. Social research evidence helps decision makers understand the true costs and benefits of policies through highlighting their social and cultural value, the social aspects of risk, public acceptability, and the intended and unintended outcomes of policy implementation. GSR gives policymakers and those on the frontline an understanding of the people and organisations affected by their decisions, as well as evidence of the wider social consequences. Social science methods, such as ethnography, are now at the heart of open policymaking."*
>
> *It goes on to state that: "Social science is essential to understanding the public values, attitudes, behaviours and norms in relation to natural science progression, and itself forms a critical part of the evidence base that should be considered in framing, developing and implementing policy."*
>
> Defra/DECC Social Science Expert Panel

In other words, even if the research findings originate in distinct disciplines, their full value to policymakers will be revealed only after they have been combined into a coherent, IDR package. If original research is required, for example in the government's Foresight studies[53], the work is usually undertaken in a cross–disciplinary team.

Bringing these different disciplinary insights together from the beginning is crucial to the generation of that coherent package. Again looking to the response from the Defra/DECC Social Science Expert Panel:

Where social, economic, and environmental values are at stake, taking an interdisciplinary approach means natural and social science disciplines working together from the start of the process to frame the problem(s), co–design the research questions and co–produce the scientific knowledge required to address those questions.

A number of initiatives that recognise the value of generating this coherent package from genuine integration at the start of projects when the problems are framed collaboratively were cited in this response, such as

The UK National Ecosystem Assessment[54] (NEA) was a major IDR programme undertaken between 2009 and 2014 to assess the full range of ecosystem services provided by the natural world, and develop tools and approaches to help take their true value into account more effectively in policy and decision–making.

And the UK Energy Research Centre (UKERC) carries out world–class research into sustainable future energy systems. UKERC is the largest energy research centre funded by the UK Research Councils, and was founded in 2004. UKERC brings together engineers, social scientists and natural scientists to explore the UK energy transition in an uncertain world, and the synergies and trade–offs between the key drivers for this transition.

Successive CSAs have published guidelines[55] on the use of scientific and engineering advice in policymaking that recognise clearly the requirement for cross–disciplinary advice:

Identify early the issues which need scientific and engineering advice and where public engagement is appropriate;

Draw on a wide range of expert advice sources, particularly when there is uncertainty;

Adopt an open and transparent approach to the scientific advisory process and publish the evidence and analysis as soon as possible;

Explain publicly the reasons for policy decisions, particularly when the decision appears to be inconsistent with scientific advice; and

Work collectively to ensure a joined–up approach throughout government to integrating scientific and engineering evidence and advice into policy making.

The guidelines have a number of implications. Most importantly, from the standpoint of IDR, is that policymakers need to have the confidence and

capability to absorb a broad range research advice into their decisions. Clear, plain language from research advisers will help, but if officials and politicians have responsibilities with strong scientific or research dimensions – health, law enforcement, economic development, environment, national security, foreign affairs, food, agriculture, energy, telecommunications, transport, financial markets and many more – then the public can reasonably expect them to have the capacity to absorb scientific thinking into their work.

This does not mean that every policymaker needs to be expert in all areas, but if a policymaker is expected to have a working knowledge of the relevant economics and law then surely they should develop an equivalent capability in the dimension of their job underpinned by the social sciences and the natural sciences.

Policymakers should be able to recognise when research advice is required, when a wider community is likely to have views on the evidence base, and where disciplines are needed to assess the ethical or societal aspects of that policy area and the evidence that informs it. In areas like public health a medical or social science dimension might stand out clearly. In others, a policy debate might be framed largely in legal or philosophical terms. Does anyone close to the policy process consider whether other scientific issues are being overlooked? In large and complicated government bodies, does a scientific adviser (or economic or legal adviser) have the personal standing and the staff to engage in a sufficient range of policy debates to identify the ones that would benefit from their input? Indeed, how should governments and public bodies decide the optimum size of their science and research advisory structure?

And then there are emergency situations which policy makers have to contend with. These emergency situations may be the responsibility of a lead government department, but the emergencies will inevitably overlap with the concerns of other departments, demanding an interdisciplinary approach. Moreover, when advice is needed quickly, the ability to identify and assimilate evidence from a wide range of sources is especially critical.

