Research, Controversy, and Accountability: A Proposed Strategy for Engaging with Scientists

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Concerns about the purpose and place of scientific research in society are recurring features of contemporary policy and public debates. Post 9-11, the relationship between national security and research has been a topic that has received considerable attention. As part of this, questions are being raised regarding whether the knowledge and techniques generated through fundamental and applied life science research might facilitate the production of bioweapons and therefore whether controls should be placed on what gets done, how, and whether information is widely circulated. In response to this emerging discussion, this paper elaborates a pragmatic empirical research agenda for engaging with practicing scientists regarding what is to be done. The 'deliberative seminars' elaborated here employed a significantly modified form of the focus group method to facilitate learning by seminar participants and presenters. In discussing the preparation for, the planning of and the conducting of these workshops, this paper aims to propose a strategy of engagement and learning relevant for other areas of emerging controversy. Various dilemmas, decisions, and difficulties of discussing the dual use status of life science research are recounted with a view to reflecting on the unavoidable choices made in efforts to promote a questioning of the practices of research.

Introduction

In recent years, the continuing high public profile of ethical, social, and political issues associated with scientific research has renewed attention to long standing questions about its place in society. After the events of 9-11 and the anthrax attacks that followed in the US, the relationship between national security and research has been one of those topics that has received significant attention (Alberts, 2002). Perhaps in a manner unprecedented, as part of this the life sciences have come under scrutiny regarding their security implications (Marburger, 2003). Not only have concerns been voiced about the possibility of diverting dangerous pathogens and toxins from laboratories, in manner analogous to that in nuclear sciences or cryptography, questions are being raised whether the knowledge and techniques generated through research might facilitate the production of bioweapons and therefore whether controls should be placed on what gets done, how, and whether it is widely circulated.

As with the emergence of other areas of public controversy about scientific practice such as the safety of laboratories, the participation of human subjects, the retention of human organs, and the use of animals in experimentation, the current security focus potentially poses considerable challenges to established practices and preoccupations. This in turn

means that attention to matters of security and research not only raises concerns about the public understanding of science, but scientists' understanding of their own activities.

This paper specifies a highly pragmatic strategy employed for engaging with life science researchers regarding the 'dual use' implications of their work. During 2004-5, the author and Malcolm Dando (University of Bradford, UK) undertook numerous 'deliberative seminars' with British researchers. These were conducted as interactive sessions that combined the goal of awareness raising with data collection. In their structure and rationale, the workshop most closely approximated focus groups, yet there were significant deviations from typical procedures employed for the latter. Our work entailed undertaking seminars as part of existing university departmental seminar series and employing a problem-orientated and dialogic methodology that transformed over time to achieve a greater mutual understanding of the issues associated with bioweapons and life science research. In discussing the preparation for, the planning of, and the conducting of these workshops, this paper aims to propose a strategy of engagement and learning relevant for other areas of emerging controversy. Various dilemmas, decisions, and difficulties are recounted with a view to reflecting on the unavoidable choices made in efforts to promote a questioning of the practices of research.

Dual Use Life Science Research as an Emerging Social Problem

With the heightened attention to bioweapon threats in the aftermath of 9-11, security-related debate has taken place regarding topics such as the protection of human subjects in experimentation (Trotter, 2003), the public health response to bioattacks (Kipnis, 2003), the procedures for regulating experimental drugs (Shamoo, 2003) and the physical containment of dangerous pathogens (Epstein, 2001). While the possible contribution of the advancement of the life sciences for enabling novel forms of biological weapons has been a matter of discussion in the past, today there is unprecedented attention to whether the knowledge and techniques generated in fields such as immunology, molecular biology, virology, toxicology, and molecular genetics could ease the development of weaponry. Possibilities envisioned include manipulating viruses and bacteria to make them resistant to anti-virals and antibiotics, modifying the virulence and pathogenicity of known bioagents, rendering the detection of bioattacks more difficult, enhancing the capacities for the dissemination of agents, and reducing the effectiveness of the body's defense system.

Just what the identification of such possibilities should mean for responsive measures though has been less than straightforward. Shortly after 9-11, the Natural Research Council of the US National Academies established a committee chaired by Professor Gerald Fink of the Whitehead Institute for Biomedical Research to examine possible changes to research practices. Fink succinctly summarized many of the commonly identified binds associated with controlling life science research in his preface to the committees' report *Biotechnology Research in an Age of Terrorism: Confronting the Dual Use Dilemma* (NRC, 2003, p. vii):

> …[A]lmost all biotechnology in the service of human health can be subverted for misuse by hostile individuals or nations. The major vehicles of bioterrorism, at least in the near term, are likely to be based on materials and techniques that are available throughout the world and are easily acquired. Most importantly, a critical element of our defense against bioterrorism is the accelerated development of biotechnology to advance our ability to detect and cure disease. Since the development of biotechnology is facilitated by the sharing of ideas and materials, open communication offers the best security against bioterrorism. The tension between the spread of technologies that protect us and the spread of technologies that threaten us is the crux of the dilemma.

As argued herein, attempts to curtail research out of fears about its eventual use may well prove counterproductive because they threaten the open communication of science.

