E·S·R·C
ECONOMIC & SOCIAL RESEARCH COUNCIL

Science in governance and the governance of science

ESRC Science in Society Programme

policies decisions influence authority

science in society

Contents

Preface 3

Foreword 5

Executive Summary 7

Introduction 11

Challenging Common Assumptions: A Dynamic Network 17
Project: Public Perceptions of Risk, Science and Governance 18
Project: Using Public Environmental Knowledge in Industry 20
Project: Caught Between Science and Society: Foot and Mouth Disease 21
Project: Contesting Environmental Science: Business and Environmentalist Non-governmental Organisations 23
Project: Credibility Claims as Scientific Commodities 24
Project: Inside or Outside the Bio-Science Tent? The Presentation of the Laboratory-Self 26
Project: Childhood Cancer Tissue Donations: A Gift Relationship 27

Cross-Cutting Themes: Rules and Regulations 31
Project: Governance and Accountability Relations in Mundane Techno-Scientific Solutions to Public Problems 32
Project: Social and Human Rights Impact Assessment and the Government of Technology 33
Project: Accountability and the Governance of Expertise: Anticipating Genetic Bioweapons 34

Conclusions 37

Sources, References and Further Reading 41
Research projects listed under topical themes 44

Preface

The science-society relationship is recognised as no longer being one in which the needs of the public are dictated by those in authority. But what is it to become? How can those in government, science and the private sector facilitate the science-society relationship more effectively? How can the public in all its diversity become more engaged in the production of science and its role in society?

The goal of the ESRC's Science in Society Programme is to explore and help develop the rapidly changing relations between science (including engineering and technology) and the wider society. These brochures are intended not only to bring together the findings of research projects in the Programme, but also to draw on wider insights into the relationship of science and society.

To that end, although these brochures provide an overview of academic research, they hope to prompt questions that go beyond the academic to the role of science and technology in daily life and experience, in all its diversity.

"Science has become the ultimate source of legitimacy, with scientists playing the role once reserved for the priesthood"

Foreword

Since the Second World War, governments on both sides of the Atlantic have increasingly looked to science to resolve difficult policy problems. Some decision makers see science-based decision making as a way of cutting the Gordian knot of competing values in an increasingly heterogeneous society. Some observers have suggested that science has become the ultimate source of legitimacy, with scientists playing the role once reserved for the priesthood, of warning rulers of hidden dangers and advising on how to protect society from them.

The increasing role of science in governance has also resulted in increasing public attention to the arrangements for the governance of science. Is a self-governing republic of peer review really able to speak to the public interest? How do scientists deal with dissenting voices in their midst? While the British public voices strong support for science and technology in general, it clearly has concerns over some specific applications of science and technology. What are the appropriate and practicable ways in which members of the public can and should engage in science policy making? Given that, at best, democracy cannot really be said to extend beyond the boundaries of nation states, and technologies now emerge as pervasive global systems, merely expanding public engagement in national decision making cannot provide a complete answer. What needs to be done to revitalise representative systems of government to make decisions about new technologies and their applications?

These are the kinds of issues that the ESRC Science in Society Programme has sought to shed light upon. The projects in this brochure are just a beginning and much room remains for social science analysis of the science and society relationship. The public good requires much more extensive and continuing scrutiny.

Steve Rayner
Director

Executive Summary

How do we decide what counts as 'scientific' information and expertise? What impact does this have on whom we believe in debates about policy? Who has access to the authority, expertise, prestige and influence associated with science?

Current models of scientific governance tend to describe the relationship between science and society as a dialogue between two groups – the public and the experts. If problems develop in the implementation of scientific policy, then they tend to be attributed to the idea that the public lacks either sufficient understanding of the scientific facts or processes involved, or appropriate trust in science and its institutions. In both cases, the solution is assumed to be either the provision of more and more adequate technical data, or processes of public consultation, in which greater public engagement leads to increasing public trust. These approaches tend to reduce problems in the relationship between science and society to process issues of science communication that can be resolved through the (one-way) transmission of scientific data.

In fact, as the projects in this brochure describe, a far more complex network of relationships, interaction and understandings is involved in the governance of science and technology. For a start, a vast variety of stakeholders are engaged in shaping the construction of science and its dissemination, including non-governmental organisations (NGOs), industries and individual companies, scientists, policymakers and the public. In many cases, the network of stakeholders may extend beyond simple national and political boundaries. For each group the selection, and content, of scientific knowledge will vary. It may be the product of a process of deliberation or the result of unexamined popular beliefs; it may come about through explicit policy decisions, or implicitly, as an unintended consequence of other factors.

The projects described in the first part of this brochure explore the attitudes of, and interactions between, diverse stakeholders involved in a range of science and technology projects. The actors under examination include NGO activists, the media, corporate employees, fishermen, scientists and researchers. As this suggests, the projects took place in a wide range of different settings, they include:

- *Using Public Environmental Knowledge in Industry* asked how experts within the chemical industry conceptualise, access and take account of 'public environmental knowledge'.
- *Caught Between Science and Society: Foot and Mouth Disease* examined how, in the wake of the UK's 2001 Foot and Mouth outbreak – and the Government response to it – policymakers gathered and used public concerns and knowledge about the disease.
- *Contesting Environmental Science: Business and Environmentalist Non-governmental Organisations* examined both business and environmentalist NGOs, investigating how these different groups talk about science, and how they seek to build their own scientific credibility in environmental debates.

"Pinning the success of scientific and technological policy making on simply expanding processes of public consultation may be inadequate"

- *Credibility Claims as Scientific Commodities* moves the focus to companies, asking how the scientific claims made by companies about their products influence public perceptions of the authority of science? What authority do consumers perceive in these claims, and how much weight do they give them?

- *Inside or Outside the Bio-Science Tent? The Presentation of the Laboratory-Self* explored the ways in which the different scientific cultures in Britain and Sweden treated dissenting experts – that is, those scientists who disagreed with the generally accepted scientific consensus in debates over contentious research.

- *Childhood Cancer Tissue Donations: A Gift Relationship* examined how rules of research practice are experienced both by those involved in recruitment to research involving childhood cancer tissue samples, and those who consent to such research.

The projects in the second half of the brochure examine the different roles of government and the nature of rules and regulations in rapidly changing local and international political environments.

- *Governance and Accountability Relations in Mundane Techno-Scientific Solutions to Public Problems* examined the ways in which mundane science and technology can be used to create and reinforce local systems of governance, exploring how networks of governance that involve technological and scientific solutions are both assembled and maintained.

- *Social and Human Rights Impact Assessment and the Government of Technology* examined how governments and financial institutions adjudicate between alternative accounts of social and human rights impacts as they seek to fund new technology projects.

- *Accountability and the Governance of Expertise: Anticipating Genetic Bioweapons* examined the changing international context of modern biological research. This study assessed how individuals and organisations in the biological and medical sciences were addressing the shared problem of responding to the growing societal concern with the proliferation of weapons-related expertise, following the terrorist attacks on the World Trade Centre in New York in 2001.

As well as those described in detail, there were a number of other projects in the programme that are more briefly described in the brochure:

- *Resolving Conflicts in Selecting a Programme of Fisheries Science Investigation* explored relationships between the different stakeholders involved in the management and daily operation of an Orkney fishery.

- *Reproducing the Centre: Performing Innovation at Xerox PARC* explored everyday realities of research practice and the maintaining of Xerox PARC's identity as a centre of innovation.

- *Interdisciplinarity and Society: A Critical Comparative Study* challenged the notion that interdisciplinary research between natural scientists and social scientists could be understood as a synthesis of existing fields.