Policy for research

If a government supports science and research for the public good it will probably put in place policies that cover:

- High–level objectives for publicly–funded science and research
- Spending limits in pursuit of those objectives
- Research priorities

- Conditions attached to the money
- Monitoring and evaluation

Extensive literature is available on the reasons for public funding of science and research.[56] How does that research funding relate to research disciplines and supporting interdisciplinarity?

Research disciplines and setting priorities

High–level prioritisation will balance the level of funding in many dimensions with the distribution between science and research disciplines. In successive budget allocations, the UK government has described the criteria for allocating resources[57,58] with explicit reference to multidisciplinary research capability. Budget allocations also provide substantial resources (around £2 billion per annum) for academic institutions under block grants allocated without any reference to research disciplines, providing universities with resources at a corporate level to develop new cross–disciplinary activities if they choose.

Implicitly or explicitly there will also be a balance between:

- Funding in universities vs government laboratories vs independent institutes
- Domestic activities vs international collaborations
- Block grants for institutions vs funding for specific projects
- Rewards for past performance vs future potential
- Funding for talented individuals vs funding to explore specific research questions

Many of these decisions are addressed infrequently: historical patterns of behaviour will persist, with occasional policy reviews examining whether performance could be improved by some shift in administrative structures or disciplinary priorities. Any pattern of resource allocation will foster communities of researchers who may well adopt the characteristics of a research discipline.

For example, focus on ‘grand challenges’ such as dementia, data science or advanced materials fosters new communities that may well create emerging disciplines by combining expertise from existing ones. That adds dynamism to the research community and challenges long–standing incumbency. Recognising and breaching long established patterns of incumbency can provide a stimulus for research.[59]

Reorganisation carries risks and the cost of change is high. Reorganisation may improve performance, but it takes time for new structures and disciplines to mature and meanwhile the science and business communities must also re–align themselves to the new arrangements. Current plans to reform the structure of funding bodies in the UK[60] are apparently sensitive to those concerns while recognising the benefits of cross–disciplinary research.

At an operational level, priorities will be set between competing proposals for:

- Specific science and research projects
- Long–term investment in libraries, databases and other facilities
- Individual research fellowships
- Support for early career researchers and leaders of international standing

There may also be a debate over the balance of funding for new research vs the deployment of existing knowledge. These decisions may be made within the research community, perhaps by committees of experts set up by government departments or public bodies such as the UK research councils, created by government but independent from it.

Operational independence leaves researchers free to support work of the highest quality without consideration of party–political factors. But communities of researchers can capture a research discipline and become unconsciously protective of it, resisting objective assessment of its place in a wider set of priorities. Similarly, as HEFCE recognised[61], specific disciplines may develop such a strong sense of ownership for a major challenge that they resist contributions from other parts of the research community.

Politicians have an important role in fostering challenge to the status quo in the structure of research disciplines.

Monitoring and evaluation

Monitoring and evaluating the outcomes of research allows policymakers to see how the best research universities act as a magnet to global corporations and philanthropists choosing where to make research investments. It demonstrates the contributions of research to economic development, public services and the cultural life of nations. It reveals enthusiasm from a wider public for research at the very frontiers of knowledge.

In other words, monitoring and evaluation reveal the many beneficial impacts of research on the economy and society, and this evaluation will be

at is most effective if it recognises and reflects both the distinct character of individual disciplines, and the distinct character of IDR.

Publishing and citation practices, and forms of recognition and reward, vary profoundly between academic disciplines and are likely to be different for certain kinds of IDR. The chapter on evaluation applies also to government evaluation of research performance. Here, the two aspects of the relationship between research and policy come together: it is critical that IDR is recognised and used for the evaluation of quality to ensure that the research funding system supports the IDR that can be of significant value to policymaking.

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ANNEX 1
CALL FOR EVIDENCE QUESTIONS

Call for evidence – Interdisciplinarity

About the project

Interdisciplinary research is of increasing prominence in UK universities and internationally, with a growing focus on research designed to address complex challenges. The British Academy's project on interdisciplinarity has the overarching aim of investigating how interdisciplinary research is carried out within universities, the relevance of interdisciplinarity to innovation in the wider economy, and the issue of how academics can forge a career path in interdisciplinary research – both within universities and beyond. The Terms of Reference for this project can be found in Appendix A.