Three experiments have come to epitomize the tensions identified by Professor Fink. One, the insertion of the interleukin-4 gene into the mousepox virus by Australian researchers in early 2001 to find an infectious contraceptive to combat mice plagues. With the high morality rates achieved for immunized and non-immunized mice with the over expressed IL-4, this experiment (unexpectedly for the research team) suggested a technique for enhancing the lethality of other pox viruses (e.g., smallpox). Second, the 2002 announcement of the successful artificial chemical synthesis of poliovirus that brought to the fore a way to create other viruses from scratch. Third, the comparison of variola major and vaccinia viruses published in 2002 that indicated how the vaccinia virus used to immunize against smallpox might be made more lethal. While recognizing the potential malign applications of such experiments, many have defended their undertaking and publication because of their value in warning about impending capabilities or because of their importance in elucidating fundamental biological mechanisms. Indeed, the initial results were extended in follow-on experiments such as the adding of the IL-4 gene to rabbitpox and cowpox and its refined insertion into mousepox (BMA, 2004).

The initial dilemmas associated with assessing the appropriateness of conducting and communicating possible 'contentious research' (Epstein, 2001) are further complicated by uncertainty and disagreement over the severity of bioweapons threats. Much of the emphasis today is with the use of agents by terrorists. The limited number of bioattacks in the past and the difficulties experienced by even well funded groups using naturally occurring pathogens (for instance, the Japanese Aum Shinrikyo cult) suggests a low likelihood of mass casualty attacks. Following from this, the possibility that such groups could or would employ advanced life science research then are even more remote. Yet, the situation is more complex than this. The potential for state sponsored terrorism significantly increases the possibility of successful weaponization. Even if one regards this as taxing for small sized state programs, as illustrated in the case of the anthrax letters, bioattacks need not inflict mass casualties to be highly disruptive. Many though have cautioned that developments in biotechnology in the near future will enable a much wider range of destructive options which will be within the reach of many groups (Petro

et al., 2003; Poste, 2003). With this uncertainty about threats, questions are being asked about the principal drive for present deliberations, whether that be the recently appreciated terrorist threats, the novel possibilities generated by rapid scientific developments, or the renewed public profile of biological weapons (Rappert, 2003).

Various measures relating to the oversight of research have been initiated. In early 2003, a group of 32 largely American based scientific journals met to agree guidelines for reviewing, modifying, and perhaps rejecting research articles where 'the potential harm of publication outweighs the potential societal benefits' (Journal Editors and Authors Group, 2003). The 2003 *Biotechnology Research in an Age of Terrorism* report recommended the establishment of an oversight system to review and assess so-called 'Experiments of Concern'. Initially this category includes activities such as increasing the transmissibility of pathogens, enhancing the virulence of agents, and rendering vaccines ineffective. The report also called for 'national and international professional societies and related organizations and institutions [to] create programs to educate scientists about the nature of the dual use dilemmas in biotechnology and their responsibilities to mitigate its risks' (NRC, 2003, p. 3). Many of NRC recommendations are to be implemented by a newly formed National Science Advisory Board for Biosecurity (NSABB). This board has been charged with developing criteria for identifying and evaluating the risks and benefits with research and also to develop 'mandatory programs for education and training in biosecurity issues for all scientists and laboratory workers at federally-funded institutions' (NSABB, 2004). In contrast, to date the responses initiated in relation to 'dangerous research' outside the US have been more limited. In the UK, for instance, much of the policy discussion has centered on community self governance measures such as professional codes of conduct and university undergraduate and postgraduate teaching provisions (UK House of Commons Foreign Affairs Committee, 2002; Royal Society, 2004; Report of Royal Society and Wellcome Trust Meeting, 2004), though the exact aims and content of these initiatives remains poorly specified (Rappert, 2003b; Rappert, 2004).

Dual Use Research and the Life Science Communities

As outlined in the previous section, the long held presumption in relation to the life sciences that national security is best served by the beneficial and protective innovations deriving from research free from security constraints or oversight has been called into question. While the storage and security of pathogens as well as the vetting of personnel working with such agents have been regulated for some time, today the possible future consequences of the data, conclusions, and techniques of *fundamental* research are under scrutiny (Marburger, 2003). Arguably the extent and type of scrutiny is historically unmatched. Those in the life sciences have been urged to 'lose their innocence' and devise responsive measures (Morse, 2003; Poste, 2001) before they are imposed (Albright, 2003; UK House of Commons Science & Technology Committee, 2003). Lively debate has taken place about what, if any, security review or oversight procedures are prudent (Block, 2002; Knezo, 2003).

In these conditions of contestation and uncertainty, the proper governance of research is a matter of some dispute. With respect to dual use issues in the life science community, two points are worth stressing. First, as suggested above, one topic upon which many agree is the need for the education of scientists (see as well ICRC, 2004; Oborne, 2004; Royal Society, 2002; WMA, 2002). Yet, that overall agreement is belied by the lack of specification about the content and specific aims such provisions. Should that, for instance, consist of providing information on the history of biological warfare, stimulating generic concerns about the responsibilities of scientists today, alerting researchers to security considerations for individual decision making, or confronting scientists with the malign potential of their work?

Addressing what sort of education is sensible is hampered by a second important point: the past dearth of empirical data on the extent of researchers' knowledge about dual use issues or evaluations of possible oversight measures.[1] Following from the points made above, it is fair to say that issues surrounding the security implication of research findings have not been a topic of widespread professional discussion in the past (see Barnaby, 1997). Yet, the extent to which researchers have considered these issues has obvious bearing on what sort of educational provisions would be prudent. While policy-orientated conferences about dual use issues abound post 9-11, the extent of the participation of practicing researchers is necessarily limited.

Strategies for Engagement

As suggested above then, the growing attention to the dual use issues associated with advanced life science research poses significant dilemmas for the conduct of research, ones which could have significant implications for future practice. Yet, at the same time, it is less than clear how much or what practicing researchers have thought about the issues at stake. In this situation, analysts wishing to investigate these issues face important choices about the types of interactions they foster through their own research.