- *Simulation Modelling of Contentious Scientific Knowledge Claims in Society* brings together some of the learning achieved so far in the field of governance of science and technology, aiming to create a tool to facilitate communication between academics and stakeholders in the arena of scientific governance.

The projects in this brochure suggest that pinning the success of scientific and technological policy making on simply expanding processes of public consultation may be inadequate. Evidence- or science-based policy models offer little room, and fewer methods, for the exploration of diversity among stakeholders, or the reckoning up of different values. Instead greater understanding is needed of how scientific knowledge comes into being, and some of the social and material practices that give it authority. Rather than thinking about the problem of society's attitude to science, it might be more useful to examine common, current assumptions about established structures of authority, power distribution, institutional prerogatives and access to decision making.

In conclusion, the projects under this theme, *Science in governance and the governance of science*, emphasise the following:

- Beyond communication: new understanding of the construction and dissemination of science and technology across society demands a radical rethink of both governance systems and cultures. Simply slotting public participation and communication processes into existing systems of science and technology governance will not suffice.

- Non-practitioner expertise: communication cannot remain limited to a one-way flow of correct facts from expert to public. Education and communication remain important, but with a crucial difference: non-practitioner expertise must be recognised, developed and engaged.

- Moral and ethical data: as well as scientific facts, new kinds of information must be considered that cannot be so easily quantified, eg the moral and ethical implications of science and technology projects, in all their variety.

- Impacts over time: as we begin to understand more fully the long-term impacts of human action, any governance process of science or technology must take account of its more long-term effects.

- Engaging everyone: any governance body charged with assessing scientific and technological innovations will have to learn how to engage with all actors, expert and non-expert, public and private, explicit and implicit, local and global, who may be involved. New roles may be necessary that bridge the expert/non-expert divide.

Introduction

"Governance: The exercise of political, economic and administrative authority in the management of a country's affairs at all levels. It is a neutral concept comprising the complex mechanisms, processes, relationships and institutions through which citizens and groups articulate their interests, exercise their rights and obligations and mediate their differences." WHO EMRO website, 2007

Governance is the theme of the 13 projects grouped together in this brochure: but what do we mean by the governance of science and technology? Certainly encompassed in this is the narrow sense of political government, which include the processes of creating policy and guiding research, as well as deciding on and implementing regulation.

Over the 20th Century, this process has become identified with expert assessment, in which scientific and technical advisors help policymakers and politicians to develop science-based or evidence-based policy, which can then be disseminated in public arenas (Rayner 2003). As the terms suggest, these processes emphasise the importance of technical information as the basis for political decisions and the success of their implementation. The implicit model underlying this approach comprises a linear, one-way process of data delivery; any kind of policy failure must, therefore, be caused by an inadequate provision of information.

But recognition has been growing that this approach is far from adequate. There are far more actors and interactions involved in the development and implementation of science and technology policy than simply experts (producing information) and non-experts (receiving it). As well as governments and the public, there are NGOs, companies, industries, financial institutions (national and international) and the media. These diverse groups bring a broad spectrum of relevant expertise and activities, as well as many potentially conflicting attitudes, informed by different interests, knowledge and value systems. As a result, and as recent and current experience shows, the governance of science and technology is constructed and maintained by a network rather than a hierarchy of actors. Moreover, there is frequently difference and debate among the various social groups.

"These diverse groups bring a broad spectrum of relevant expertise and activities, as well as many potentially conflicting attitudes"

The recognition that there are multiple stakeholders involved in the governance of science and technology raises a myriad of challenges, but there are other crucial dynamics to consider as well. For example, recently some commentators have drawn attention to a growing and widespread distrust of science and technology in society (House of Lords 2000). Some argue that this is a result of an 'erosion of deference' in existing institutions (Giddens 1990, Beck 1992, Smart 1993); while others hold that it is because of the recent acknowledgment of uncertainty around cause and effect within scientific practice itself (Cohn 2000). Yet another position states that the crisis of trust is in fact a culture of suspicion, stirred up by a media that tends to report sensational stories about science and technology, highlighting the more shocking or risky aspects, and making it difficult for people to assess the truth about, and reliability of, science and technology (O'Neill 2002).

In response to these insights, policymakers and social scientists have been trying to encourage greater public involvement in scientific and technological policy making processes. Their efforts include the development of more transparent decision-making processes, the participation of an expanding range of stakeholders and the institution of public assessment processes. These are all laudable initiatives, but as the projects in this brochure ask, not only are there questions about the adequacy of these approaches, but they may not even be trying to tackle the right problem.

For example, public consultation certainly offers the opportunity for broader social involvement, opening up dialogue and initiating learning processes, as well as increasing public legitimacy. However, there are also weaknesses in such processes: for a start, there are questions to ask about the design of such processes. How will participants be selected? Which parts of society will be represented? How are their views to be recorded and evaluated? There are also questions to ask about the nature of stakeholder involvement, and how companies, governments and the public create and engage with such a process. There are surprisingly few studies of how these processes work or how the information gleaned from public consultation is used. The few evaluations that exist have been carried out by people committed to the process (the organisers or social scientists); usually, they are process-, rather than outcome-based.

Critical evaluations suggest that processes of participation may not always be as positive as we are led to believe. For example, contrary to most people's beliefs, greater engagement does not necessarily help to develop greater trust among participants (Institute for Science and Technology Studies, Bielefeld University website 2007). Participatory processes are usually designed so that they drive towards a consensus, but is this the most useful aim? Striving for consensus may stifle debate and dissent; it may produce a decision so compromised or diluted that it cannot receive the commitment of any of the participants.

Current processes of participation rarely take into account the role played by the emotions, and particularly of passion, in the construction of political viewpoints – although innovations in science and technology often evoke passionate feelings, ranging from pleasure and delight, to horror and fear (Hessenbruch 2005). The process of getting everyone to reach agreement may erode the enthusiasm and trust of individuals involved. If communication among participants is too difficult or their views differ too widely, or if there is no clear win-win outcome, the experience can actually undermine the commitment felt by participants. Indeed, some participants report feelings of anger and frustration at having given their time and energy to a process that, in the end, had no noticeable impact (Rayner 2003). In the end, it is far from clear that public participation can help to reach technically or socially sound outcomes that would otherwise not have been reached.

These questions hint at more fundamental conceptual problems underlying such processes. For example, a common assumption of policymakers is that public disaffection with science and technology is usually prompted by concern about risks. In this approach, any more complex moral and aesthetic concerns are reduced to far simpler, straightforward scientific framings. Such blanket diagnoses may miss the significant differences of concern, and levels of concern, between various communities and interest groups. Of course, assumptions about the causes of public anxiety will influence the kinds of action that policymakers are prepared to take. If they simply assume that the public is afraid of potential risks, then their responses will largely be concerned with tackling problems of misinformation and misplaced fears, rather than examining more profound questions about the role of science and technology in society.

In fact, despite the popularity of this theory in expert circles, polls suggest that the widely accepted problem of the crisis of public confidence in science does not correspond to reality. In fact, when asked, 70-80 per cent of the public said they agree with positive statements about science, while 85 per cent agree that scientists and engineers make a valuable contribution to society. In fact, a survey conducted for the Science in Society Programme (*Public Perceptions of Risk, Science and Governance* by Nick Pidgeon) showed that respondents felt that science makes a good contribution to

"There is a tendency for governments to frame questions about science and technology initiatives solely in terms of national concerns"

society, (replicating similar findings from the OST/Wellcome 1999 survey of public attitudes to science and technology). Trust in scientists seems to be mainly determined by a judgement about the organisation they are working for, possibly based upon knowledge of its agenda, roles and past history. Confirming other research, people trusted scientists working for universities and scientists working for environmental organisations most. People tended to trust scientists working for industry least. On average, people neither trusted nor distrusted scientists working for the Government.