The project includes in its scope a wide range of interdisciplinary research. Interdisciplinarity can involve the creation of sub–disciplines at the intersection of inquiries between disciplines, which may in turn become disciplines in their own right. There are also interdisciplinary interactions that are more transient, focused on specific challenges and which involve disciplinary collaboration without the creation of new areas or methods of research. Interdisciplinary research can also involve the sharing of methodologies to address questions within a given discipline.

The project will involve taking evidence from a wide range of stakeholders, including individual researchers and research teams; university teachers, management and leadership; funding bodies; publishers and some of the employers with an interest in interdisciplinary research methods and skills. A vfinal report presenting the findings from the research will be published in the first quarter of 2016.

This project is guided by a working group, chaired by Professor David Soskice FBA. The working group membership is:

- Professor Georgina Born FBA, Professor of Music and Anthropology; Professorial Fellow, Mansfield College Oxford
- Professor Graeme Reid, Chair of Science and Research Policy, UCL
- Professor Colette Fagan, Deputy Dean (& Associate Dean – Research), University of Manchester
- Professor Barry Smith, Director of the Institute for Philosophy, School of Advanced Study
- Professor Julia Black, Pro Director for Research, LSE
- Professor Tom McLeish FRS, University of Durham
- Mr Carl Gombrich, Programme Director Arts and Sciences, UCL

We would welcome evidence from anyone who works in an interdisciplinary way, even if this is not explicitly recognised at an institutional level or otherwise. If you would like further information about this project, please contact:

Jonathan Matthews
Policy Adviser, Higher Education j.matthews@britac.ac.uk
020 7969 5214

Please state whether you are responding as an individual or on behalf of an organisation:

Individual/Organisation

In your response, please also give your name/ the name of your organisation and contact details. This will help us to contact you if we have further questions. We will contact the provider for prior permission before quoting any evidence we receive in our final report. Moreover, please do let us know if you or a representative from your organisation would be willing to attend a relevant evidence session.

We value the time taken to respond to this call for evidence and would encourage you to offer illustrative examples to support your answers wherever possible; there is no word limit.

Please ensure all responses are in Microsoft word format and returned to policy@britac.ac.uk by Friday 26 June 2015.

Postal address:

Policy Team
The British Academy
Carlton House Terrace London
SW1Y 5AH

The working group for this project have helped shape the questions below which are intended to stimulate your views about interdisciplinarity. These questions are not intended to be prescriptive. While we would value responses to individual questions, we would welcome your views on aspects of interdisciplinarity which might not be considered here.

Moreover, if you do not fall under one of the categories below but would still like to submit evidence, please do so as you see appropriate.

Questions for individual researchers

1. What broad area is your research, teaching or work situated in (eg, history/psychology/mechanical engineering or humanities/social sciences/physical sciences if more broadly situated)?
2. What do you consider the key features of interdisciplinary research? In what ways is the research that you are engaged in interdisciplinary?
3. What advantages, benefits and broader value do you get by carrying out interdisciplinary research? What motivators, or specific opportunities, have stimulated your engagement in interdisciplinary research?
4. How does your department support you, or colleagues, in interdisciplinary research?
5. What barriers and challenges do you face when undertaking interdisciplinary research?
6. What advice would you provide an early career researcher wanting to start out on an interdisciplinary career or undertake an interdisciplinary project?
7. What provision is there for interdisciplinary taught courses at the undergraduate level at your institution? Are you able to draw on interdisciplinary research in your teaching?

Questions for publishers and editors

1. What proportion of titles that you publish would you characterise as interdisciplinary?
2. What are the reasons for and against publishing interdisciplinary journals, edited books ormonographs?
3. How easy is it for interdisciplinary research to be published in subject specific journals and edited books?
4. What steps, if any, are you taking to promote the publication of interdisciplinary research?

Questions for university management

1. To what extent do you seek to promote interdisciplinary research and why? How do you support interdisciplinary research at your organisation?