Consider some reflections on conventional interviewing techniques. As part of a pilot collaborative project about genetics and bioweapons,[2] in 2003 the author conducted 16 semi-structured one-to-one interviews with university sector British life science researchers regarding dual use issues. On the basis of a technical review conducted by [my partner], it was decided to focus on those investigating the functioning of muscarinic acetylcholine receptors in the brain;[3] this provided a bounded sub-population where all those doing significant research in the UK could be approached. Prior to the interviews, interviewees were sent a one-page sheet outlining both past military interest in acetylcholine transmission and a summary of key recent scientific trends. The interviews sought to determine how scientists defined the possible biological weapons applications of their research, where problems with research derived from, and what they thought of ongoing debates about security regulations or oversight measures. To summarize, interviewees indicated little awareness of bioweapon prohibition agreements or ongoing security-orientated deliberations and in addition only three stated ever having considered

the weapons applications of their work (two of whom as a result of being approached by US military establishments) (Rappert, 2003c).

For the purpose of this paper, two reflections are worth noting about the interviews. First, they repeatedly bordered on the awkward and confrontational. As scientists were being asked about possible negative consequences of their work that they had largely hitherto ignored (and thus had not formed well-thought out rationales regarding) as well as the prospect of restrictions on their activities, the management of confrontation was a continuing preoccupation. So, many participants offered blanket reasons against any additional security controls on research by suggesting such measures would comprise the open character of science or that restrictions would be futile given the extent of knowledge already in circulation. In light of commercialization and competitiveness pressures in research (e.g., Thackray, 1998), for instance, it was readily possible to question the veracity of some claims, but in the situation of one-to-one interviews this sort of challenging threatened to degrade the interview into an adversarial to and fro inquisition. In this case that meant an opposition between a junior sociologist and (almost always) a more senior biologist about the implication of his work. Second, despite the ongoing tensions, by getting scientists engaged with issues which few of them had given prior consideration, the interviews arguably provided something of an educative experience. While most interviewees doubted the merits of limitations on publications or research agendas as well as the need for pre-project oversight reviews, despite the often initial doubt about the relevance of dual use concerns, through the interaction of the interviews none in the end refuted at least the potential for the malign application of their research. Yet, not least for practical reasons relating to cost and time, one-to-one interviews are limited in their ability to form a strategy for education.

Given the argument up this point in the paper, the understanding of the dual use issues with life science research could usefully benefit from a strategy of combining research and education. As part of any approach, it would be necessary to question the merits of current and proposed policies while questioning how that questioning was conducted. Given this, a formalized survey method would risk asking questions that are not understood by, have different or little meanings for, or are dismissed by scientists. One-to-one interviews allow for more interaction, but also threatened to decay into oppositional exchanges.

Focus group research is one technique that has gained considerable popularity in recent decades, particularly in marketing but more recently in the social sciences. 'Focus group' methods differ considerably in terms of their make-up, but generally consist of a group of 5-9 people that collectively discuss a predetermined set of issues regarding a given topic through the guide of a so-called moderator (or facilitator) (see Stewart and Shamdasani, 1992). Two advantages are frequently claimed for such groups. One, they are 'ideal for exploring people's experiences, opinions, wishes and concerns. The methodology is particularly useful for allowing participants to generate their own questions, frames and concepts and to pursue their own priorities in their own terms, in their own vocabulary' (Kitzinger and Barbour, 1999, p. 5). As such, focus groups allow for an examination of the *whys* behind individuals' thinking. Two, they entail '*the explicit use of the group*

interaction to produce data and insights that would be less accessible without the interaction found in groups' (Morgan, 1998, p. 12). As Krueger (1998, p. 20) states, 'focus group interviews produce data derived from a group process in a focused manner. As a result, participants influence each other, opinions change, and new insights emerge. Focus group participants learn from each other, and things learned can shape attitudes and opinions. The discussion is evolutionary, building on previous comments and points of view.' As suggested by these quotes, the open-ended character of focus groups provides a flexible and responsive way to undertake research.

In relation to exploring the dual issues aspects of life science research, such characteristics are desirable for a variety of reasons. As the security implications of biological research is a rather novel topic for bioscientists (and security analysts), understanding how they conceive of and frame the basic issues at stake is vital. Potentially at least, the interaction between scientific peers could be a way of minimizing both the asymmetrical relation between outside researchers and scientists vis-à-vis technical expertise as well as the potential oppositional relation between interviewer and interviewee(s). As interviewers do not have to press particular individuals with potentially threatening questions, group interviews allow for a space for personal reflection and withdrawal. Indeed, some have suggested focus groups might be particularly useful for examining 'sensitive' issues (Farquhar and Das, 1999; Kitzinger, 1994). The interactive dimensions can, in turn, serve educational purposes and foster change in people's thinking (Baker and Hinton, 1999).

The flexibility and openness afforded by this general methodology though have also been objects of criticism. The typical use of 'purposive' sampling and the often low number of focus groups conducted means those employing this methodology rarely strive for 'statistical representativeness' (O'Brien, 1993). In marketing at least, focus groups often serve the purpose of informing other forms of research. When focus groups are held with pre-existing groups, then their interaction can be said to be 'contaminated' by past relationships. Even if members are unfamiliar which each other, the group dynamic is said to result in conformity and individual censorship (Albrecht et al., 1993). Of course, with any type of (overt) social research, the potential for individuals to offer socially preferred responses and rationalized justifications has long been recognized (e.g., Scott and Lyman, 1968). As well, in terms of analyzing focus group discussions, because of the interactions between participants and the scope for argumentation, it is difficult to ascribe 'views' to individuals (see below). In short, the scientific basis of focus groups has been called into question. On a more practical level, the resources, expertise and planning required for successful focus groups are said to nullify many of the advantages of conveying group-type interviews.