This research suggests that members of the public tend not to have concerns about science itself but about the pace of scientific development, and the ways in which scientific developments are implemented. Particular communities have specific concerns that are shaped by their culture and experiences. For example, the survey conducted by Nick Pidgeon showed that people feel strongly that the funding of science is becoming too commercialised, and that as a result the independence of scientists is increasingly being put at risk; people expressed support for more public control over science.

The need for policymakers to think in more complex conceptual terms is also highlighted by the international nature of many scientific and technological projects. There is a tendency for governments to frame questions about science and technology initiatives solely in terms of national concerns. But many such initiatives harness international networks and globalised systems of finance or expertise – as a number of the projects in this brochure demonstrate. In addition, these initiatives may have impacts far beyond their immediate geographical location, and these may raise ethical questions, for example, questions of inequity between say the developers of the technology and those experiencing its effects. Finding the solutions to such challenges involve cross-cultural negotiations. Policymakers must get to grips with the structure, process and boundary characteristics of other national policy cultures.

Closely related is the fact that assessments of the impacts of science and technology projects on social and human rights are becoming a key part of both formal negotiations and public debates about the desirability of technological development projects in developing countries or communities. Any serious process of adjudication is likely to involve a wide range of different stakeholders and interested actors, bringing a variety of (often conflicting) data, and it is often far from clear how governments and international financial institutions can decide between alternative accounts of social and human rights impacts. Turning to international guidelines on ethical conduct does not necessarily offer a straightforward solution. Their practical implementation may need to be shaped, for example, by both social and economic pressures. How do people negotiate tensions between public accountability and social and ethical acceptability on the one hand, and the need to foster international competitiveness, on the other?

This brief overview of the problems related to public consultation suggests that, as it is currently conceived, it may not be delivering the outcomes that are wanted. But does that mean it is the wrong solution? Or is it because, in fact, we are asking the wrong questions? Evidence- or science-based policy models offer little room, and fewer methods, for the exploration of diversity or the reckoning up of different values. It is no wonder, then, that there is a gap between the anxieties felt by the public, and the solutions offered by the experts. If there is a crisis of confidence it is not in science itself, but in the governance of science.

The projects in this brochure examine particular aspects of the current system of science and technology governance. They are clustered around two main themes: the projects in *Challenging Common Assumptions: A Dynamic Network* focus on some of the ways in which various stakeholders frame the governance of science and technology, and how these approaches may interact. Those in the second section of this brochure, *Cross-Cutting Themes: Setting the Rules*, have a particular concern with the question of geographical or cultural scope in the governance of science and technology. The projects in both sections draw attention to ways in which non-experts are becoming increasingly, although unofficially, involved in the process of creating and disseminating science and technology in society. They explore some of the challenges this involvement presents to current systems of science and technology governance, and some of the solutions that are being developed.

Challenging Common Assumptions: A Dynamic Network

"Technological characteristics alone cannot explain patterns of social response and we resist the idea that certain technologies cause public controversy. Instead, our case studies suggest much more complex patterns of social construction and response." STAGE 2005

The projects described in this section explored the attitudes of, and interactions between, diverse stakeholders to particular examples of science and technology projects. The actors under examination included NGO activists, the media, corporate employees, fishermen, scientists and researchers. As this suggests, the projects took place in a wide range of different settings. As well as those described in detail here, there were projects that involved an Orkney fishery and a computing research and development centre.

These projects examine in detail the question of how scientific knowledge comes into being, and some of the social and material practices that give it authority. They explore how the relations between science and society are framed and challenged within specific institutions and research practices. Rather than implying the existence of a general model of the relations between science and society these studies demonstrate its multiple forms.

In *Resolving Conflicts in Selecting a Programme of Fisheries Science Investigation*, Professor Jonathan Side and his team explored the alienated relationships between the many different stakeholders involved in the management and daily operation of an Orkney fishery. In *Reproducing the Centre: Performing Innovation at Xerox PARC*, Professor Lucy Suchman explored everyday realities of research practice in the attempt to get behind the reputation of this famous research facility and describe the inter-workings of the organisation, its members and the artefacts created in maintaining PARC's identity, within scientific networks and through popular media representations, as a centre of innovation. In *Interdisciplinarity and Society: A Critical Comparative Study*, Drs Andrew Barry, Georgina Born and Marilyn Strathern challenged the notion that interdisciplinary research between natural scientists and social scientists could be understood as a synthesis of existing fields. The study highlighted the importance of an agonistic mode of interdisciplinarity in which new fields are constructed in opposition to existing disciplinary forms.

"People stated that they felt the Government was not responsive to what ordinary people thought, and did not provide enough information about risks to the public"

Project: Public Perceptions of Risk, Science and Governance

Professor Nick Pidgeon and his research team set out to advance understanding of how people perceive and respond to questions of science and risk. They set up one of the largest and most substantive surveys of public attitudes to key issues of risk, science, and governance undertaken anywhere in the world.

The survey asked respondents about five risk cases which all involve topical public policy questions: genetically modified food, climate change, mobile telecommunications, human genetics, and radioactive waste. These cases were chosen because they not only relate to scientific knowledge, and public trust in science and scientific procedures, but they also test governmental competence as well as scientific authority, especially when scientific interpretations clash with wider values such as free choice, democratic accountability and the role of business and civil society in changing patterns of governance. As well as asking about the five risk cases and background information, the survey also asked respondents about the importance of various personal and social issues (to put the five risk cases into context), cultural values, worldview, and the role of scientists and science in society.

The results of the survey show that the meanings that different actors place upon risk controversies turn on two key factors. The first is the varied standpoints and attitudes people adopt, influenced by their particular social settings. The project showed that although people were very interested in the risk cases, they were, for the most part, deemed relatively unimportant compared to other personal and social issues. The second is the political and governmental context of the specific issues involved – and in particular the levels of trust in the institutions involved. For example, on average, consumer and environmental organisations, friends and family, doctors, as well as scientists working for environmental organisations and scientists working for universities were trusted the most in each of the five risk cases. In contrast, general trust in government was low. People stated that they felt the Government was not responsive to what ordinary people thought, and did not provide enough information about risks to the public. Respondents also indicated they had relatively low trust in government policy towards the risks. Low confidence in current risk regulation probably contributed to the finding that people felt that there is need for organisations that are separate from government and industry to regulate the five risks.

Perceptions of risk hold very real political, economic, and health consequences for individuals and society (Pidgeon, Kasperson and Slovic 2003); trust plays an important role in the acceptability and communication of risks (Renn and Levine 1991, Cvetkovich and Löfstedt 1999). The results of this survey show that the context and nature of governance plays a crucial role in people's motivation either to adopt, or to resist, the behavioural and policy changes that might be necessary to adapt to a variety of contemporary risk phenomena.

Although it focuses on clarifying public views of science and scientific procedures and the factors that influence them, this project issues clear challenges to scientists and policymakers. It suggests that new models of science governance are required, involving innovative social and institutional solutions that reach far beyond attempts to promote better communications about the science of hazards and risk assessment. The projects that follow continue this theme, examining various aspects of current science governance, and exploring their influence on public perceptions of, and responses to, science and science policy.

Public Perceptions of Risk, Science and Governance

Professor Nick Pidgeon, Cardiff University

How do contemporary public attitudes and discourse towards science, governance and risk interact?