2. How do the departmental structures in your university support (or potentially hinder) the development of interdisciplianry research? How is interdisciplinary research best situated within departmentes, institutes or centres?
3. What are the advantages of organising university departments or research centres along interdisciplinary lines? What are the disadvantages of doing so?
4. At what point does an area of research necessitate the development of new departments, institutes or centres?
5. To what extent, and how, do you promote interdisciplinary teaching and training at the undergraduate and postgraduate levels?
6. What, if any, specific career development support do you have in place for academics pursuing interdisciplinary research?

Questions for funders

1. What proportion of your funding schemes is explicitly interdisciplinary? What proportion is open to interdisciplinary research?
2. How do you assess interdisciplinary research? Are funding decisions on interdisciplinary research more difficult than on research within traditional disciplinary boundaries?
3. What examples do you have of interdisciplinary schemes or research programmes? In what way are they interdisciplinary?
4. What are the criteria you use for drafting interdisciplinary calls? How are these calls put together?
5. Does interdisciplinary research (funding?) work differently internationally? Are there any particularly good international examples?
6. What specific support, if any, do you provide for interdisciplinary research beyond the funds fo rresearch?

Questions for Government and Industry

1. How do you collaborate with universities to promote and engage in interdisciplinary research?
2. How do you make use of interdisciplinary research?

3. Are there specific benefits for engaging with, or employing, researchers or graduates with interdisciplinary experience?
4. What training backgrounds do you consider when seeking academic expertise for policy making?
5. What backgrounds do you consider when making employment decisions?
6. In what ways does interdisciplinarity contribute to innovation in the wider economy?

Other comments

Terms of Reference – Interdisciplinarity

The overarching scope of this work is to investigate how interdisciplinary research is carried out, and whether the processes are in place to support it, through research and teaching.

The Working Group for this project would like to consider the following questions:

- Researchers and academics: How can researchers and academics forge long–term careers in interdisciplinary areas, and how does involvement in interdisciplinary research early in an academic career influence career paths?
- Universities: How do university structures and systems (e.g. department structures and teaching delivery) accommodate interdisciplinary research?
- Funders: Is the focus on interdisciplinary or challenge based research appropriate? Do current models of research funding support interdisciplinary research to the extent that they should?
- Assessment: How is assessment of interdisciplinary research best carried out?
- International: How is interdisciplinary research carried out in an international context?
- Humanities and Social Sciences: How do moves towards more challenge–based, interdisciplinary research affect the humanities and social sciences in particular?
- Publishers: What are the publishing routes for interdisciplinary research, and how do the existing routes for publication impact on researchers' career prospects?

- Government: What role does, and should, government have in promoting and supporting interdisciplinary, challenge–led research?
- Industry: In what way is interdisciplinary academic training valued by industry?

Detailed questions to be considered include

Researchers and academics:

How can researchers and academics forge long–term careers in interdisciplinary areas, and how does involvement in interdisciplinary research early in an academic career influence career paths?

Detailed questions for research:

- How can researchers and academics (from PhD study onwards) forge long–term careers in interdisciplinary areas, and how does involvement in interdisciplinary research early in an academic career influence career paths? How does it affect the careers of researchers who may change disciplines or who want to move back into a 'pure' discipline? How will more senior researchers respond? What is the evidence base in terms of the support for interdisciplinary research and researchers?

Universities:

- How do university structures and systems (e.g. department structures and teaching delivery) accommodate interdisciplinary research?

Detailed questions for research:

- What kinds of structures work best? What perceptions do universities have of their role in supporting or accommodating interdisciplinary research? How do universities work with industry, and are these partnerships more important in an interdisciplinary environment? How do universities create departmental structures that are sustainable as well as supporting cross–disciplinary and interdisciplinary work?

Funders:

Is the focus on interdisciplinary or challenge based research appropriate? Do current models of research funding support interdisciplinary research to the extent that they should?

Detailed questions for research:

- What should the balance be between challenge–based research funding and funding for more 'pure' research? Do Doctoral Training Centres and Centres for Doctoral Training help to both promote interdisciplinary research and provide the basis for enduring academic careers? Can the prize model help meet interdisciplinary challenges? How does that affect funding? In particular, this activity could analyse the Research Councils' cross council challenges such as 'Living with Environmental Change' and the new NEXUS call. How do researchers applying for Research Council money actually engage with these cross–council programmes?