In response, proponents of focus groups have acknowledged the often lack of statistical generalizability and the resource demands, but defended them by arguing that even when done on their own, if conducted properly, they can produce verifiable results (Krueger, 1998). Defining a research protocol, conducting disciplined moderation, and establishing feedback between researchers and group participants, other researchers and outside experts are all presented as vital for producing systematic results.

Despite the burgeoning literature about focus groups, arguably it remains deficient in addressing crucial issues surrounding the openness of and rationale behind moderator questioning and subsequent probing. As both focused and disciplined as well as open and reciprocal, those moderating such groups must balance or otherwise resolve questions about how to question. In this respect, Morgan (1998, p. 58) advises that '…focus groups allow you both to direct the conversation towards topics that you want to investigate and to follow new ideas as they arise' but how the competing aims desired should be reconciled is rarely a topic of detailed consideration even when noted as a crucial. So Kitzinger (1994, p. 106) advocates that 'trying to maximize interaction between participants could lead to a more interventionist style: urging debate to continue beyond the stage it might otherwise have ended, challenging people's taken for granted reality and encouraging them to discuss the inconsistencies between participants and within their own thinking' but without any further elaboration of the rationales for how choices are made about what to do. The tensions with questioning not only have implications for assessments of 'rigor' but also claims that focus groups allows participants to 'generate their own questions, frames and concepts and to pursue their own priorities in their own terms, in their own vocabulary' (Kitzinger and Barbour, 1999, p. 5). Krueger (1998, Appendix) provides various examples of questions posed as part of group sessions, but all can be read as asking relatively specific matters and they are the same over time. Instead of treating the openness and expressiveness as given properties of this method, future sections of this paper treat them as matters in need of continuing attention.

Deliberative Seminar Design

Section two and three argued that the recent turn to dual use issues in the life sciences could be productively considered through a strategy that sought to both collect data about practising researchers' assessments and to engage them in an educational process. As suggested in section four, with the attention given to exploring individual's understandings and concerns as well as deliberate interaction among peers, the focus group method provides at least a starting basis for such undertakings. Yet, since the term 'focus group' encompasses a wide range of activities and agendas, crucial but often neglected questions exist about the basis for questioning in them. In addition, their educational potential remains relatively underdeveloped. Given these considerations, important planning choices must be made. The section discusses the initial design of 26 seminars with practicing life scientist conducted during the academic year 2004-5. While not wishing to present the work undertaken as a panacea, it considers how the aims of exploration and education can be achieved through a relatively low cost adapted form of the focus group method. The next two sections do this by first briefly considering the themes of the discussions and then providing more detailed consideration of the rationale and benefits for the questioning undertaken.

In the range of all those in industry, government departments, and educational institutions who undertake life science research, our study took as its population those in university life science departments; this including university faulty, technical support staff, and

postgraduate students. There were a variety of reasons for this purposive sampling: one, many of the novel dual use controls being proposed are primarily designed for civilian research outside of government, military or corporate laboratories, the latter grouping which overall is much more accustomed to institution-*specific* restrictions on the conduct and communication of research than universities. Two, as British university research is already subject to numerous biosafety regulations and research protocols, participants would have given thought to general issues of governance. Three, universities are relatively open institutions (e.g., in comparison to industry) that have a tradition of facilitating discussion about societal issues. This point, however, should not be taken to imply that universities are devoid of tensions in undertaking inquiry. Tracy (1997) argues that the interaction fostered through departmental 'colloquium' need to be seen as contending with a number of competing demands associated with expertise and intellectual debate. As she argued on the basis of an empirical study, there was often a:

> need to avoid overly heated and hostile exchanges while ensuring boring discussions were not tacitly promoted; to create an appropriately playful/serious environment that did not tilt to far in either direction; to make certain that the discussion became neither a social chitchat nor a lecture from a knowledgeable to ignorants and to reconcile the contradictory injunctions about how experience/status difference should be managed (*ibid*., p. 134).

So while university seminars are notionally about the status of ideas, it is wrong to see them as devoid of social or personality considerations that might structure inquiry.

University staff already have extensive demands on their time, by some measures this occupation undertakes one of the highest rates of unpaid overtime in the UK (TUC, 2004). This situation makes scheduling group (or any other) interview sessions difficult. Initially, the seminars were intended to be convened in the evening with the help of the regional offices of the Institute of Biology, a professional body representing biologists in the UK. This, however, proved laborious and ultimately unsuccessful. Instead, the seminars were offered as part of university departmental seminar series. 76 universities with active biology research seminar series were approached. 26 seminars were held in total (two being pilots) involving 624 participants and lasting between one and two hours: 13 in England (excluding Greater London); 6 with universities in Greater London, 3 in Scotland, 2 in Wales, 1 in Northern Ireland, and 1 in Germany.

Using pre-existing university seminar series provided a number of practical benefits: the room and equipment was already arranged; no monetary compensation was required as in typical focus groups (and therefore its impact on the discussion was not relevant); because in many British universities staff and postgraduate students are expected to attend the seminars this proved a relatively straightforward way to secure audiences with varied profiles who were also relatively at ease with the setting location; and the expectation for attendance meant additional time demands were not imposed on participants. As a relatively minor negative, the lack of control over the specific venue location meant the quality of audio recordings suffered.