This project:

- advanced our theoretical understanding of public framings and attitudes towards science and risk issues
- explored a number of relationships between public attitudes to science and risk, trust in risk regulation and risk governance, and through this the testing of a range of theoretical propositions
- generated a comparative dataset of perceptions of five core risk cases: genetically modified food, climate change, mobile telecommunications, human genetics, and radioactive waste.

http://www.sci-soc.net/SciSoc/Projects/Governance/Public+perceptions+of+risk.htm

"The selection of what counts as scientific knowledge is made by many different actors at many different levels of society"

How do we decide what counts as scientific information and expertise? What impact does this have on whom we believe in debates about policy? These questions matter because when groups are seen as scientific, they can access the authority, expertise, prestige and influence associated with science. The selection of what counts as scientific knowledge is made by many different actors at many different levels of society. It may be explicit, involving policy decisions, or implicit, the unintended consequences of the behaviour of particular groups. It may be the product of a process of deliberation or the result of unexamined popular beliefs. As the next six projects reveal, all of these different sources of information play a crucial part in the production of knowledge and the governance of science and technology.

The relationship between experts and the public was the focus of the next three projects, each of which looked at how experts take account of public knowledge.

Project: Using Public Environmental Knowledge in Industry

Dr Kate Burningham and her team asked how experts within the chemical industry conceptualise, access and take account of public environmental knowledge. The study aimed to find out how industry experts thought about the public and their knowledge, and how this related to the ways in which they then set out to engage with the public.

The project worked with a range of companies of different sizes, some of which had direct contact with public consumers, others who worked primarily with other businesses. In addition, the project targeted different functions in each company, including representatives from head office, research and development, production, marketing, sales, distribution and public relations, intending to describe and evaluate the relationship between organisational function and the use of lay environmental knowledge.

Using Public Environmental Knowledge in Industry

Dr Kate Burningham, University of Surrey

How is public environmental knowledge and concern conceptualised, accessed and used by companies in the chemical industry?

This project:

- explored how the companies involved understand and use public environmental knowledge
- found that companies tend to view the public in terms of their status as consumers and neighbours – ie, as groups with concerns needing to be assuaged, rather than knowledge meriting engagement
- since companies are most willing to engage with local people, this may provide the most productive route for them to connect to the public.

http://www.sci-soc.net/SciSoc/Projects/Governance/Using+public+environemental+knowledge+in+industry.htm

Project: Caught Between Science and Society: Foot and Mouth Disease

Professor Brigitte Nerlich examined how, in the wake of the UK's 2001 foot and mouth outbreak – and the Government response to it – policymakers gathered and used public concerns and knowledge about the disease.

When foot and mouth disease broke out in the UK in 2001, the response of the Government repeated that shown in previous recent health and food crises, for example, around the MMR vaccine, BSE in cattle and concerns about GM food. Policymakers appeared to feel they must choose between following the advice of either the public, or the experts. Public concerns were taken into account both during and after the foot and mouth outbreak, but policymakers preferred to deal with expert and institutional advice about the approaches to be taken and lessons to be learned.

Using an innovative mix of methods from the social sciences and humanities, the project's main aim was to provide a deeper understanding of the popular and lay beliefs held by various social groups regarding disease, farming and agricultural technology – and the potential risks they present. The research analysed both the sources of this knowledge, such as farmers, family members, scientific literature, the media, animal welfare

organisations, folklore, and the ways in which this knowledge is perceived and expressed, for example, through metaphors, poems, anecdotes, or scientific facts.

The team was able to examine how these many different kinds of knowledge were used to construct meaning in a situation that challenged normal processes of understanding; how they overlapped or differed; how they interacted or failed to interact with government policy; and how the relationship between lay and expert knowledge was constructed in the context of a crisis. The aim was to use this information to shape the communication between government and publics, finding better ways of balancing conflicting understanding, and building more positive relationships between science, agriculture and the wider world.

Caught Between Science and Society: Foot and Mouth Disease

Professor Brigitte Nerlich, University of Nottingham

How will increasing recognition of the expertise and knowledge of various (non-expert) stakeholders and social groups affect the governance of science and agriculture?

This project:

- drew on the events of the 2001 foot and mouth disease outbreak in the UK to explore the cultural foundations of the public understanding of farming and agricultural technology
- sought to enable policymakers to create future policies that do not conflict with deep-rooted, social representations and feelings of various social constituencies and stakeholders.

http://www.sci-soc.net/SciSoc/Projects/Governance/Caught+between+science+and+society.htm

Two projects considered how scientific claims are constructed and disseminated in the public arena, and particularly how non-governmental organisations (NGOs) are involved in this.

Project: Contesting Environmental Science: Business and Environmentalist Non-governmental Organisations

Dr Sally Eden and her team examined both business and environmentalist NGOs to analyse how they try to influence public debate on environmental science, specifically in waste debates. The approach was unusual, since such different NGOs are rarely compared or analysed as scientific actors, despite their long history of involvement in debates about environmental science, management and policy. The project focussed on how these different groups talk about science and how they seek to build their own scientific credibility in environmental debates.

The different groups were revealed to be quite similar in their approach to, and use of, science, especially in their need to have scientific knowledge be relevant to their own environmental concerns and campaigns. Among those in business NGOs, relevance was linked to being practical and realistic, while those in some of the environmentalist NGOs saw relevance as about addressing important ethical and moral questions. These differences were not fundamental disagreements about science between the participants, but tended to reflect the job that their organisations needed science to do.

The NGOs felt that they needed to maintain scientific credibility in order to achieve personal and organisational authority and influence in policymaking. This was sought in different ways, from recruiting professionally trained scientists into the group, to developing a reputation for objective and trustworthy research over the years. These are quite traditional ways of establishing scientific credentials, which contrasts with some arguments that NGOs should challenge traditional scientific definitions and norms, in the interests of opening up and democratising debates about science and its use in society.

Contesting Environmental Science: Business and Environmentalist Non-Governmental Organisations

Dr Sally Eden, University of Hull

How do NGOs commission, communicate and contest environmental science in order to influence public debate?

This project:

- compared how business and environmentalist NGOs commission, communicate and contest science
- evaluated theoretical and methodological approaches to the analysis of different groups in the environmental debate.

http://www.sci-soc.net/SciSoc/Projects/Governance/Sept2003.htm

Project: Credibility Claims as Scientific Commodities

This second project also led by Sally Eden, broadened the scope from NGOs to companies and the public, asking: How do the 'scientific' claims made by companies about their products influence public perceptions of the authority of science? What authority do consumers perceive in these claims, and how much weight do they give them?

The researchers explored how a complex international division of scientific and operational labour supports the claims made by companies about their commercial products, especially through the certification of their sustainable origins. This used detailed case studies, such as the Forest Stewardship Council's scheme for sustainably produced timber and wood products, and the Marine Stewardship Council's scheme for well managed fisheries and the certification of food produced to UK organic standards. Such examples depend in part upon their reputation for scientific credibility and legitimacy, especially by drawing in diverse and recognised forms of environmental expertise, to influence industry to apply for certification as well as to encourage the ordinary consumer to buy certified products.

The project also investigated how consumers respond to these certification schemes and how they judge the environmental knowledge and expertise that underpin them. The results suggest that people like the idea of independent verification of products, but are sceptical about the feasibility of doing this in practice, especially across international borders. The research team, therefore, argued that certification networks are innovative in their approach to integrating science and policy in pursuit of sustainability, but often this innovation is not appreciated because of the difficulties of conveying complex verification processes to busy consumers.

Credibility Claims as Scientific Commodities

Dr Sally Eden, University of Hull

How are scientific claims about the environmental and health benefits of products made and perceived? How does this influence both how businesses use science and the authority of science in the public domain?