Assessment:

How is assessment of interdisciplinary research best carried out?

Detailed questions for research:

- Does interdisciplinary research present challenges for research assessment? Do current models of research assessment adequately measure the quality of interdisciplinary research?

International:

How is interdisciplinary research carried out in an international context?

Detailed questions for research:

- Will this move towards greater interdisciplinarity foster more international collaboration, at the levels of research teams and of universities?

Humanities and Social Sciences:

How do moves towards more challenge–based, interdisciplinary research affect the humanities and social sciences in particular?

Detailed questions for research:

- On the surface at least, it may appear as if there are some HSS disciplines which do not get brought into interdisciplinary research– is this the case, and if so why?

Publishers:

What are the publishing routes for interdisciplinary research, and how do the existing routes for publication impact on researchers' career prospects?

Detailed questions for research:

- What are the publishing routes for interdisciplinary research, and how do the existing routes for publication impact on researchers' career prospects? How will the journal market help or hinder this trend? The operation of the journal market will determine the impact this trend will have on a fundamental level. At present, it is perhaps difficult to foresee in some disciplines where the kind of interdisciplinary research that this trend encourages would be published with high impact.

Government:

What role does, and should, government have in promoting and supporting interdisciplinary, challenge–led research?

ANNEX 2
LETTER FROM PROFESSOR DAVID SOSKICE FBA IN RESPONSE TO LORD STERN'S REVIEW OF THE REF

Lord Stern's Review of the REF

Letter from Professor David Soskice FBA, Chair of Working Group, British Academy Interdisciplinarity project

Sent via e–mail to: helen.cross@bis.gsi.gov.uk; REFreview@bis.gsi.gov.uk; 24 March 2016

Dear Nick

The British Academy began its 'Interdisciplinarity' project at the start of 2015. This project has looked at how interdisciplinary research is carried out in the UK, the demand for interdisciplinary research and research skills, how academics can forge interdisciplinary careers and whether the right structures are in place to support interdisciplinarity across the UK's research and higher education system. This project is scheduled to report towards the end of May 2016.

In my capacity as Chair of the Working Group for this project, I would like to take this opportunity to highlight evidence about the REF and its relationship to interdisciplinarity that has emerged through this project, in time for the 24 March 2016 deadline for responses to the Stern Review of the REF. I would also like to add some suggestions on the way forward which have come out of the project, though these have not been fully discussed.

The REF is a major influence on academic careers and its treatment of interdisciplinarity is a key factor in the extent to which interdisciplinary research will be encouraged in future.

Evidence we have gathered through this project suggests that the perception that interdisciplinarity is not treated well in the REF is widespread and that it is seen as a major disincentive to undertaking interdisciplinary work. This perception is clear from a body of responses from individual researchers to this project's call for evidence, as well as interviews at major interdisciplinary institutions across the UK.

There is a lack of confidence that an assessment process that is set–up along disciplinary lines will be able to appropriately judge the quality of interdisciplinary work, or that interdisciplinarity will be equally valued by reviewers as monodisciplinary research. This is in a context of much interesting and impactful academic work happening at the margins of disciplines and in projects that synthesise expertise from multiple disciplines. Analysis of impact case studies from REF2014 shows that 60% drew on interdisciplinary research. The fluidity of disciplinary boundaries and the limited extent to which existing disciplinary lines map onto current intellectual issues was emphasised in our evidence gathering by the Chair of Main Panel C inREF2014.

The Academy's Working Group heard evidence from HEFCE that interdisciplinary research that was submitted to REF2014 scored equally as highly as any other research that was submitted to the REF. However, HEFCE commissioned citation–based research also shows that a lower proportion of interdisciplinary research was submitted to REF as outputs than exists in the entire UK research output.[1] This lends further support to the many comments that we have received throughout our project that institutions were risk averse when it came to submitting interdisciplinary research to the REF.