Assessing the types of interactions fostered through the use of pre-existing groups is complicated. Here benefits mixed with negatives, a situation which suggests the importance of attending to the implications of the choices made in the research design. Since many of the issues discussed related to how particular institutions might govern research, conducting discussions within existing department groups was prudent. Yet, the acquaintance of participants also threatened to produce conformity to the views expressed by those in hierarchical positions or to result in discussions fractured along established divisions (see below). Also, university departments in the UK differ considerably in terms of their size and composition. The number of people participating ranged from 5 to 75 with an average of 24. No systematic differences were notable in the ease of initiating and carrying on discussions due to audience size. While this average size enabled many people to be involved in the seminars, it was also significantly higher than typical focus groups. As such the seminars had to trade-off between the space it enabled for individual respondents and the breadth of those reached. In the end, the lack of familiarity of attendees with dual use issues (see below) and therefore the typical exploratory quality of the discussions fitted relative large groups.

The seminars typically began with self introductions of Malcolm Dando and myself, a brief statement about the topic of dual use research and the importance of initiating discussion about this by practicing researchers, and a request for permission to make anonymous audio recordings of the session. In terms of their composition, the seminar was not simply a presentation with a question and answer period at the end. Rather it consisted of a series of slides with information regarding the future threats posed by biological weapons, the relation between current biomedical and bioscientific research and new weapons possibilities, and the range of national and international measures currently being implemented or proposed. Discussions were initiated through questions posed after speaking to the information on the slides.

The seminars differed in important respects from common prescriptions for focus groups. As focus groups typically try to 'tap' individuals' experiences or preferences, the advice is often given to start with general, bland, and non-challenging questions that can 'loosen up' participants for more substantive questioning. However, given our initial presumptions (later confirmed) about the lack of consideration or even awareness of dual use issues among practicing researchers (see below), operating in this manner both had less justification and risked losing the attention of participants. Instead, after the introduction, one of the controversial dual specific cases was described and the question asked of what should be done (i.e., either the interleukin-4 mousepox experiment that inadvertently suggested a way to manipulate smallpox and the question of whether it should have been published or the artificial chemical synthesis of poliovirus and the question of whether it should have been conducted in the first place). An early example of the sequence of slides and key questions is shown in Box 1.

Box 1: Slide Titles and Questions in an Early Seminar

1. Title slide for 'The Life Science, Biosecurity, and Dual-Use Research' seminars

2. What are we doing?
    An explanation of the scope and goal of our research and seminars

3. Cause for Concern?: Synthetic Polio Virus
    Question: Should it have been done?

4. Cause for Concern?
    Slide detailing recent advances in synthesizing capabilities
    Question: Is artificial synthesis still a good idea?

5. Mousepox Experiment
    Question: Should such experimental results have been widely circulated?

6. The British Reserve
    Slide suggesting an example of suppressing the implications of research
    Question: What options are there for the publication of research?

7. US Fink Committee
    Slide detailing proposed US system for the oversight of research
    Question: Would such a system be helpful or dangerous?

8. Spanish Flu: What Should be Done?
    Slide detailing efforts to recreate the deadly 1918 Spanish Flu
    Question: Are there any limits on what should be done or how it is communicated?

9. Codes of Conduct
    Background information about British and international codes activities
    Question: What individual and collective responsibilities should be included?

10. Thanks and contact information

The rationale for the information and questions posed is a matter of considerable importance, especially because of the educational aim of the seminars. These issues are considered in some detail in section six. For now, it is worth initially noting two further differences between the conduct of seminars and that common in focus groups. One, the seminars were *transformative*: this in the sense that many of the questions and their order altered over time. Both because of the aim to initiate discussion and reflection as well as the lack of understanding about what researchers thought about dual use issues, it was necessary to reappraise what we asked and how. So, while in each questions were asked whether there should be any limits on what research was done vis-à-vis dual concerns, whether it would be sensible to restrict the communication of 'dual use' results, or whether systems of research oversight were prudent, the seminars differed in the ordering of questions, the other questions posed, and the follow up probes used.

Two, and as a related point, the number of seminars conducted went beyond typical prescriptions. For instance, Morgan (1998, p. 81) advocates that if 'the discussions reach saturation and become repetitive after two or three groups, there is little to be gained by doing more' sessions and furthermore that if one 'can clearly anticipate what will be said in the next group then the research is done'. Instead of taking this approach which is indebted to thinking about research as a process of elucidating information, the emergence of common themes was treated as a way to generate further examination of our and their presumptions and inferences.

A Thumbnail Sketch of Responses

Following on these design considerations, this section briefly considers the main themes of the seminars, though an extended examination is beyond the scope of this paper. Rather the intent is to discuss pervasive themes and how they factored into choices made about the conduct of the seminars developed in the next section.

Interactive group discussions are not straightforward to analyse. Their *interactive* dimension means that the discussion can evolve along unique lines in particular seminars. Their *group* dimension means that the statements made should not be treated as merely an aggregation of one-to-one interviews. As noted above, there is reason to think individual responses offered in (existing) peer groups are likely to differ in some respects from those given in one-to-one settings. Crucially though, this does not thereby imply the latter should be regarded as more authentic by some metric (Morgan, 1993). As has been argued, group interview settings can both produce conformity and encourage openness (Kitzinger, 1994). Each method of research should be scrutinized in terms of its underlying assumptions and the trade-offs in the commitments made. As argued above, since what was needed in the case of dual use life science research was an exploratory process of peer engagement to enable the formation of standpoints, group session methods had definite overall advantages.