This project:

- evaluated the processes whereby a range of actors – including private-sector companies, NGOs and government – are involved in making scientific claims about commercial goods, especially through complex networks of certification
- examined the public evaluation of these claims and their implications for the credibility of companies and NGOs and for sales of the certified products
- analysed how scientific information is produced, monitored and audited along product supply chains, especially internationally, in terms of its content, authority, affiliation and specificity.

http://www.sci-soc.net/SciSoc/Projects/Governance/Credibility+claims+as+scientific+commodities.htm

"Although public disagreements about science may, undermine public trust, they may also help to diminish the perception of science as a realm of unquestionable expertise"

The last two projects in this section examined how cultures within a scientific community may influence both the ways in which it conducts scientific research, and how that shapes public perceptions of that research.

Project: Inside or Outside the Bio-Science Tent? The Presentation of the Laboratory-Self

Dr Lena Eriksson focussed on the ways in which the different scientific cultures in Britain and Sweden treated dissenting experts – that is, those scientists who disagreed with the generally accepted scientific consensus in debates over contentious research.

The project examined first how this shapes the culture of expertise, examining how the different ways in which scientists organised their work and defined what counted as acceptable behaviour might influence scientific activity. For example, if a scientist feels that he may risk his reputation, even his job, by saying something unacceptable, he or she is more likely to fear potential criticism and censor his findings, or be more cautious about distributing scientific findings for peer review. Moreover, scientific cultures often define accepted behaviour rather narrowly, creating a strong division between insiders and outsiders. This may increase the likelihood of scientific controversies moving into the public domain. Scientific controversies were more likely to hit the headlines, producing adverse publicity, than if a dissenter is not excluded from the scientific community. In this way, the research suggests, a research community does not just react to a contentious claim from a scientific dissenter, it also – through its own culture – helps to shape the form in which dissent will be expressed. In turn, this influences how the community appears to the outside world, influencing how science is represented to and perceived by the publics. For example, although public disagreements about science may, potentially, undermine public trust, they may also help to diminish the perception of science as a realm of unquestionable expertise.

Inside or Outside the Bio-Science Tent? The Presentation of the Laboratory-Self

Dr Lena Eriksson, University of York (research undertaken at Cardiff University)

In what ways might the ways in which scientific work is conducted shape the public representation and perception of the science itself?

This project aims to explore:

- how differences in the management of dissent within a potentially contentious scientific field can shape the public representation and perception of science itself
- how funding and employment conditions affect the capacity of scientists to act independently and contribute to new, more democratic policy forums.

http://www.sci-soc.net/SciSoc/Projects/Governance/Inside+or+outside+the+bioscience+tent.htm

Project: Childhood Cancer Tissue Donations: A Gift Relationship

Professor Mary Dixon-Woods and colleagues at the University of Leicester, examined how rules of research practice are experienced both by those involved in recruitment to research involving childhood cancer tissue samples, and those who consent to such research. They explored the influence of systems of governance on trust and confidence in research, and showed how the formal rules embedded in such systems might produce perverse effects by disrupting trust-based relationships. This project also produced unexpected challenges to the notion of 'gift relationship' as it is deployed in relation to tissue samples for research.

This project showed how media reporting of organ retention controversies, such as those at Bristol Royal Infirmary in 1998 and at Alder Hey children's hospital in 1999, impacted on registrations of tissue in a tumour bank. It demonstrated how individual public transgressions of this kind, even when they are limited in scope, can become generalised across an entire field of research (in this instance, research involving use of children's tissues), and often result in regulation. These organ retention controversies helped to prompt the Human Tissue Act (2004) on childhood cancer tissue banking – the impacts of which were analysed as part of this project.

Childhood Cancer Tissue Donations: A Gift Relationship

Professor Mary Dixon-Woods, University of Leicester, and colleagues

In the field of tissue donation, how do researchers, clinical staff and researched conceive of their role, and allot meaning to their activities?

This project:

- explored the views, beliefs, preferences and experiences of families of children with cancer about tissue donations, and of clinical staff who seek consent for tissue donations
- evaluated the prevailing media representations of this research, and how are they influenced by particular events (eg the organ retention controversies)
- reviewed legal, ethical and governance questions regarding use of children's tissue for research
- examined how involvement in research may develop new social norms, and uncertainties
- produced unexpected challenges to the notion of the 'gift relationship' in the context of childhood cancer tissue donations.

http://www.sci-soc.net/SciSoc/Projects/Governance/Childhood+cancer+tissue+donations.htm

A complex network of relationships is involved in the governance of science and technology, as all these projects demonstrate. A wide variety of stakeholders are engaged in shaping the construction of science and its dissemination, including NGOs, industries and individual companies, scientists, policymakers and the public. In many cases, the network of stakeholders may extend beyond simple national and political boundaries. The various goals and intentions of each group means they take diverse, and sometimes conflicting, approaches to their activities.

The complexity of this territory raises questions about useful approaches to the governance of science and society, for example, consideration of the attribution of responsibility and accountability in each context. The number of stakeholders involved shows that the participation of government and the narrow sense of political governance, although it is necessary, is only a first step. But these projects also demonstrate that simply increasing public participation is of little help, unless there is full appreciation of the many different dynamics shaping public engagement.

So, in such a challenging context, what role can governance play? What shape might it take, and how can it take account of our changing environment?

Cross-Cutting Themes: Rules and Regulations

"Ultimately, US Congressional behaviour on issues of science and technology may be important for what they tell us about politics more generally… If science and technology policies become highly politicised and partisan, we should then expect confrontation and gridlock across the policy spectrum. Alternatively, effective collaboration on issues related to science and technology might just indicate that the promises of a new spirit of bipartisanship have some meaning to them." Pielke 2006

The projects in the next section, examine some of the different relationships that might develop between science and technology on the one hand, and particular structures of governance on the other. It is easy to assume that this relationship only works one way, that is, that rules and regulations imposed on science will shape how research is carried out, and new technologies are used. However, as the projects in this section demonstrate, the imposition of such rules is rarely a simple, linear event, since, for example, regulations may be interpreted in different ways, among communities with different expectations of responsibility and accountability, and, may produce quite unintended consequences.

The three projects in this section concern local and international governance.

Project: Governance and Accountability Relations in Mundane Techno-Scientific Solutions to Public Problems

This research focussed on local systems of governance. Professor Steve Woolgar and his team examined the ways in which mundane science and technology can be used to create and reinforce local systems of governance, such as rubbish collection and recycling, traffic and parking regulation, and systems for regulating passenger flow through airports.

The aim of the project was to develop a model of accountability relations in these particular contexts and examine how networks of governance that involve technological and scientific solutions, are both assembled and maintained. The project's emphasis on mundane and pervasive contexts means that the findings are likely to be widely relevant.

Governance and Accountability Relations in Mundane Techno-Scientific Solutions to Public Problems

Professor Steve Woolgar, University of Oxford

Is it possible to construct a model of accountability in networks of governance that use everyday science and technology to solve public problems?

This project explored:

- the relative value and utility of the various concepts of governance and accountability developed in different social science perspectives
- how these sociological theories can be usefully combined with insights from science and technological studies into technical details
- in what ways mundane technologies help to create and maintain systems of accountability and governance.

http://www.sci-soc.net/SciSoc/Projects/Governance/Governance+and+accountability+relations.htm

Two projects explore aspects of international governance.

Project: Social and Human Rights Impact Assessment and the Government of Technology

Andrew Barry examined how BP, along with a number of international financial institutions sought to forge a new regulatory space along the length, literally, of a 1760km oil pipeline. This would allow the assessment of the social and environmental impact of the pipeline. The study demonstrated critical weaknesses to this approach to international governance and analysed how the formation of a regulatory space channelled the attention of opposition groups, reinforcing the importance of measuring particular impacts and not others, and of finding facts about very specific events that were thought to reveal their existence.