The assessment process has a number of measures built into its design in order to accommodate interdisciplinary research. These measures, such as the ability to 'flag' outputs as interdisciplinary, to cross–reference between panels, to have outputs reviewed by a different panel than the one to which the researcher's unit of assessment is submitting, and allowing multiple submissions of interdisciplinary outputs to different panels, are reported to have made interdisciplinary research more acceptable, and raised its profile in such exercises.

These measures were, however, used to varying degrees by different panels, suggesting that there was a lack of confidence in their effectiveness and appropriateness. In addition, while guidance for and management of the REF peer review attempts to ensure that information on where outputs were published, such as the journal ranking, is not taken into account, there was widespread disbelief expressed in written and verbal evidence throughout our project that this was in fact the case. This is regarded as particularly problematic for interdisciplinary research, which is often necessarily published in non–traditional formats and in non–disciplinary journals.

Existing measures to accommodate interdisciplinarity do not seem to have tackled the disincentive to submit interdisciplinary research to the exercise. Other evaluation criteria such as research 'environment' (which has the capacity to reward structural support of interdisciplinarity) and especially 'impact' (on which there is strong evidence that interdisciplinary research constitutes a strong majority of the supporting research) have equally not shifted the impression that core–disciplinary research will earn higher rewards in the REF both from the perspective of individuals and of those responsible at department or higher levels for the choice of submissions. Equally problematic, was the perception that career and salary progression was often based on the publication of 'REFable' articles.

These worries went beyond disincentives to engage in interdisciplinary work to disincentives to work on large and often complex issues. Most important contemporary problems, as well as most large intellectual questions,

[1] www.hefce.ac.uk/pubs/rereports/Year/2015/interdisc/Title,104883,en.html

cannot be reduced to the 'bite–sized' facts which well–honed disciplinary techniques are capable of analysing. Yet there was significant evidence that the career disincentives for early–career academics make it seem as almost irresponsible for senior academics to encourage young researchers to work on such areas.

Let me conclude in a personal capacity with some further observations. Before discussing possible solutions, some qualifications are in order, even if not all members of our group might agree to all of them. In my own view, first, rigorous disciplinary work is central to most advances in the sciences and social sciences: and interdisciplinary breakthroughs often take the form of new (sub)–disciplines which have to be developed to take account of anomalies at the joins between disciplines. The problem is the strength of the disincentives for academics to move beyond disciplinary formulations. Second, in my view, publication in top disciplinary journals can yield valuable information in research assessment about the quality of research, since it usually means the research has been carefully peer–reviewed; and frequently by reviewers with relevant specific expertise in the precise area of the research. Using such information moreover can cut down on the cost of REF–type exercises. Even if journal names are concealed the current discipline–based evaluation procedures are unlikely to evaluate interdisciplinary work differently. Thus in assessing much research in the REF it makes no obvious sense to conceal the name of the journal, (though this view is not shared by everyone). The problem is how to assess the type of imaginative and creative research, pursuing interdisciplinary methods and/or tackling big picture issues, which is unlikely to be published in top disciplinary journals.

What steps might be taken, given the perception in the academic community based on evidence to the Working Group that interdisciplinary research as well as research which addresses major economic, social and environmental challenges and large–scale questions more generally was not treated effectively in the REF, and that universities respond to these perceived disincentives in their submission procedures and perhaps more widely in terms of career structures?

In my personal view the most effective step to take would be to consider setting up explicitly interdisciplinary panels, charged also with the evaluation of research tackling major questions. The members of these panels should be chosen independently of the members of the disciplinary panels, even though there might be overlap, and they should themselves have reputations for wider interdisciplinary work.

Implementation of such a proposal would change incentives for universities in their organisation of the REF submission process. While this process

would presumably remain largely organised on departmental lines, universities would have an incentive to think in terms of developing groups of senior interdisciplinary academics.

From the perspective of the REF sponsoring institution (i.e. the HEFCE successor institution), this would allow for interdisciplinary panels which could develop evaluatory structures that do not differentiate the categories of 'output' and 'impact' as strongly as at present, but combine them in ways that respond to the non–linear nature of interdisciplinarity that involves partners external to the university, and that can capture the transformative effect of interdisciplinarity on contributing disciplines. Additionally, the evidence that the British Academy has gathered in its work on evaluating interdisciplinary research has repeatedly stressed the need to identify the degree to which the emergent whole is greater than the sum of its parts, and to communicate this as a hallmark of quality. This could be made explicit in the interdisciplinary panel's evaluation processes.