In addition to these widely recognized considerations though, questions can be asked about the analytical status of the responses given. Morgan (1998, p. 25), as with many others, maintains that focus groups are a way getting closer to 'participants' experiences and perspectives'. Yet, much of the recent work in social science regarding the discursive status of accounts would counsel against extracting statements made in some particular form of interaction as simply representing individuals' attitudes (e.g., Edwards, 1997; Silverman, 2004). Taking this orientation forward in the study of environmental risks, for instance, Waterton and Wynne (1999) critique the idea that attitudes should be regarded as stable, coherent, and unambiguous entities that can be tapped through surveys or interviews. Instead, attitudes expressed are done so '(a) in relation to their relevant social context…(b) interactively – that is, they actively form attitudes though the opportunity of discussing issues that are not often addressed;…and (c) as a process of negotiation of trust between themselves as participants and…researchers' (*ibid*., p. 127). In the case of risks assessments, that might mean that the accounts (be they as part of surveys, one-to-one interviews, or group interviews) offered relate to matters such as: the historical context for consideration, the sequence of what questions and responses have

already been made, the perceived uses of the research, trust in institutions that control risks and pose questions, and the sense of agency of respondents. A general implication of this and related studies is the inappropriateness of treating responses made about complex topics as discrete entities that should be added together to provide a summation of individuals' 'attitudes'. Again, the upshot of such assessments is not to condemn all methods of social research, but rather to attend to the underlying assumptions of each.

In light of such discussions, the analytical orientation to participants' responses could be a topic of detailed and prolonged reflection. It is not an aim here to provide an exhaustive account of the interactive dimensions of the seminars undertaken. Just as the choice between competing research methods demands consideration of the purpose of the research and the problems being addressed, so too does the choice in what sort of analysis is provided. As the central purpose of this is paper is to suggest a strategy for engaging with scientists in emerging areas of public concern, the remainder of this section provides a broad, albeit sketchy, overview of the dominant themes in the seminars which then sets up a discussion in the next section about how we questioned participants in response.[4]

In this regard, two overall themes are worth noting. First, very few participants indicated giving previous consideration to the dual use potential of life science research. While this was not completely unexpected given the interviews conducted in 2003 noted in section three, the extent of the absence was surprising. We had presumed at least many would be aware that there has been continuing international debate about the security dimensions of the findings and techniques of advanced research, but this proved mistaken. As a result of the apparent low level of engagement with dual use issues expressed in the first few seminars, prior to discussing the case of the experiment with IL-4 in mousepox, we began asking how many participants had even heard of it. Reported levels of awareness of more than 10 per cent were extremely unusual.

Second, despite important differences, it is possible to identify broad themes of commonality. As mentioned above, while changes were made in the content of the slides throughout the research process, we devised information and slides for all the seminars that broadly addressed three key questions in current policy debates: Are there experiments or lines of research that should not be done? Is some research better left unpublished or otherwise restricted in dissemination? Are the envisioned systems of pre-project research oversight strategies sensible?

To the question 'Are there experiments that should not be done?', the vast majority of responses given supported undertaking the 'contentious' experiments cited, and did most often by stating that the results obtained through them were in some sense inevitable. Herein, the question of *whether* something should be done missed the point that it *would* be done (in the end) by someone. There were variations on the general theme of inevitability, with some saying that the knowledge necessary for malign applications was already out there and so restricting further research would be useless, others that efforts to restrict research in only certain locations (e.g., universities, the West) would be ineffective, still others that attempts to somehow limit particular experiments would be futile because the underlying knowledge in the field could indicate directions for novel

malign applications. Those that did question the advisability of undertaking some research tended to be (as far as we could tell) students.

The advisability of restricting publications was overwhelmingly doubted; reasons for this included the importance of communication in countering the deliberate and natural spread of disease, the limitations of the details in articles to enable the replication of research, and the status of publications as just one way researchers share information. Further, strong scepticism was expressed about the advisability of an enforceable, binding biosecurity oversight system for such reasons as the difficulties of weighing costs and benefits, the ease for those with malevolent intent to circumvent controls, as well as the amount of existing regulations. Elsewhere (Dando and Rappert, 2005), such overall themes were marshalled to contrast two Weberian ideal types, that of 'security-conscious' and 'classic open science' respondents, and to then argue that the latter is much more typical heuristic type.

Questions of Engagement

With the emerging understanding of the prominent responses, ever present choices had to be made about the proper course of further questioning. Just as when one moves beyond abstract statements about the need for education about dual use issues to consider what in particular should be done then the issues at hand become much more complicated; when one moves beyond statements about the potential for focus group-type methods to explore people's experiences in their own vocabulary then difficult issues must be addressed about what exactly should be done. This section discusses the broad outline of the strategy of questioning employed and what it enabled by way of data collection and educational engagement.

As suggested above then, with each general research method there is a need to attend to the types of interactions fostered and the strengths/weaknesses of each approach. In the case of undertaking group-type interviews through 'focus groups' about dual use issues as part of university departmental series, that means recognizing the potential for group conformity, the possible threatening quality of questions, the scope for individuals to profess rationalized views, and the prospect for the internal dynamics of university seminars to constrain discussion. Against such concerns, the seminars conducted here did not merely seek to elicit responses. Instead in their content and conduct they sought to make the data, assumptions, and inferences underlying responses explicit and to then openly test them.