The project pointed to the ways in which the application of the principle of transparency reinforced the importance of secrecy and discretion on the part of multinationals, financial institutions and NGOs.

Social and Human Rights Impact Assessment and the Government of Technology

Dr Andrew Barry, Oxford University

How do governments and financial institutions in looking to fund new technology projects adjudicate between alternative accounts of social and human rights impacts?

This project:

- examined how the formation of regulations can bring emphasis to particular kinds of impacts and not others
- demonstrated the complex networks of relationships between governments, companies, financial institutions and NGOs that these processes of adjudication help to create
- explored the implications of these factors for questions of accountability with regard to the implementation of large technological projects.

http://www.sci-soc.net/SciSoc/Projects/Governance/Social+and+Human+Rights+Impact+Assessment+and+the+Governance+of+Technology.htm

"While many scientists and policymakers share an abhorrence of biological weapons, just what this should imply vis-à-vis research controls was not a matter of clear agreement"

Project: Accountability and the Governance of Expertise: Anticipating Genetic Bioweapons

Dr Brian Rappert, University of Exeter and Professor Malcolm Dando, University of Bradford, examined the changing, international context of modern biological research. This study assessed how individuals and organisations in the biological and medical sciences were addressing the shared problem of responding to the growing societal concern with the proliferation of weapons-related expertise, following the terrorist attacks on the World Trade Centre in New York in 2001. While many scientists and policymakers share an abhorrence of biological weapons, just what this should imply vis-à-vis research controls was not a matter of clear agreement.

Although, at the moment, it seems unlikely that biological agents are able to cause mass casualties, that threat is likely to increase, both through the spread of technological capabilities and the development of greater technological capabilities. Policy options therefore have to be chosen with this timeframe in mind.

Although current concerns in this area focus on illegal state programmes, the project drew attention to the need to begin to put in place an integrated international approach more appropriate for dealing with a more dispersed threat, in which the nature of bio-weaponry is likely to mean that many people will be able to acquire destructive capabilities. The findings of this project make it clear that rules and regulations are necessary but not sufficient. A change in the scientific/research culture is needed, in which specialists become involved in initiatives that will steadily enact, elaborate and reinforce a norm that the biotechnology revolution is not to be used for the production of weaponry.

Accountability and the Governance of Expertise: Anticipating Genetic Bioweapons

Dr Brian Rappert, University of Exeter, and Professor Malcolm Dando, University of Bradford

How do individuals and organisations in the biological and medical sciences address the shared problem of responding to the growing societal concern with the proliferation of weapons-related expertise?

This project explored:

- how current and future bioscience research might facilitate the development of new forms of biological weapons
- the possibilities bioscience researchers perceive in the development of genetic bioweapons
- how 'professionalism' is defined, articulated, and negotiated in relation to the development of biological weapons and the implications such considerations have for the communication of research
- the range of advocacy activities undertaken by professional organisations and individual scientists in the UK and elsewhere to alert experts and members of the public regarding the dangers of genetic weapons.

http://www.sci-soc.net/SciSoc/Projects/Governance/Accountability+and+the+governance+of+expertise.htm

Conclusions

Most current models of scientific governance describe the relationship between science and society as a dialogue between two groups – the public and the experts. Any perceived problems of governance tend to be viewed as deficits on the part of the public: a lack of understanding of either scientific facts or processes, or a lack of trust in science and its institutions. This approach reduces problems in the relationship between science and society to process issues of science communication that can be resolved through the (one-way) transmission of scientific fact.

Within this context, expanding public participation in the science-society relationship may be desirable, but its effects will be limited. If the debate is reduced from the outset to questions of scientific fact and/or uncertainty, and, if the aim is simply to enable the promotion of 'right thinking' among members of the public, eliding aesthetic, ethical and political concerns as matters to be corrected by technical information, then many of the potentially useful outcomes of public consultation will be lost. It is far from clear what kinds of impacts on policy any decision arising from such processes can have. But if greater public participation and communication are not a sufficient answer, then what is?

The projects in this brochure suggest that rather than searching for a solution, we need to reframe the question. Rather than thinking about the problem of society's attitude to science, we need to examine the governance of science in society, challenging common, current assumptions about established structures of authority, power distribution, institutional prerogatives and access to decision making.

To begin with, we might ask how useful is the common model of top-down command, with its in-built deference to expertise. The projects in this brochure draw attention, instead, to the complex, dynamic network of stakeholders, and the plurality of knowledge and activities, that are actually involved in shaping the construction and dissemination of science and technology across society. As these projects demonstrate, the meanings that different communities take from scientific innovations, impacts and information, as well as their understanding of the scientific and policy institutions behind those innovations, vary widely and crucially. Each of the projects in this brochure explores how, in any particular

"Society has a significant and far more complex part to play in the governance of science"

context, meaning is actively being constructed and disseminated by a range of different actors at different levels in society, across a dynamic global network – a process that goes well beyond earlier models of communication and of science-society interaction which evoke a simple, linear flow of knowledge (Reddy 1979). The realisation of this process of constructing meaning carries significant implications for the governance of science and technology, demanding a constant and fluid response at a number of different levels, and by a variety of stakeholders.

This may seem anathema to a system of governance that has inherited a focus on maximizing efficiency in a resource-constrained environment, but it doesn't mean that the wheel must be reinvented for each new science and technology initiative. As a number of the projects described here show, there is widely relevant, transferable learning in the field of governance of science and technology. In fact, Dr Simon Shackley's *Simulation Modelling of Contentious Scientific Knowledge Claims in Society* is a project in the Science and Society Programme that brings together some of the learning achieved so far in the field of governance of science and technology, aiming to create a tool to facilitate communication between academics and stakeholders in the arena of scientific governance.

However, simply slotting public participation and communication processes into existing systems of science and technology governance will not suffice. New understanding of the construction and dissemination of science and technology across society demands a radical rethink of both governance systems and cultures. Communication cannot remain limited to a one-way flow of correct facts from expert to public. Education and communication remain important, but with a crucial difference: non-practitioner expertise must be recognised, developed and engaged.

Any governance body charged with assessing scientific and technological innovations will have to learn how to engage with all actors, expert and non-expert, public and private, explicit and implicit, local and global, who may be involved. As well as scientific facts, new kinds of information must be considered that cannot be so easily quantified, for example, there needs to be explicit recognition and exploration of the moral and ethical implications of science and technology projects, in all their variety. Moreover, as we begin to understand more fully the long-term impacts of human action, any governance process of science or technology must take account of its more long-term effects.

New roles may be necessary that bridge the expert/non-expert divide. Comparing science with other fields of human endeavour (fine art, food, architecture) suggests that science needs popular connoisseurs, who can help society to think through the values and implications of scientific and technological innovations, rather than simply focus on scientific facts or draw attention to particularly sensational aspects.

The projects in this brochure demonstrate that society has a significant and far more complex part to play in the governance of science than has previously been assumed. However, they also draw our attention to problems with the current models of public participation in policymaking. In the end how effective can the participatory approach be, especially in a context of increasing globalisation where new technologies emerge as pervasive global systems and national or regional experimentation is not possible?

This challenge carries implications that go beyond the governance of science, raising questions about our understanding of how democracy itself functions in a globalised environment (Dalton and Wattenberg 2000). At a time when electoral participation in countries such as the US and UK are in decline, we urgently need to revitalise current models of representative democracy. The projects in the Science in Society Programme go beyond the realm of science governance to suggest we need a serious rethinking of democratic institutions and procedures.