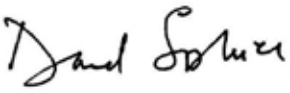
It would also provide a reason for the REF sponsoring institution to think through the identification and deployment of a pool of panel members with strong interdisciplinary expertise and experience in evaluation.

There is an important qualification to these suggestions: They are not evidence based, for obvious reasons. And in my view a task for the Stern Review will be to analyse how the REF sponsoring organisation can assess proposed policy developments in a situation in which pilot projects are not immediately obvious.

A final and more general point is this. It can be said with some justification that disincentives to work on interdisciplinary and 'large' contemporary problems are not specific to the UK academy. The same is true of the American academy, and for serious researchers around the world American academic norms are dominant. Moreover, as I suggested above, disciplines have proved for all their problems the underlying building blocks of the advance of knowledge. But most other advanced countries allow greater space for large interdisciplinary research than has the UK; and it is not unreasonable to lay the blame for that at least partially on the REF. Hence the importance attached – not necessarily to wholesale reform of the REF – but to finding an institutional way for the REF to provide a space in which interdisciplinary research can flourish.

This letter is written primarily in my capacity as Chair of the British Academy's Working Group on Interdisciplinarity, based on the discussions in and evidence given to the Working Group. Where I have indicated I have written comments in my personal capacity. The letter as a whole reflects a very valuable dialogue with the other members of the Working Party,

although my personal comments do not necessarily reflect their views. (Professor Julia Black FBA is a member of the Working Party, but as a member of the Stern Review played no role in the composition of this letter.) The letter focusses on the disincentives in the REF for interdisciplinary research and relatedly research on large issues tackling major problems and intellectual questions. The letter does not reflect the views of the British Academy; and the British Academy has submitted a formal response to the Stern Review which covers many wider issues beyondinterdisciplinarity.



Professor David Soskice FBA
Chair, British Academy Working Group on Interdisciplinarity

Appendix:

- British Academy Interdisciplinarity Working Group Membership
- (Chair) Professor David Soskice FBA, LSE School Professor of Political Science and Economics
- Professor Georgina Born FBA, Professor of Music and Anthropology, University of Oxford
- Professor Graeme Reid, Chair of Science and Research Policy, UCL
- Professor Colette Fagan, Deputy Dean (& Associate Dean – Research), University of Manchester
- Professor Barry Smith, Director of the Institute for Philosophy, School of Advanced Study
- Professor Julia Black FBA, Pro Director for Research, LSE
- Professor Tom McLeish FRS, University of Durham
- Mr Carl Gombrich, Programme Director Arts and Sciences, UCL

ANNEX 3
EVIDENCE SESSIONS

Evidence Session 1

21st October 2015 Researchers and University Managers

Professor Roger Burrows, Pro–Vice Chancellor (Interdisciplinarity) Goldsmiths

Professor Steve Fuller, Auguste Comte Chair in Social Epistemology, University of Warwick

Professor Steve Rayner, James Martin Professor of Science & Civilisation, Director, Institute for Science, Innovation & Society, University of Oxford

Evidence Session 2

18th November 2015 REF Interdisciplinary evaluation

Professor Dame Janet Finch, Chair, REF Panel C

Professor Robin Osborne, University of Cambridge and CUP Editorial Board

Dr Tim Holt, Publishing Editor, Interface

Evidence Session 3

18th November 2015 Government use of interdisciplinary research

Professor Judith Petts, Chair DECC–DEFRA Social Science Expert Panel

Elizabeth Surkovic, Deputy Director, Government Office for Science

Evidence Session 4

3rd December 2015 Funding of Interdisciplinary research

Mr Phil Sooben, Director for Policy and Research, and Deputy Chief Executive, ESRC

Professor Mark Llewellyn, Director of Research, AHRC

Professor Gordon Marshall FBA, Director, Leverhulme Trust

Ms Vicky Jones, HEFCE

Ms Vivienne Hurley, Director of Funding and Policy, The British Academy

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