This basic orientation was inspired from the substantial work of Chris Argyris and colleagues (e.g., Argyris, 2003; Argyris and Schön, 1996; Argyris et al., 1985) who have sought to devise forms of interaction that promote mutual learning. As Argyris has argued, despite widely professed commitments, many organizations and inter-personal relations are characterized by features that discourage inquiry and learning. This includes the presence of covert attributions of motives, the treatment of one's own views as obvious and correct, and the use of unsupported evaluations. The result is often personal defensiveness in questioning and the (re)production of invalid assessments and

inferences. To counter this, Argyris advocates the seemingly simple suggestion of making data, inferences, assessments, and private attributions explicit and to treat these as disconfirmable through public testing. So the prescription is to challenge any assessments, but in a way that fosters further inquiry into their basis. His analysis though offers not just a critique of many types of social interactions, but also forms of social research which strive to mimic artificial experimental conditions in the physical sciences. Instead, he advocates undertaking research which through iterative processes of action and change enables the greatest reflection on the substantive concerns of individuals and the rules of inquiry.

In terms of the seminars then, whether the responses offered were given out of concerns about group acceptability, personal antagonisms, or other motivating factors, an upshot of Argyris' work is the importance of encouraging a questioning of the justifications for statements. In other words, the concern is not so much with whether responses are by some metric authentic or biased, but rather treating accounts on their own right (whatever the situational, interpersonal, or other factors impinging on them) and finding ways of testing the basis for whatever is said in the service of promoting mutual understanding and further reflection.

How this can be achieved in practice is a topic in need of elaboration. We strove to adopt, if not always in practice realized, a fairly formulaic method for responding to answers given to the questions posed:

1. Restate what said;
2. State what we understand this to mean;
3. Any evaluation/commentaries/inferences we draw from the statement (i.e., what do we take respondents to mean or the implication of what they say);
4. Put a question back to them if what we said was accurate.

In this way the effort was made to acknowledge individuals' responses, to test the 'ladder of inference' (ibid.) underlying assessments, to make those a matter of further discussion and, through doing these actions, to illustrate our commitment to further inquiry. This then set up a basis for others in the audience to agree with or challenge the data, inferences, and assessments (or their absence) offered by others. In this manner, we sought to move beyond a soliciting of views to an examination of reasoning. The interaction between participants was essential in moving the locus of questioning and the burden of substantiating positions away from us as facilitators to them as participants.

Trying to promote interaction in this manner though should not be understood as a straightforward exercise. Achieving the sort of openness to inquiry sought was a skilful task where learning was required on our part. As well, the negotiation of expertise was a constant theme. While participants were scientific experts in their particular fields, we as presenters were knowledgeable about policy debates that few others were even aware of and we as individuals had an obvious interest in raising this topic in the first place. Thus, whatever the importance of being non-judgemental, as presenters we could hardly pretend not to be experts (as is often suggested in facilitating focus groups, see Kitzinger and Barbour 1999; Morgan 1998) about the dual use issues being discussed. But rather

than use that expertise to close off debate by proposing definitive facts and assessments, when asked regarding our assessments of situations, the efforts was made to substantiate assessments in such a way as to make our reasoning explicit and to put those views up for a public test.

Of course, the strategy as outlined so far of shifting the locus of questioning was dependent on participants actively forwarding accounts and doing so in a manner where enough diversity was expressed to enable further peer-to-peer consideration of the data and inferences supporting evaluations. With the additional factor of the relative lack of consideration of participants of dual use issues in the past, realizing the participant-participant dialogue could hardly be presumed. Therefore we sought to structure the seminars such that *within* particular sessions we could question the basis for previously stated evaluations by revising the seminars *between* sessions. In an effort to understand the basis for evaluations made about the biosecurity issues posed, the seminar's content was altered so as to test out participants' statements.

To elaborate, while in each seminar questions were asked regarding what research was done, how it was published, or whether systems of research oversight were prudent, the sequencing of such slides and the content of the other slides evolved over time with the intent of enabling further questioning of stated evaluations. Consider this strategy as it related to the theme of inevitability. As elaborated previously, claims about the inevitability of scientific development loomed large in many justifications for downplaying or dismissing questions about whether certain experiments should not be conducted on biosecurity grounds, whether the scientific papers should be modified or even not published in light of such concerns, or whether viable security-related systems of research oversight could be established. Herein, the question of *whether* some line of work should be done missed the point that it *would* be done (in the end) by someone; which in practice would further mean that those 'sufficiently skilled' would know about it. In this sense then, any limitations or controls would be futile.

The frequency with which such responses were offered was somewhat unexpected for us. Many of our initial slides and prepared questions were designed to test for the boundary where participants might start expressing concerns. So, we included a slide about the artificial synthesis of polio virus (which we expected few researchers would say should not have been done) and then followed it up by a slide indicating the substantial pace with which synthesising capabilities have moved ahead since to see if this gave any reasons for pause. As well, the current effort to recreate the 1918 Spanish Flu was used as an 'extreme case' for asking if there were any limits to what should be done or communicated. Yet, because science was so often presented as more or less inevitable, these sorts of considerations or cases were deemed inconsequential.

As a result of such interactions in the first several seminars, we ended up combining the initial polio virus slide with the one giving details about the pace of development and dropped the case of the Spanish Flu altogether. We then had to consider how to better understand and probe characterizations of inevitability from there. A modified slide was introduced in subsequent seminars that detailed the multi-billion expansion of biodefence

programs in the US. We had hoped by bringing to the fore the contingent policy choices made about what gets funded in the life sciences (and thus what science gets done), this would encourage some participants to openly query claims made by others about inevitability.

When this failed to happen we then introduced a slide summarising themes of earlier ones, in which we explicitly challenged notions about inevitability by comparing the limited funds dedicated to many tropical diseases against those recently made available for pathogenic agents. This and other summarizing themes were put back to participants in the spirit of publicly testing out views. However, presenting such multiple and controversial points in this manner rarely resulted in much discussion, in fact it tended to stop whatever dialogue had been fostered up to that point. Starting from seminar 15, we varied this by discussing some the main dilemmas identified in previous seminars relating to inevitability in a more removed and formal neutral manner. However, again, this proved a conversation stopper.