Sources, References and Further Reading

Beck U (1992) *Risk Society: Towards a New Modernity* (London)

Bielefeld University (2007) Summary of work in the research area 'Science and Technology Governance' of the Institute for Science and Technology Studies (IWT), (http://www.unibielefeld.de/iwt/forschung/Schwerpunkte/science_and_technology_governance.html)

Commission of the European Communities (2005) CIPAST: 'Boosting Society's Participation in Science', EU project on Citizen Participation in Science and Technology (http://europa.eu.int/comm/science-society/)

Cohn S (2000) 'Risk, Ambiguity and the Loss of Control: How People with a Chronic Illness Experience Complex Biomedical Causal Models' in P Caplan (ed.) *Risk Revisited* (London) pp. 204-225

Commission of the European Communities (2005) Science Technology and Governance in Europe: Challenges of Public Engagement STAGE (HPSE-CT2001-50003) Final Report (http://www.stage-research.net/STAGE/)

Commission of the European Communities (2000) 'Conclusions: Towards a New Alliance between Science, Citizens and Society', Conference 'Science and Governance in a Knowledge Society: The Challenge for Europe' 16-17 October 2000, Brussels

Commission of the European Communities (2001) 'European Governance', Brussels

Cvetkovich G & Lofstedt R E (1999) *Social Trust and the Management of Risk*. London: Earthscan.

Dalton R and Wattneberg M (2000) *Parties Without Partisans* (Oxford)

Giddens A (1990) *The Consequences of Modernity* (Cambridge)

Hessenbruch A (2006). 'Beyond Truth: Pleasure of Nanofutures'. In Joachim Schummer and Davis Baird, eds., *Nanotechnology Challenges: Implications for Philosophy, Ethics and Society*, London: World Scientific Publishing, 357-382

House of Lords (2000). Science and Society 3rd Report, House of Lords Select Committee on Science and Technology HL Paper 38 (Her Majesty's Stationery Office: London)

O'Neill O (2002) *A Question of Trust* (Cambridge)

OST/Wellcome (2000) Science and the Public: A Review of Science Communication and Public Attitudes to Science in Britain. London: Office for Science and Technology/Wellcome Trust.

Pidgeon N F, Kasperson R K and Slovic P (2003) *The Social Amplification of Risk* Cambridge: CUP.

Pielke R Jr. 'The 2006 US Midterm Elections and Science & Technology Policy in Bridges', the OST's Publication on S&T Policy, vol. 12, December 2006 http://www.ostina.org/content/view/1674/630/

Rayner S (2003) 'Democracy in the Age of Assessment: Reflections on the Roles of Expertise and Democracy in Public-Sector Decision Making' *Science and Public Policy* 30:3, 163-170

Reddy M J (1979). 'The conduit metaphor – a case of frame conflict in our language about language'. In A. Ortony (Ed.), *Metaphor and thought*. Cambridge: Cambridge University Press, 284-297.

Renn O & Levine D (1991). 'Credibility and trust in risk communication'. In R E Kasperson & P J M Stallen (Eds.), *Communicating Risks to the Public*. The Hague: Kluwer.

Smart B (1993) *Postmodernity* (London)

Tait J and Lyall C 'A New Mode of Governance for Science, Technology, Risk and the Environment?' Abstract for Innogen Working Paper, no. 17; full paper published as Chapter 10 in New Modes of Governance. Developing an Integrated Policy Approach to Science, Technology, Risk and the Environment, edited by C Lyall and J Tait, Ashgate, 2005

UNESCO (2007) *Science, Technology and Innovation Policy* (http://www.unesco.org/science/psd/thm_innov/innovation_policy.shtml)

UNESCO (2006) 'Future Directions for National Reviews of Science, Technology, and Innovation in Developing Countries: Workshop Report, 23-24 April 2003, Paris, France', Science Policy Studies, Division of Science Policy and Sustainable Development, UNESCO, Paris, 2006

UNESCO (1998) 'Toward a New Contract Between Science and Society', Exec. Summ: of the Report of the North American Meeting held in advance of the World Conference on Science (http://www.unesco.org/science/wcs/meetings/eur_alberta_98_e.htm - contents)

UNESCO 'Science and Technology Policy Forums', Division of Science Policy and Sustainable Development, UNESCO doc. No. 141785, Paris

WHO EMRO, Management Effectiveness Programme (http://www.emro.who.int/mei/mep/Healthsystemsglossary.htm#goal)

Research projects listed under topical themes

The Science in Society Programme is one of the ESRC's major investments and is a six year commitment running from 2002 to 2007. The Programme, originally conceived following a parliamentary report on science and technology, is both broad in scope and diverse in its research focus and has been host to 45 different research projects during its lifetime. The Programme is separated into six themes, each one acting as an umbrella for a variety of projects, all of which consider a different aspect of the science-society relationship.

Science in Governance and the Governance of Science

Social and Human Rights Impact Assessment and the Governance of Technology
Dr Andrew Barry, research undertaken at Goldsmiths College, London – now based at the University of Oxford
andrew.barry@ouce.ox.ac.uk

Interdisciplinarity and Society: A Critical Comparative Study
Dr Andrew Barry, University of Oxford *andrew.barry@ouce.ox.ac.uk*

Using Public Environmental Knowledge in Industry
Dr Kate Burningham, University of Surrey *k.burningham@surrey.ac.uk*

Childhood Cancer Tissue Donations: A Gift Relationship?
Professor Mary Dixon-Woods, University of Leicester *md11@le.ac.uk*

Contesting Environmental Science: Business and Environmentalist NGOs
Dr Sally Eden, University of Hull *s.e.eden@hull.ac.uk*

Credibility Claims as Scientific Commodities
Dr Sally Eden, University of Hull *s.e.eden@hull.ac.uk*

Inside or Outside the Bio-science Tent? The Presentation of the Laboratory-self
Dr Lena Eriksson, research undertaken at Cardiff University – now at the University of York *le502@york.ac.uk*

Caught Between Science and Society: Foot and Mouth Disease
Dr Brigitte Nerlich, University of Nottingham *brigitte.nerlich@nottingham.ac.uk*

Public Perceptions of Risk, Science and Governance
Professor Nick Pidgeon, research undertaken at the University of East Anglia – now at Cardiff University *pidgeonn@cardiff.ac.uk*

Accountability and the Governance of Expertise: Anticipating Genetic Bioweapons
Dr Brian Rappert, University of Exeter *b.rappert@exeter.ac.uk*

Simulation Modelling of Contentious Scientific Knowledge Claims in Society
Dr Simon Shackley, University of Manchester *simon.shackley@manchester.ac.uk*

Resolving Conflicts in Selecting a Programme of Fisheries Science Investigation
Professor Jonathan Side, Heriot-Watt University *j.c.side@hw.ac.uk*

Reproducing the Centre: Performing Innovation at Xerox PARC
Professor Lucy Suchman, Lancaster University *l.suchman@lancaster.ac.uk*

Governance and Accountability Relations in Mundane Techno-Scientific Solutions to Public Problems
Professor Steve Woolgar, University of Oxford *steve.woolgar@sbs.ox.ac.uk*

Re-modelling Science Communication

Deliberating the Environment: Scientists and the Socially Excluded in Dialogue
Dr Derek Bell, University of Newcastle *derek.bell@ncl.ac.uk*

Spinning Science: The Nanotech Industry and Financial News
Ms Mary Ebeling, University of Surrey *m.ebeling@surrey.ac.uk*