In response, we then varied the way in which we questioned statements about inevitability by first being sure to carefully probe for the assumptions underlining such statements when initially made and second by then challenging those accounts through probes whenever a consideration pertinent them was later brought up (e.g., in relation to the funding of research). Embedding our queries in this way generated much more discussion about whether the development of science is 'inevitable'.

In a similar manner we also sought to question other related presumptions. Assessments of inevitability typically relied on the assumption that once research was conducted, it would then automatically become known by others with suitable expert in the field – in other words, as we repeatedly heard, once knowledge was generated 'the genie was out of the bottle'. Probing for the reasons why the dissemination of research was unavoidable indicated a number of issues such as the pressures placed on academics to publish and the advent of Internet publishing which meant vast amounts of resources were easily available. Yet, such statements existed in an uneasy relationship with another claim often made that the publication of some contentious research posed little danger because of difficulty of replicating results from the necessarily limited information given in formalized articles. With our growing understanding of responses, when such contrasting assessments were offered over the course of one seminar, this provided an occasion for encouraging dialogue between participants; when only assessment was offered we could forward the other to further deliberation.

In addition, the question of how appropriate it is for scientists to actively communicate the possible implications of their work provided a basis for thinking about how research becomes 'known' and is thus able to be evitable. While originally for the case of the IL-4 mousepox experiment we had focused on whether the researchers should have published their results in general, eventually we began to appreciate that participants often voiced starkly contrasting views about whether it was appropriate to make a distinction between the audiences for the dissemination of results. Just whether researchers are compelled by current funding mechanisms or obliged because of their social responsibilities to

'publicize' the implications of their research through non-specialist journals was a topic on which contrasting accounts were routinely offered. By examining the underlying assumptions about what publications provided and who should be regarded as an appropriate audience, we were able to examine and publicly question the all-or-nothing framing often given to initial questions of whether 'contentious' research should be published.

Thus, we were able to challenge the evaluations given without doing so in a directly confrontational manner. This had beneficial implications within the specific setting of university seminars. The first few responses in each session were often given by senior participants; further in many cases these responses were lengthy, expressing definitive positions, and often politely dismissive of dual use concerns. Through the strategy of questioning employed though, it was possible to publicly scrutinize the assumptions informing them and their ultimate validity. In this way and others touched on above, our seminar design with these 'technical' elites differed significantly from other approaches in elite interviewing that suggest the need avoid challenging authority so as to maintain access or that in practice take information given by elites in an unquestioning manner (Kezar, 2003).

As a final note for this section, it follows from the argument above that we as facilitators did not strive for the type of substantive 'neutrality' often stipulated as part of running successful focus groups (e.g., Krueger, 1998). Since much more was sought here than the eliciting of views about products or services, much more was required than merely asking questions and ensuring the participants kept to them. To the extent neutrality was sought, it was sought in the form of a commitment to inquiry rather than advocacy. The extent to which it was achieved was a joint accomplishment between us and participants.

Concluding Remarks

As with many other areas of emerging controversy about the conduct of scientific research, the enhanced attention to dual use issues in recent years poses considerable challenges: challenges for life scientists in thinking about the implications of their work and challenges for social analysts in thinking about how to undertake their work. Both those sets of challenges relate to the same basic question: what do we want from research?

In response, this paper elaborated a research design that provided a flexible and responsive means for data collection and educational engagement with scientists. The venue of university department seminar series provided a pragmatic one for discussion. The 'deliberative seminars' employed a modified form of the focus group method. As maintained, this overall method had the advantages of enabling participants significant latitude in their responses, facilitating dialogue between scientific peers, and reducing the oppositional dynamics associated with other forms of social research. However, this paper also contended that many of the advantages claimed for focus groups – such as their potential to let individuals express themselves in their own terms – often rely on inadequately substantiated claims. In contrast, the seminars discussed here took as a

central concern the matter of what kind of questioning was required. The basic orientation adopted *within* individuals seminars and in the transition *between* seminars was not to merely seek to elicit responses but instead to make explicit the data, assumptions, and inferences underlying responses and to publicly challenge those in aid of learning.

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[1] Though with the continuing interest in dual use issues, this is changing, see for instance, McLeish and Nightingale (2005).

[2] Brian Rappert and Malcolm Dando. Economic and Social Research Council Award 'Accountability and the Governance of Expertise: Anticipating Genetic Bioweapons' Project Ref: L144250029

[3] To explain this choice, in relation to muscarinic acetylcholine receptors, nerve agents developed in the early 20th century such as tabun, sarin and VX functioned by inhibiting acetylcholinesterase. Acetylcholine is normally broken down in the synaptic cleft by an enzyme called acetylcholinesterase. Past nerve agents acted by inhibiting the function of acetylcholinesterase. Since acetylcholine has a significant role in both the central and peripheral nervous systems, the net result is total disruption of their functioning. In the search for treatments to neurodegenerative diseases such as Alzheimer's and Parkinson's disease, major attempts have been made in recent decades to specify the functioning of acetylcholine and its receptors, such as muscarinic receptors. The latter have been found to be involved in motor control, temperature regulation, cardiovascular regulation and memory. Recently the use of 'knock-out' mice and other techniques has enabled a greater understanding of the behavioural effects of eliminating the genes for individual muscarinic receptor sub-types. In relation to bioweapons, such developments may enable both the more effective targeting of acetylcholine and the ability to achieve specific effects (e.g., incapacitation).

[4] For a more detailed, though interim, analysis of these seminar themes see ***