Public Involvement, Environment and Health: Evaluating GIS for Participation
Dr John Forrester, University of York *jf11@york.ac.uk*

Communicating Science through Novel Exhibits and Exhibitions
Professor Christian Heath, King's College London *christian.heath@kcl.ac.uk*

Experiments In Science Communication: A Pilot Study with a Digital TV Channel
Dr Richard Hull, University of Newcastle upon Tyne *richard.hull@ncl.ac.uk*

The New Zoos: Science, Media and Culture
Dr Nils Lindahl-Elliot, University of the West of England *nils.lindahl-eliot@uwe.ac.uk*

Consultation as Science Communication? The Case of Local Air Quality Management
Professor James Longhurst, University of the West of England *james.longhurst@uwe.ac.uk*

Divided we Stand: Bridging Differential Understanding of Environmental Risk
Ms Laura Potts, York St John College, York *l.potts@yorksj.ac.uk*

What Does Social Change Mean in the Context of Engineering Education?
Dr Jane Pritchard, University of Glasgow *j.pritchard@udcf.gla.ac.uk*

Science in the Economy and the Economics of Science

Mobility and Excellence in Scientific Labour Markets: The Question of Balanced Growth
Professor Louise Ackers, University of Liverpool *lawhla@liverpool.ac.uk*

The Impact of Enlargement of Scientific Labour Markets
Professor Louise Ackers, University of Liverpool *lawhla@liverpool.ac.uk*

Work Roles and Careers of Academic Scientists in University-Industry Collaboration
Professor Alice Lam, Royal Holloway, University of London *alice.lam@rhul.ac.uk*

Making Science History: The Regionalisation of Science Policy
Professor Simon Marvin, University of Salford *s.marvin@salford.ac.uk*

Building Science Regions in the ERA: Governance in the Territorial Agora
Ms Beth Perry, University of Salford *b.perry@salford.ac.uk*

Labour Markets and Knowledge Flows in the Chinese National System of Innovation
Dr Matias Ramirez, Brunel Business School *matias.ramirez@brunel.ac.uk*

Issues Involved in the Diffusion of Knowledge through Migration of Scientific Labour
Professor David Wield, Open University *d.v.wield@open.ac.uk*

The Impact of Gender Innovation on Regional Technology, Economy and Society
Professor Pooran Wynarczyk, University of Newcastle *pooran.wynarczyk@ncl.ac.uk*

Science Technology and Globalisation

Institutional Impacts of North-South Partnerships in Agricultural Biotechnology
Professor Joanna Chataway, Open University *j.c.chataway@open.ac.uk*

Regulatory Practices and Challenges of the African Crop Biotechnology Sector
Professor Joanna Chataway, Open University *j.c.chataway@open.ac.uk*

Science, Technology and Water Scarcity: Investigating the 'Solutions'
Dr Lyla Mehta, IDS, University of Sussex *l.mehta@ids.ac.uk*

Childhood Vaccination: Science and Public Engagement in International Perspective
Professor James Fairhead, University of Sussex *j.r.fairhead@sussex.ac.uk*

The World Wide Web of Science: Emerging Global Sources of Expertise
Dr Ralph Schroeder, University of Oxford *ralph.schroeder@oii.ox.ac.uk*

Databases, Naturalists and the Global Biodiversity Convention
Ms Claire Waterton, Lancaster University *c.waterton@lancaster.ac.uk*

Science and Gender, Ethnicity and the Lifecycle

Boundary Work, Normal Ageing and Brain Pathology
Professor John Bond, University of Newcastle-upon-Tyne *john.bond@ncl.ac.uk*

Public Perceptions of Gamete Donation in British South Asian Communities
Professor Lorraine Culley, De Montfort University *lac@dmu.ac.uk*

Gender Theories and Risk Perception: A Secondary Analysis
Professor Nick Pidgeon, Cardiff University *pideonn@cardiff.ac.uk*

Asbestos Diseases: Scientific Definitions and Gendered Identites
Dr Linda Waldman, Institute of Development Studies *l.waldman@ids.ac.uk*

Genomics and Society

Doing Embryo Ethics: Safety and Efficacy in Research and Practice
Professor E. Anne Kerr, University of Leeds *e.a.kerr@leeds.ac.uk*

Farmers' Understandings of Genetically Modified Crops within Local Communities
Dr Andy Lane, The Open University *a.b.lane@open.ac.uk*

Pharmacogenomics, Diagnostic Tests and Clinician Acceptance
Dr Graham Lewis, University of York *gl12@york.ac.uk*

Science, Security and Regulation: How Effective are Export Controls?
Dr Jeremy Littlewood, University of Southampton *j.littlewood@soton.ac.uk*

Dual Use Controls and Genomic Research
Dr Paul Nightingale, SPRU, University of Sussex *p.nightingale@sussex.ac.uk*

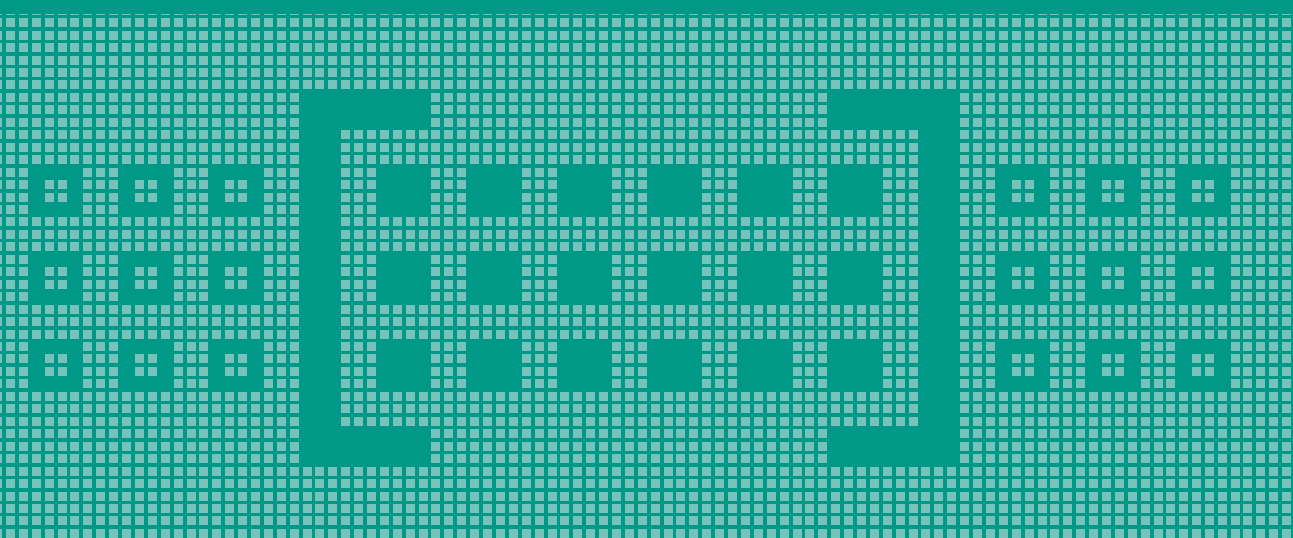
Economic and Social Research Council
Polaris House
North Star Avenue
Swindon
SN2 1UJ

Telephone: 01793 413000
Fax: 01793 413001

The Economic and Social Research Council is the UK's leading research and training agency addressing economic and social concerns. We aim to provide high-quality research on issues of importance to business, the public sector and Government. The issues considered include economic competitiveness, the effectiveness of public services and policy, and our quality of life.

The ESRC is an independent organisation, established by Royal Charter in 1965, and funded mainly by the Government.

More at **www.esrcsocietytoday.ac.uk**



science in society